

MES COURSE MODULES

In

AUTOMOTIVE REPAIR

GENERAL INFORMATION FOR BASIC AUTOMOTIVE SERVICING 2W&3W

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| Name of Sector | AUTOMOTIVE REPAIR |
| Name of Module | BASIC AUTOMOTIVE SERVICING OF 2&3W |
| MES Code | AUR701 |
| Competency as per N C O Code | |
| Duration of Course | 500 Hrs |
| Entry Qualification of Trainee | 5 th Pass + 14 yrs of age |
| Unit size (No. Of trainees) | 20 |
| Power Norms | 3 KW |
| Space Norms (Workshop and Class Room) | 80 sqm +30 sqm parking area |
| Job Profile | Two wheeler / three wheeler Mechanic Helper for garage boy |
| Objective | <p>1. Produce Two wheeler / three wheeler Mechanic Helper for Garage Boy in automotive workshop by pinning with following Employability skills:</p> <p>(i) Safety awareness about work safety, tools, Equipments & Machinery safety, Personal safety and Environmental safety.</p> <p>(ii) Quality awareness.</p> <p>(iv) Skills to do general servicing and maintenance of 2 Wheelers & 3 Wheelers.</p> <p>(v) Skills to do minor repair works in 2 & 3 wheelers.</p> <p>2. Self Employment in the area of Vehicle washing and Tyre Repair.</p> |
| Terminal competency | <p>1. Safe practice on Work</p> <p>2. First Aid</p> <p>3. Handling of General Tools, Special tools, equipments and Machineries available in the Automobile Garage</p> <p>4. Identifying vehicle components</p> <p>5. Use of fasteners</p> <p>6. Able to check engine condition</p> <p>7. Able to do general maintenance of 2 & 3 wheeler</p> <p>8. Able to do minor repair works of 2 & 3 wheeler</p> <p>9. Washing of vehicle</p> <p>10. Tyre repair work</p> |
| Instructors Qualification | <p>Degree in automobile Engineering with one year relevant Experience</p> <p>OR</p> <p>Diploma in automobile Engineering with two year relevant Experience</p> <p>OR</p> <p>NTC/ NAC in automobile Trade Group with three years of relevant</p> |

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| | Experience |
| Desirable Qualification | Craft Instructor Certificate (CIC) |

Course Contents for Module BASIC AUTOMOTIVE SERVICING OF 2&3 WHEELERS

| PRACTICAL COMPETENCIES | UNDERPINNING KNOWLEDGE (THEORY) |
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| BASICS <ul style="list-style-type: none"> • Reading and understanding of service manual • Vehicle identification(VIN) • Practice on different types of fastening devices • Measuring threads • Practice 5S techniques • Handling of fire extinguishers • Practice on different types of hand tools • Handling of workshop equipments | <ul style="list-style-type: none"> • General service information • General safety • Handling of vehicle components • Handling of fuels • Types of fasteners • Effects of exhaust smoke • Fire extinguishers • Threads and its types • Reading and Understanding service manuals • 5S techniques • Handling and Disposal of consumables • Hand tools-types-description • Study about various workshop equipments • Using sand paper-grades of sand paper |
| ENGINE <ul style="list-style-type: none"> • Checking engine compression • Checking engine vacuum • Removing timing chain • Dismantling cylinder head • Decarbonizing • Testing valve, valve seat and valve guide • Reassembling cylinder head • Adjusting valve clearance | <ul style="list-style-type: none"> • 4s&2s engines • Petrol, diesel and LPG engines-principle • Effects of engine compression • Effects of engine vacuum • Constructional details of valve mechanism • Importance of correct valve clearance • Types of cylinder head • Effects of carbon deposits in the cylinder • Precautions to be taken while decarbonizing • Using torque wrenches |
| EXHAUST SYSTEM <ul style="list-style-type: none"> • Testing exhaust smoke • Cleaning secondary air injection system • Silencer cleaning in 2stroke engine vehicles | <ul style="list-style-type: none"> • Emissions of exhaust smoke and its effects • Principle of secondary air injection system • Importance of clean silencer • Principle of catalytic converter |
| FUEL SYSTEM <ul style="list-style-type: none"> • Cleaning fuel tank • Servicing air cleaner • Cleaning carburetor • Tuning carburetor • Bleeding diesel fuel system in 3wheelers • Changing fuel filters | <ul style="list-style-type: none"> • Description of fuel tank • Air cleaner – types- effects of clogged air cleaner • Carburetor principles-types-importance of carburetor adjustments-do’s and don’ts while servicing carburetor • Diesel fuel system in 3wheelers |

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| <p>LUBRICATING SYSTEM</p> <ul style="list-style-type: none"> • Draining and measuring engine oil level • Replacing/cleaning oil filter • Cleaning the engine with flushing oil • Replacing engine oil | <ul style="list-style-type: none"> • Lubricants-types-properties of lubricants • Lubrication system-lubricating circuit-functions of engine oil-engine oil grade-importance of correct quality and quantity of engine oil-troubles and causes for lubricating system |
| <p>COOLING SYSTEM</p> <ul style="list-style-type: none"> • Replacing coolant • cleaning radiator • Adjusting fan belt tension | <ul style="list-style-type: none"> • Cooling system-basic parts and its functions • Coolant –types- different coolant mixture ratios- troubles and causes in cooling system |
| <p>TRANSMISSION</p> <ul style="list-style-type: none"> • Adjusting clutch play • Removing chain and sprocket • Lubricating chain • Reassembling chain and sprocket • Servicing variable transmission | <ul style="list-style-type: none"> • Clutch-types-constructural details • Constructural details of Chain and sprocket • Details of variable transmission assembly • Troubles and causes for transmission |
| <p>BRAKE SYSTEM</p> <ul style="list-style-type: none"> • Dismantling the brake assembly • Inspecting brake drum, brake shoes and brake pads • Reassembling brake assembly • Replacing brake fluid • Bleeding the hydraulic brake system • Adjusting brake | <ul style="list-style-type: none"> • Brake-types-principle-constructural details • Brake fluid-types • Troubles and causes for brake system • Care to be taken while handling brake shoes |
| <p>STEERING AND SUSPENSION SYSTEM</p> <ul style="list-style-type: none"> • Adjusting steering play • Changing front fork oil • Adjusting shock absorbers | <ul style="list-style-type: none"> • Constructural details of steering-reasons for steering play • Effects of stiff steering • Description of front fork assy • Shock absorbers–types –constructural details |
| <p>ELECTRICAL</p> <ul style="list-style-type: none"> • Practice on use of multimeter • Testing battery • Charging battery • Replacing the bulbs and fuses • Cleaning and adjusting spark plug gap • Aligning head lamp beam • Testing and tuning horn • Test relays | <ul style="list-style-type: none"> • Electrical basics • AC & DC • Current, voltage &resistance • Voltage drop • Wiring diagrams of ignition, lighting, starting and charging systems • Head lamp-description • Description of horn circuits • Purpose and functions of relay • Maintenance of battery-specification |

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| ADJUSTING CABLE FREE PLAY AND LUBRICATION <ul style="list-style-type: none"> • Clutch cable free play adjustment • Front brake cable free play adjustment • Accelerator cable adjustment | <ul style="list-style-type: none"> • Reasons for providing cable free play • Different lubricating points |
| TYRE REPAIR WORK <ul style="list-style-type: none"> • Check inflation pressure and inflate properly • Measure tread depth and inspect for damage • Wheel truing • Repair tyre puncture & tube | <ul style="list-style-type: none"> • Tyre designation(size) • Procedure for repairing the punctured tube • Description about the tyres-types-importance of correct inflation-tyre selection-troubles and causes • Factors affecting tyre life |
| WATER WASHING A VEHICLE | Informations regarding water wash Safety points to be considered before water washing (masking the engine) |

TOOLS AND EQUIPMENTS REQUIRED:

| SL NO | LIST OF TOOLS,EQUIPMENTS,MACHINERIES AND VEHICLES | QUANTITY |
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| GENERAL TOOLS REQUIRED for 20 trainees (4 trainees/batch) | | |
| 1 | Double ended spanner set 6-32mm | 05set |
| 2 | Ring spanner set 6-32mm | 05 set |
| 3 | Tubular spanners 8,10,12,14,16,17mm | 05 no each |
| 4 | Socket spanners 6-32 mm with T bar and ratchet | 05 set |
| 5 | Allen keys 4-12mm in steps of 2mm | 05 set |
| 6 | Screw driver (flat) 20cm x 9mm blade | 05 no |
| 7 | Screw driver (flat) 30cm x 9 mm blade | 05 no |
| 8 | Screw driver (Philips type) 100 -300mm set of 5 pieces | 05 set |
| 9 | Hammer ball peen 0.75 kg | 05 no |
| 10 | Mallet hammer | 05 no |
| 11 | Hammer rubber | 05 no |
| 12 | Nose plier straight 15 cm | 05 no |
| 13 | Combination plier 15 cm | 05 no |
| 14 | Circlip plier external & contracting 6" | 05 no each |
| 15 | Circlip plier external & contracting 7" | 05 no each |
| 16 | Drift | 05 no |
| 17 | Feeler gauge 20 blades metric | 05 no |
| 18 | Adjustable spanner 20 cm | 05 no |
| 19 | Spark plug spanner 12,14,17mm | 05 no each |

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| 20 | File different shapes and size of 15cm | 05 set |
| LIST OF TOOLS,EQUIPMENTS,MACHINERIES AND VEHICLES | | |
| 21 | Water pump plier | 01 no |
| 22 | Torque wrench 0-50 NM | 01 no |
| 23 | Inspection lamp with guard | 01 no |
| 24 | Thread pitch gauge metric | 01 no |
| 25 | Oil can 0.5 litre capacity | 01 no |
| 26 | Centre punch 10 mm dia x 100mm | 01 no |
| 27 | Digital Tachometer able to measure up to 9999 RPM | 01 no |
| 28 | Compression gauge minimum up to 20 kg/cm ² for petrol and 25 kg/cm ² for diesel | 01 no each |
| 29 | Vacuum gauge | 01 no |
| 30 | Battery charger | 01 no |
| 31 | Digital Multi meter | 01 no |
| 32 | Hydrometer | 01 no |
| 33 | Battery load tester | 01 no |
| 34 | Engine valve removing tool(C clamp) | 01 no |
| 35 | Tappet adjuster | 01 no |
| 36 | Air compressor 200 litres capacity | 01 no |
| 37 | Impact screw driver for flat and Philips type | 01 set |
| 38 | Pneumatic tyre inflator | 01 no |
| 39 | Tyre changer | 01 no |
| 40 | Greasilator | 01 no |
| 41 | 2w lift hydraulic type | 04 nos |
| 42 | 3w lift hydraulic type | 02 nos |
| 43 | Pneumatic tools (connected with air compressor by pipe fittings) | 01 set complete |
| 44 | Universal clamp wrench | 01 No |
| 45 | Clutch puller for available vehicles | 01 No each |
| 46 | Magneto puller for available vehicles | 01 no each |
| 47 | Cleaning tray 45 x 30 cm | 10 nos |
| 48 | Work benches each 250 x 120 x 60 with 4 bench vises 12 cm jaw | 01 set |
| 49 | Spark plug cleaning and testing machine | 01 NO |
| 50 | Bench grinder | 01 no |
| 51 | Tread depth gauge | 01 no |
| 52 | Car washer portable type | 01 no |
| 53 | Wheel trueing machine | 01 no |
| 54 | Timing light | 01 no |
| 55 | Hydraulic Brake bleeding machine | 01 no |
| 56 | Hydraulic press 2 ton capacity | 01 no |
| 57 | Vacuum cleaner | 01 no |
| 58 | Fire extinguisher | 01 no |
| 59 | Steel tool box with lock and key (folding type) 400 x 200 x 150 mm size | 05 boxes |
| 60 | Steel almirah minimum 6' height | 03 nos |
| 61 | Moped up to 50 cc 2 stroke with service manual | 01 no |
| 62 | Scooter 4 stroke variable transmission type 100-125 cc with service manual | 01 no |
| 63 | Bike 4 stroke electric start up to 100cc with service manual | 01 no |
| 64 | Bike 4 stroke electric start with ABS up to 150cc with service manual | 01 no |

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| 65 | Bike 4 stroke water cooled up to 150cc with service manual | 01 no |
| 66 | Auto rickshaw petrol version 4 stroke with service manual | 01 no |
| 67 | Auto rickshaw diesel version 4 stroke with service manual | 01 no |

GENERAL INFORMATION FOR BASIC AUTOMOTIVE SERVICING (4 WHEELERS)

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| Name of Sector | AUTOMOTIVE REPAIR |
| Name of Module | BASIC AUTOMOTIVE SERVICING 4 WHEELERS |
| MES Code | AUR702 |
| Competency as per N C O Code | |
| Duration of Course | 500 Hrs |
| Entry Qualification of Trainee | Minimum 5th Std., 14 years of Age |
| Unit size (No. of Trainees) | 20 |
| Power Norms | 6 KW - (a) Class Room: 1 KW (b) Workshop: 5 KW |

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| Space Norms(Workshop and Class Room) | 210 sq. m - (a) Class Room: 30 Sq. meter @ 1.5 sq. meter per trainee (b) Workshop: 120 sq. meter + 60 sq. meter (parking area) |
| Job Profile | Service Mechanic helper / Motor Mechanic Helper/ Garage Boy |
| Objective | <p>1. Produce Service Mechanic helper / Motor Mechanic Helper/ Garage Boy in automotive workshop by pinning with following Employability skills:</p> <p>(i) Safety awareness about work safety, tools, Equipments & Machinery safety, Personal safety and Environmental safety.</p> <p>(ii) Quality awareness.</p> <p>(iii) Basic skills of fitting and sheet metal work.</p> <p>(iv) Skills to do general servicing and maintenance of Wheelers.</p> <p>(v) Skills to do minor repair works in 4 wheelers.</p> <p>2. Self Employment in the areas of Vehicle washing, Tyre Repair, Wheel Alignment and Wheel Balancing.</p> |
| Terminal competency | <ol style="list-style-type: none"> 1. Safe practice on Work 2. First Aid 3. Handling of General Tools, Special tools, equipments and Machineries available in the Automobile Garage 4. Implementation of Quality tools on work 5. Basic fitting works such as marking, Punching, Hack sawing, Filing, Drilling, tapping, Reaming, and Measuring 6. Basic sheet metal works and welding such as Flattening, Cutting, Bending, Folding ,Soldering, Brazing 7. General Servicing, minor repair works and maintenance of Four wheelers 8. Tyre repair work 9. Wheel Alignment & wheel balancing of a vehicle. |
| Instructor Qualification | <p>Degree in Automobile/ Mechanical Engg. With one year relevant experience</p> <p>OR</p> <p>Diploma in Automobile/ Mechanical Engg. With two year relevant experience</p> <p>OR</p> <p>NTC/NAC in Automobile trade group with three years of relevant experience</p> |

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| Desirable Qualification | Craft Instructor Certificate(CIC) |
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Course Contents for Module Basic Automotive Servicing 4 wheelers (AUR702)

| Practical Competencies | Underpinning Knowledge(Theory) |
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| <p>SAFETY: Safety attitude develop by using of Personal Protective Equipments (PPE). First-Aid methods Use of fire extinguishers. Safe disposal of used oil and Battery. Quality concept developing by applying 5S. Preventive maintenance of automotive equipments.</p> | <p>General health & Safety precautions to be observed in the workshop / garage, Personal protective equipments, first aid, signs for Danger, Warning. Environmental safety - safe disposal of waste oil and Battery Concept of Quality. Over view on 5S technique. Care and maintenance of automotive tools & equipment.</p> |

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| <p>HAND TOOLS AND EQUIPMENTS: Measurement and Cutting works using measurement and cutting tools.</p> <p>Practice on marking using marking tools.</p> <p>Practice on Filing using different type of files.</p> <p>Practice on using all kind of workshop equipments e.g. Lift, air compressor, car washer, pneumatic gun, torque wrench and special tools.</p> | <p>Description and uses of Steel rule, measuring tape, try square, callipers, dividers, surface gauges.</p> <p>Uses of Hacksaw, File, Chisel, Hammer.</p> <p>Uses of Marking media, Surface plates, scribe and punches.</p> <p>Uses of Vices & clamps, Spanners, Sockets & accessories, Screw-drivers, Pliers, Allen key, Wrenches, air impact wrench, air ratchet, air chisel, air blowgun, Torque wrenches, jet washers and cleaners, Pipe flaring & cutting tool, pullers.</p> |
| <p>DRILLING AND GRINDING: Practice on drilling, selection tap drill size, tapping (through & blind hole), reaming, dieing and grinding.</p> <p>Safety precautions to be observed during drilling, tapping, reaming and grinding operation.</p> | <p>Purpose and use of Bench type Drilling machine, Portable electrical Drilling machine, drill holding devices, Drill bits.</p> <p>Uses of Hand Tap, Die, Hand Reamer</p> <p>Uses of bench and pedestal grinders.</p> |
| <p>FASTENERS, SHEET METAL: Practice on sheet metal cutting, flattening, Bending and folding, soldering & brazing.</p> <p>Removal of stud/bolt from blind hole.</p> <p>Practice on using various types of fasteners.</p> | <p>Fasteners - Study of different types of screws, nuts, studs & bolts, locking devices, Such as lock nuts, cotter, split pins, keys, circlips, lock rings, locks washers and locating where they are used. Washers & chemical compounds can be used to help secure these fasteners.</p> <p>Sheet metal – Tools used, Description of simple soldering and brazing fluxes used on common joints. Sheet and wire-gauges. Blow lamp- its uses. Explanation of various common metal Sheets used in Sheet Metal shop.</p> |

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| <p><u>ENGINE BASIC:</u> Familiarization of workshop manual. Practice on how to read job-card. Identification of different types of vehicle. Identification of Vehicle Identification Number, Chassis No., & Engine no Identification of different types of engine components. Checking of compression and vacuum. Car wash – before & after servicing using different types of nozzles</p> <p>Check / replenish / top up – lubricating oil, engine coolant, power steering hydraulic oil, wind screen wiper water.</p> <p>Replace – air cleaner, oil filter & fuel filter</p> <p>Apply Grease to parts / through greasing points (if necessary)</p> | <p>Nomenclature of different parts of vehicle and their locations. Classification of vehicle.</p> <p>Vehicle Identification Number</p> <p>E C & I C Engine – Types, engine terminologies, parts description & functions.</p> <p>Compression gauge, Vacuum Gauge.</p> <p>Types of fuels used in vehicle.</p> <p>Working principle of 4 stroke SI & CI engines.</p> <p>Differences between 2 strokes & 4 strokes engine, petrol & diesel engines.</p> <p>Fuel supply layouts in petrol & diesel engines, injection systems.</p> <p>Brief introduction on injectors.</p> <p>Lubrication and cooling system & types of lubricants.</p> <p>Lay out of greasing points.</p> |
| <p><u>POWER TRANSMISSION BASIC:</u> Remove & refit vehicle body parts (bonnet, front bumper & door)</p> <p>Check / replenish / top up brake fluid, transmission oil.</p> <p>Adjust Hand brake and replace hand brake cable</p> <p>Adjust clutch and brake pedal plays</p> <p>Replace propeller shaft, wheel hub bearings & brake pads</p> | <p>Torquing & detorquing technique / procedures</p> <p>Layout of power flow from Engine to wheels.</p> <p>Purpose of clutch, gear box & differential</p> <p>General defects in clutch, manual gearbox</p> <p>Types of Brake & steering systems – working principle of drum and disc brakes</p> <p>General defects in brake systems.</p> |
| <p><u>BATTERY AND IGNITION SYSTEM:</u> Remove and refit head lamp assembly.</p> <p>Check power plug and inspect H.T. cables</p> <p>Clean, Check and Adjust spark plug</p> <p>Cleaning and topping up of a lead acid battery, testing battery with hydrometer, battery tester, connecting battery to a charger for battery charging.</p> | <p>Ignition system circuit & components</p> <p>Brief introduction on ignition</p> <p>Description of chemical effect, Batteries and cells, lead acid batteries & stay maintenance free (SMF) batteries.</p> |

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| <p><u>TYRE REPAIRER/INSPECTION:</u> Removal & re-fitting of wheel from light & heavy vehicle. Measurement of tread wear. Dismantling tyre & tube, checking puncture, assembling, inflate it to correct pressure. Vulcanizing of tubes & tyres. Repair tubeless tyre puncture. Air inflation with nitrogen gas inflator according to the manufacturer's recommendation. Practice on Tyre rotation as per vehicle manufacturers recommendation</p> | <p>Safety precautions during dismantling & assembling tyre & rim. Types of wheels, designation, construction. Types of tyres & tubes (solid & pneumatic tyre – Cross ply & Radial ply, desirable properties component & function, designation, tyre ratings for temperature & traction. Maintenance of tyre & tubes. Reasons for defects of tyre. Tread patterns & their applications. Inspection procedure. Vulcanizing process. Tyre pressure monitoring system. Procedure for retreading the Tyre. Procedure for tyre rotation for Different make of vehicle.</p> |
| <p><u>COMPUTER BASIC:</u> Familiarization & Identification of computer parts, practice on computer for MS Word, MS Power Point, MS Excel</p> | <p>Basic of computer, MS Office</p> |
| <p><u>WHEEL BALANCING:</u> Remove tyre from vehicle. Check tyre & rim and also check for run out. Fit the tyre assembly to the vehicle.</p> | <p>Meaning of balance, causes & effects of imbalance, vibration. Identification of source, transfer path & responder of vibration(can be felt & can be heard) Steering wheel shake – shimmy, wobble & waddle Brief on static balance, dynamic balance, Mounting errors (radial & lateral) & excessive (Tyre & rim) run out-lateral & radial and mismatches. Brief description of wheel balancer (block diagram balancer), fixed data & data to be fed to the machine, Balancing tolerance values.</p> |
| <p><u>WHEEL ALIGNMENT:</u> Check tyres, ride height, wheel bearings, ball joints, control arms bushings and sway bars, shock absorbers, struts & power steering. Identify components, brief working principle & operation of computerized wheel aligner</p> | <p>Layout of steering & suspension systems, function of each part. Brief on suspension and its effects on steering Steering geometry: Description and purposes of Ackerman steering, toe,</p> |

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| <p>Procedure to make the aligner ready to check wheel alignment.</p> <p>Procedure for taking readings, interpreting alignment readings and rectify steering geometry with wheel aligner – take a print out.</p> <p>Procedures for test drive to confirm the repairs.</p> | <p>castor, camber, king pin inclination/SAI(steering Axis Inclination), turning angle, included angle, set back, thrust angle & frame angle.</p> <p>Pre alignment inspection/checks</p> <p>Two wheel & four wheel alignment</p> <p>Reasons for Alignment problems – steering pull, off-centre steering, steering shimmy, excessive steering effort, poor self centering and memory steer, bump steer, torque steer & steering harshness-alignment diagnostics chart & steering problem diagnostic chart.</p> |
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List of Tools & Equipment for module Basic Automotive Servicing 4 Wheelers (AUR702)

| Sl. No. | Name of Tool/Equipment | Quantity (nos) | Sl. No. | Name of Tool/Equipment | Quantity (nos) |
|---------------------|---|----------------|---------|---|----------------|
| TRAINEES KIT | | | | | |
| 1. | Steel Rule 15 cm inch and metric | 5 nos | 22 | Divider spring 15cm | 5 nos |
| 2. | Steel Rule 30 cm inch and metric | 5 nos | 23 | Pliers combination 15 cm | 5 nos |
| 3. | Steel measuring tape 10 meter in a case | 5 nos. | 24 | Wire cutter and stripper | 5 nos. |
| 4. | Try square 10 cm blade | 5 nos | 25 | Inspection lamp with guard and wandering lead of 10 ft (consumable) | 5 nos |
| 5. | Calliper outside 15cm spring | 5 nos | 26 | Horses and wheel chokes | 5 nos |
| 6. | Calliper inside 15cm spring | 5 nos | 27 | Oil can 0.5 litre cap | 5 nos |
| 7. | Calliper hermaphrodite 15cm spring | 5 nos | 28 | Desktop computer Windows'8 and above | 5 nos |
| 8. | Hammer ball peen 0.75 kg | 5 nos. | 29 | Socket Spanners with handle, T bar & ratchet | 5 sets |
| 9. | Mallets (wooden/plastic/copper) | 5 nos | 30 | Scriber 15 cm with scribing block universal | 5 nos |
| 10. | Screw driver 20 cm. x 9 mm blade | 5 nos. | 31 | Hacksaw frame adjustable for 30 cm | 5 nos |

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| | | | | blade | |
| 11. | Screw driver 30 cm x 9 mm blade | 5 nos | 32 | Hand vice 37mm | 5 nos |
| 12. | Philips Screw Driver Type set of 5 pieces 100 mm to 300 mm | 5 sets | 33 | Feeler gauge 20 blades (metric) | 5 nos. |
| 13. | Spanner D E set of 12 pieces (6 to 32 mm) | 5 sets | 34 | Steel tool box with lock & key (folding type) size 400x200x150mm. | 5 nos. |
| 14. | Ring spanner set of 12 pieces 6 to 32mm | 5 sets | 35 | Cleaning Tray 45 x 30 cm. | 5 nos |
| 15. | Centre punch Dia.10 mm x 100 mm | 5 nos. | 36 | Allen Key set of 12 pieces (2 mm to 14 mm) | 5 sets |
| 16. | Prick punch 15cm | 5 nos | 37 | File card/cleaner | 5 nos. |
| 17. | Chisel cold flat 20 mm | 5 nos | 38 | Scriber 15cm | 5 nos. |
| 18. | Chisel cross cut 200mm x 6mm | 5 nos | 39 | Safety glasses for grinding | 5 nos. |
| 19. | Hand file 20 cm. Second cut | 20 nos | 40 | Stud extractor ezy out types | 5 sets |
| 20. | Hand file 20 cm. Second cut half round | 20 nos | 41 | Hand file 30 cm. bastard | 20 nos |
| 21. | Hand file 20 cm. Smooth triangular | 20 nos | 42 | Hand file 30 cm. round bastard | 20 nos |

| Sl. No | Name of Tool/Equipment | Quantity (nos) | Sl. No | Name of Tool/Equipment | Quantity (nos) |
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| GENERAL TOOLS EQUIPMENTS AND MACHINERIES | | | | | |
| 1 | Oil stone 15cm x 5cm x 2.5cm | 1 no | 34 | Grease gun | 2 nos. |
| 2 | Spanner, adjustable 20 cm. | 1 no | 35 | Sheet metal gauge | 1 no. |
| 3 | Torque wrench 5 - 35 Nm, 12 - 68 Nm, 50 - 225 Nm. | 1 set | 36 | Compression gauge | 1 no. |
| 4 | Plier round nose 15cm | 2 nos | 37 | Vacuum gauge to read 0 to 760mm of Hg | 1 no |
| 5 | Pipe wrench 350mm | 1 no. | 38 | Spanner for spark plugs 14 mm | 2 nos |
| 6 | Vice grip pliers | 2 nos | 39 | Tubed tyre of cars | 1 no |
| 7 | Circlip pliers Expanding and contracting type 15 cm and 20 cm each | 1 each | 40 | C clamp 100mm, 150mm, 200mm | 2 each |
| 8 | Screw pitch gauge | 1 no | 41 | Solid tyre | 1 no |
| 9 | Fire bucket (4 nos.) with stand | As required | 42 | Tubeless tyre of cars | 1 no |
| 10 | Hollow punch set of | 1 set | 43 | Cut section model of | 1 no |

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| | seven pieces 6 to 15 mm | | | cross ply and radial tyres. | |
| 11 | Letter punch 4mm | 1 set | 44 | Pullers screw powered 2 mm with bearing puller attachment | 1 no |
| 12 | Tread depth gauge | 2 nos | 45 | Different types of Injectors | 1 set |
| 13 | Wheel aligner pit/lifter with rolling jack | 1 no | 46 | Tachometer - to read upto 10000 rpm | 1 no |
| 14 | Battery charger 12V- 36 V | 1 no | 47 | Battery 12 V (consumable 2 yrs span) | 2 nos |
| 15 | Portable electric drill 6 mm | 1 no | 48 | Hydrometer | 2 nos |
| 16 | Computerized wheel balancing machine with all accessories | 1 no | 49 | Fire Extinguisher | As required |
| 17 | Computerized wheel aligner with all accessories along with manuals & diagnostic charts | 1 no | 50 | Tyre repair kit | 1 set |
| 18 | Angle plate adjustable 250 x 150 x 175 | 1 no. | 51 | Nitrogen inflator with Tyre Pressure gauge | 1 no |
| 19 | Latest 4 Wheelers of different make (one LMV & one HMV) along with workshop manuals, common exhaust system | 1 each | 52 | Trolley type portable air compressor single cylinder with 45 liters capacity air tank, along with accessories & with working pressure 6.5 kg/sq cm | 1 no |
| 20 | Different types of gaskets(consumable) | As required | 53 | Tyre changer | 1 no |
| 21 | Different types of oil seal(consumable) | As required | 54 | Tube vulcanizing machine | 1 no |
| 22 | Marking material (consumable) | As required | 55 | Tyre vulcanizing machine | 1 no |
| 23 | "V" Block 75 x 38 mm pair with Clamps | 2 nos | 56 | Drilling machine bench to drill up to 12mm dia along with accessories | 1 no |
| 24 | Drill Twist (assorted) | As required | 57 | Grinding machine (general purpose) D E pedestal with 300mm dia wheels rough and smooth | 1 no |
| 25 | Tap and tap wrenches UNC UNF and metric | 2 sets | 58 | Hacksaw blade (consumable) | As required |
| 26 | Set of stock and dies-UNC, UNF and metric | 2 sets | 59 | Snip straight and bent 200mm | 2 nos each |
| 27 | Hand reamers adjustable 10.5 to 11.25mm, 11.25 to 12.75mm, 12.75 to | 2 sets | 60 | Arbor press 1 ton | 1 no |

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|----|---|-------|----|---|-------|
| | 14.25mm, 14.25 to 15.75mm | | | | |
| 28 | Spark plug cleaner and tester similar to Bosch / champion | 1 no | 61 | Battery tester | 1 no |
| 29 | Work bench each 250 x 120x60 with 4 bench vices 12 cm jaw | 1 no. | 62 | Air impact wrench | 1 no. |
| 30 | Air ratchet | 1 no | 63 | Air chisel | 1no. |
| 31 | Air blow gun | 1 no. | 64 | Tubular spanner 6mm to 22mm set of 8 pieces | 1 set |
| 32 | Marking out table 90 x 90cm | 1 no. | 65 | Tube valve insert key | 2 nos |
| 33 | Two post lifter 3 ton capacity | 1 no. | 66 | Steel Almirah 6' Height | 4 no |

REDESIGNED MODULES FOR THE SECTOR

OF

AUTOMOBILE

UNDER

MODULAR EMPLOYABLE SKILLS (MES)

Redesigned in - 2014

By

Government of India

Directorate General of Employment & Training

Ministry of Labour & Employment (DGE&T)

GENERAL INFORMATION FOR DRIVER CUM MECHANIC

| | |
|---|--|
| Name of Sector | AUTOMOBILE |
| Name of Module | DRIVER CUM MECHANIC |
| MES Code | AUR703 |
| Competency as per N C O Code | |
| Duration of Course | 600 Hrs |
| Entry Qualification of Trainee | Minimum 8 th Std., 14 years of Age |
| Unit size (No. of Trainees) | 20 |
| Power Norms | 6 KW - (a) Class Room: 1 KW (b) Workshop: 5 KW |
| Space Norms(Workshop and Class Room) | 210 sq. m - (a) Class Room: 30 Sq. meter @ 1.5 sq. meter per trainee (b) Workshop: 120 sq. meter + 60 sq. meter (parking area) |
| Job Profile | Driver/Service Mechanic/ Motor Mechanic Helper/ Garage Boy |
| Objective | <p>1. Produce Service Mechanic/ Motor Mechanic Helper/ Garage Boy in automotive workshop by pinning with following Employability skills:</p> <p>(i) Safety awareness about work safety, tools, Equipments & Machinery safety, Personal safety and Environmental safety.</p> <p>(ii) Quality awareness.</p> <p>(iii) Basic skills of fitting and sheet metal work.</p> <p>(iv) Skills to do general servicing and maintenance of Wheelers.</p> <p>(v) Skills to do minor repair works in 4 wheelers.</p> <p>2. Self Employment in the areas of Vehicle washing, Tyre Repair, Wheel Alignment and Wheel Balancing.</p> |
| Terminal competency | <p>1. Safe practice on Work</p> <p>2. First Aid</p> <p>3. Handling of General Tools, Special tools, equipments and Machineries available in the Automobile Garage</p> <p>4. Implementation of Quality tools on work</p> <p>5. Basic fitting works such as marking, Punching, Hack sawing, Filing, Drilling,</p> |

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| | <p>tapping, Reaming, and Measuring</p> <p>6. Basic sheet metal works and welding such as Flattening, Cutting, Bending, Folding ,Soldering, Brazing</p> <p>7. General Servicing, minor repair works and maintenance of Four wheelers</p> <p>8. Tyre repair work</p> <p>9. Wheel Alignment & wheel balancing of a vehicle.</p> |
| Instructor Qualification | <p>Degree in Automobile/ Mechanical Engg. With one year relevant experience</p> <p>OR</p> <p>Diploma in Automobile/ Mechanical Engg. With two year relevant experience</p> <p>OR</p> <p>NTC/NAC in Automobile trade group with three years of relevant experience</p> |
| Desirable Qualification | Craft Instructor Certificate(CIC) |

Course Contents for Module Driver cum Mechanic (AUR703)

| Practical Competencies | Underpinning Knowledge (Theory) |
|---|---|
| <p><u>SAFETY:</u></p> <p>Safety attitude develop by using of Personal Protective Equipments (PPE).</p> <p>First-Aid methods</p> <p>Use of fire extinguishers.</p> <p>Safe disposal of used oil and Battery.</p> <p>Quality concept developing by applying quality tools.</p> <p>Soft skills practices.</p> <p>Safety Precautions while handling Tools, equipment and machinery.</p> <p>Familiarization with the name and location of different assemblies of motor vehicles.</p> <p><u>NOTE:</u></p> <p><u>IT IS TRAINEES RESPONSIBILITY TO APPLY FOR LEARNER LICENSE TO THEIR RESPECTIVE LOCAL RTO.</u></p> | <p>General health & Safety precautions to be observed in the workshop / garage, Personal protective equipments, first aid, signs for Danger, Warning.</p> <p>Environmental safety - safe disposal of waste oil and Battery</p> <p>Concept of Quality. Over view on 5S technique.</p> <p>Care and maintenance of tools & equipment.</p> <p>Motor Vehicle Act, Important definitions and salient features of motor vehicle Act.</p> <p>Important provision of motor vehicle Act section 122,123,125,126,128,131,134,136 & 139.</p> <p>Legal awareness.</p> <p>Vehicle registration and insurance of motor vehicle.</p> <p>Environmental Education (pollution etc.).</p> <p>Qualities required for a good driver.</p> <p>Responsibilities of a driver.</p> <p>Learner's license and its particulars, Driving license particulars and its renewal.</p> <p>Fire precautions.</p> <p>Importance of wearing seat belts.</p> <p>Vehicle specification.</p> <p>Vehicle controls-Foot control, Hand control and other controls.</p> <p>Necessities of different assemblies of all (types) motor vehicles.</p> |

PREREQUISITES OF A DRIVER:

Preliminary checking of the vehicle before driving.

Starting and stopping of the engine.

Reading different gauges on instrument panel.

Straight driving on an open ground and practice in observing different gauges and meter while driving.

Practice in changing gear from

a) Low gear to high gear and b) High gear to low gear

Straight driving on wide road and practice in changing gear from low gear to high gear and high gear to low gear.

Simple introduction to automobile engines and their working.

Gauges used in automobiles.

Pre-driving checks before sitting on driver's seat and after sitting on driver's seat.

Precautions to be followed while starting.

Driving road rules.

Knowledge about log book and different papers related to vehicles.

Precautions to be followed while moving and steering control and biting point.

Road traffic signals and hand signals of Traffic constables.

Hand signals of driver and signaling devices.

Crossing electrical signals.

Gear shift pattern on different vehicles.

Precautions to be followed while changing of gear.

Local road map reading.

Types of clutch and brakes, hand brake. Introduction to road markings.

Speed regulations on highway and city roads.

Stopping distance and Precautions to be followed while stopping and Braking.

DRIVING PRACTICE:

Driving through lanes and curves, straight and 'S' bends, sand, wet surface, steep slope and downhill, Highway.

Night driving practice.

Practice in parking vehicle. Parallel parking and diagonal parking.

Driving over narrow bridges, overtaking another vehicle.

Detection of minor faults while driving.

Familiarization with Automatic transmission, Gear shift pattern and Gear position. Driving practice on Automatic transmission vehicle.

Driving test

NOTE:

IT IS TRAINEES RESPONSIBILITY TO UNDERGO DRIVING TEST FOR

Precautions to be taken while driving through lanes and curves, reversing the vehicle, through sand and wet surface, over slope and downhill, highway.

Precautions to be taken while driving night.

Different kind of parking,

Precautions to be taken while driving over narrow bridges, overtaking another vehicle.

Introduction to Automatic transmission, Advantages, Difference between automatic transmission and manual transmission. Components of automatic transmission and its Location .Gear shift pattern and Gear position.

Driving test. Procedure for international driving license. Vehicle fitness certificate.

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| <p><u>OBTAINING DRIVING LICENSE TO THEIR RESPECTIVE LOCAL RTO.</u></p> | <p>Causes of Accidents. Safe driving practice. Fuel saving methods by good driving habits.</p> |
| <p><u>HAND TOOLS AND EQUIPMENTS:</u> Measuring practice on engine components by use of instruments. Practice on Cutting works using cutting tools. Practice on marking using marking tools. Practice on Filing using different type of files. Practice on using all kind of workshop equipments e.g. Lift, air compressor, car washer, pneumatic gun, torque wrench and special tools.</p> | <p>Conversion of English into metric Systems of measurement & vice- versa. Steel rule, measuring tape, try square, calipers, dividers, surface gauges. Hacksaw, File, Chisel, Hammer: Description, Specification, types and uses. Description, care and use of Marking media, Surface plates, scribe and punches. Vices & clamps, Spanners, Sockets & accessories, Screw-drivers, Pliers, Allen key, Wrenches, air impact wrench, air ratchet, air chisel, air blowgun, Torque wrenches, jet washers and cleaners, Pipe flaring & cutting tool, pullers.</p> |
| <p><u>DRILLING AND GRINDING:</u> Practice on drilling, selection tap drill size, tapping (through & blind hole), reaming, dieing and grinding (sharpening of twist drill). Safety precautions to be observed during drilling, tapping, reaming and grinding operation.</p> | <p>Description and study of Bench type Drilling machine, Portable electrical Drilling machine, drill holding devices, Drill bits. Description, Types, Use & Calculation: Hand Tap, Die, Hand Reamer OFF-hand grinding with sander, bench and pedestal grinders.</p> |
| <p><u>FASTENERS, SHEET METAL:</u></p> | <p>Fasteners - Study of different types of screws, nuts, studs & bolts, locking devices,</p> |

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| <p>Practice on sheet metal cutting, flattening, Bending and folding, soldering & brazing.</p> <p>Removal of stud/bolt from blind hole.</p> <p>Practice on using various types of fasteners.</p> | <p>Such as lock nuts, cotter, split pins, keys, circlips, lock rings, locks washers and locating where they are used. Washers & chemical compounds can be used to help secure these fasteners.</p> <p>Sheet metal - common hand tools- their names and uses. Description of simple soldering and brazing fluxes used on common joints. Sheet and wire-gauges. Blow lamp- its uses and pipe fittings. Explanation of various common metal Sheets used in Sheet Metal shop.</p> |
| <p><u>ENGINE BASIC:</u></p> <p>Identification of different types of vehicle.</p> <p>Identification of different types of engine components.</p> <p>Familiarization of workshop manual.</p> <p>Practice on how to read job-card.</p> <p>Checking of compression and vacuum.</p> <p>Car wash – before & after servicing using different types of nozzles.</p> <p>Check / replenish / top up – lubricating oil, engine coolant, power steering hydraulic oil, wind screen wiper water, battery electrolyte and transmission oil</p> <p>Replace – air cleaner, oil filter & fuel filter</p> <p>Apply Grease to parts / through greasing points (if necessary)</p> | <p>Nomenclature of different parts of vehicle and their locations. Classification of vehicle.</p> <p>E C & I C Engine – Types, engine terminologies, parts description & functions.</p> <p>Types of fuels used in vehicle.</p> <p>Working principle of 4 stroke SI & CI engines.</p> <p>Differences between 2 strokes & 4 strokes engine, petrol & diesel engines.</p> <p>Concept of MPFI, CRDI.</p> <p>Compression gauge, Vacuum Gauge.</p> <p>Fuel supply layouts in petrol & diesel engines, injection systems.</p> <p>Brief introduction on injectors.</p> <p>Lubrication and cooling system & types of lubricants.</p> <p>Lay out of greasing points.</p> |
| <p><u>POWER TRANSMISSION BASIC:</u></p> <p>Remove & refit vehicle body parts (bonnet, front bumper & door)</p> <p>Check / replenish / top up brake fluid, transmission oil.</p> <p>Adjust Hand brake and replace hand brake cable</p> <p>Adjust clutch and brake pedal plays</p> <p>Replace propeller shaft, wheel hub bearings & brake pads</p> | <p>Torquing & detorquing technique / procedures</p> <p>Layout of power flow from Engine to wheels.</p> <p>Purpose of clutch, gear box & differential</p> <p>General defects in clutch, manual gearbox</p> <p>Types of Brake & steering systems – working principle of drum and disc brakes</p> <p>General defects in brake systems.</p> |

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| <p><u>BATTERY AND IGNITION SYSTEM:</u> Remove and refit head lamp assembly. Head light alignment using head light testing equipment. Check power plug and inspect H.T. cables Clean, Check and Adjust spark plug Cleaning and topping up of a lead acid battery, testing battery with hydrometer, battery tester, connecting battery to a charger for battery charging.</p> | <p>Ignition system circuit & components Brief introduction on ignition Description of chemical effect, Batteries and cells, lead acid batteries & stay maintenance free (SMF) batteries.</p> |
| <p><u>TYRE REPAIRER/INSPECTION:</u> Removal & re-fitting of wheel from light & heavy vehicle. Measurement of tread wear. Dismantling tyre & tube, checking puncture, assembling, inflate it to correct pressure. Vulcanizing of tubes & tyres. Repair tubeless tyre puncture. Air inflation with nitrogen gas inflator according to the manufacturer's recommendation. Practice on Tyre rotation as per vehicle manufacturers recommendation</p> | <p>Types of wheels, designation, construction. Types of tyres & tubes (solid & pneumatic tyre – Cross ply & Radial ply, desirable properties component & function, designation, tyre ratings for temperature & traction. Maintenance of tyre & tubes. Reasons for defects of tyre. Tread patterns & their applications. Inspection procedure. Vulcanizing process. Tyre pressure monitoring system. Procedure for retreading the Tyre. Procedure for tyre rotation for Different make of vehicle. Safety precautions during dismantling & assembling tyre & rim.</p> |
| <p><u>COMPUTER BASIC:</u> Familiarization & Identification of computer parts, practice on computer for MS Word, MS Power Point, MS Excel</p> | <p>Basic of computer, MS Office</p> |
| <p><u>WHEEL BALANCING:</u> Remove tyre from vehicle. Check tyre & rim and also check for run out. Fit the tyre assembly to the vehicle.</p> | <p>Meaning of balance, causes & effects of imbalance, vibration. Identification of source, transfer path & responder of vibration(can be felt & can be heard) Steering wheel shake – shimmy, wobble & waddle Brief on static balance, dynamic balance, Mounting errors (radial & lateral) & excessive (Tyre & rim) run out-lateral & radial and mismatches.</p> |

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| | Brief description of wheel balancer (block diagram balancer), fixed data & data to be fed to the machine, Balancing tolerance values. |
| <p><u>WHEEL ALIGNMENT:</u></p> <p>Check tyres, ride height, wheel bearings, ball joints, control arms bushings and sway bars, shock absorbers & struts & power steering.</p> <p>Identify components, brief working principle & operation of computerized wheel aligner</p> <p>Procedure to make the aligner ready to check wheel alignment.</p> <p>Procedure for taking readings, interpreting alignment readings and rectify steering geometry with wheel aligner – take a print out.</p> <p>Procedures for test drive to confirm the repairs.</p> | <p>Layout of steering & suspension systems, function of each part.</p> <p>Brief on suspension and its effects on steering</p> <p>Steering geometry: Description and purposes of Ackerman steering, toe, castor, camber, king pin inclination/SAI (steering Axis Inclination), turning angle, included angle, set back, thrust angle & frame angle.</p> <p>Pre alignment inspection/checks</p> <p>Two wheel & four wheel alignment</p> <p>Reasons for Alignment problems – steering pull, off-centre steering, steering shimmy, excessive steering effort, poor self centering and memory steer, bump steer, torque steer & steering harshness-alignment diagnostics chart & steering problem diagnostic chart.</p> |

List of Tools & Equipment for module Driver cum Mechanic (AUR703)

| Sl. No. | Name of Tool/Equipment | Quantity (nos) | Sl. No. | Name of Tool/Equipment | Quantity (nos) |
|---------------------|---|----------------|---------|---|----------------|
| TRAINEES KIT | | | | | |
| 1. | Steel Rule 15 cm inch and metric | 5 nos | 22 | Divider spring 15cm | 5 nos |
| 2. | Steel Rule 30 cm inch and metric | 5 nos | 23 | Pliers combination 15 cm | 5 nos |
| 3. | Steel measuring tape 10 meter in a case | 5 nos. | 24 | Wire cutter and stripper | 5 nos. |
| 4. | Try square 10 cm blade | 5 nos | 25 | Inspection lamp with guard and wandering lead of 10 ft (consumable) | 5 nos |
| 5. | Calliper outside 15cm spring | 5 nos | 26 | Horses and wheel chokes | 5 nos |
| 6. | Calliper inside 15cm spring | 5 nos | 27 | Oil can 0.5 litre cap | 5 nos |

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|-----|--|--------|----|---|--------|
| 7. | Calliper hermaphrodite 15cm spring | 5 nos | 28 | Desktop computer Windows'8 and above | 5 nos |
| 8. | Hammer ball peen 0.75 kg | 5 nos. | 29 | Socket Spanners with handle, T bar & ratchet | 5 sets |
| 9. | Mallets (wooden/plastic/copper) | 5 nos | 30 | Scriber 15 cm with scribing block universal | 5 nos |
| 10. | Screw driver 20 cm. x 9 mm blade | 5 nos. | 31 | Hacksaw frame adjustable for 30 cm blade | 5 nos |
| 11. | Screw driver 30 cm x 9 mm blade | 5 nos | 32 | Hand vice 37mm | 5 nos |
| 12. | Philips Screw Driver Type set of 5 pieces 100 mm to 300 mm | 5 sets | 33 | Feeler gauge 20 blades (metric) | 5 nos. |
| 13. | Spanner D E set of 12 pieces (6 to 32 mm) | 5 sets | 34 | Steel tool box with lock & key (folding type) size 400x200x150mm. | 5 nos. |
| 14. | Ring spanner set of 12 pieces 6 to 32mm | 5 sets | 35 | Cleaning Tray 45 x 30 cm. | 5 nos |
| 15. | Centre punch Dia.10 mm x 100 mm | 5 nos. | 36 | Allen Key set of 12 pieces (2 mm to 14 mm) | 5 sets |
| 16. | Prick punch 15cm | 5 nos | 37 | File card/cleaner | 5 nos. |
| 17. | Chisel cold flat 20 mm | 5 nos | 38 | Scriber 15cm | 5 nos. |
| 18. | Chisel cross cut 200mm x 6mm | 5 nos | 39 | Safety glasses for grinding | 5 nos. |
| 19. | Hand file 20 cm. Second cut | 20 nos | 40 | Stud extractor ezy out types | 5 sets |
| 20. | Hand file 20 cm. Second cut half round | 20 nos | 41 | Hand file 30 cm. bastard | 20 nos |
| 21. | Hand file 20 cm. Smooth triangular | 20 nos | 42 | Hand file 30 cm. round bastard | 20 nos |

| Sl. No | Name of Tool/Equipment | Quantity (nos) | Sl. No | Name of Tool/Equipment | Quantity (nos) |
|---|---|-------------------|-----------|--|-------------------|
| GENERAL TOOLS EQUIPMENTS AND MACHINERIES | | | | | |
| 1 | Oil stone 15cm x 5cm x 2.5cm | 1 no | 34 | Grease gun | 2 nos. |
| 2 | Spanner, adjustable 20 cm. | 1 no | 35 | Sheet metal gauge | 1 no. |
| 3 | Torque wrench 5 - 35 Nm, 12 - 68 Nm, 50 - 225 Nm. | 1 set | 36 | Compression gauge | 1 no. |
| 4 | Plier round nose 15cm | 2 nos | 37 | Vacuum gauge to read 0 to 760mm of Hg | 1 no |
| 5 | Pipe wrench 350mm | 1 no. | 38 | Spanner for spark plugs | 2 nos |

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| | | | | 14 mm | |
| 6 | Vice grip pliers | 2 nos | 39 | 14 mm | 1 no |
| 7 | Circlip pliers Expanding and contracting type 15 cm and 20 cm each | 1 each | 40 | Tubed tyre of cars C clamp 100mm, 150mm, 200mm | 2 each |
| 8 | Screw pitch gauge | 1 no | 41 | Solid tyre | 1 no |
| 9 | Fire bucket (4 nos.) with stand | As required | 42 | Tubeless tyre of cars | 1 no |
| 10 | Hollow punch set of seven pieces 6 to 15 mm | 1 set | 43 | Cut section model of cross ply and radial tyres. | 1 no |
| 11 | Letter punch 4mm | 1 set | 44 | Pullers screw powered 2 mm with bearing puller attachment | 1 no |
| 12 | Tread depth gauge | 2 nos | 45 | Different types of Injectors | 1 set |
| 13 | Wheel aligner pit/lifter with rolling jack | 1 no | 46 | Tachometer - to read upto 10000 rpm | 1 no |
| 14 | Battery charger 12V- 36 V | 1 no | 47 | Battery 12 V (consumable 2 yrs span) | 2 nos |
| 15 | Portable electric drill 6 mm | 1 no | 48 | Hydrometer | 2 nos |
| 16 | Computerized wheel balancing machine with all accessories | 1 no | 49 | Fire Extinguisher | As required |
| 17 | Computerized wheel aligner with all accessories along with manuals & diagnostic charts | 1 no | 50 | Tyre repair kit | 1 set |
| 18 | Angle plate adjustable 250 x 150 x 175 | 1 no. | 51 | Nitrogen inflator with Tyre Pressure gauge | 1 no |
| 19 | Latest 4 Wheelers of different make (one LMV & one HMV) along with workshop manuals, common exhaust system | 1 each | 52 | Trolley type portable air compressor single cylinder with 45 liters capacity air tank, along with accessories & with working pressure 6.5 kg/sq cm | 1 no |
| 20 | Different types of gaskets(consumable) | As required | 53 | Tyre changer | 1 no |
| 21 | Different types of oil seal(consumable) | As required | 54 | Tube vulcanizing machine | 1 no |
| 22 | Marking material (consumable) | As required | 55 | Tyre vulcanizing machine | 1 no |
| 23 | "V" Block 75 x 38 mm pair with Clamps | 2 nos | 56 | Drilling machine bench to drill up to 12mm dia along with accessories | 1 no |
| 24 | Drill Twist (assorted) | As required | 57 | Grinding machine (general purpose) D E | 1 no |

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| | | | | pedestal with 300mm dia wheels rough and smooth | |
| 25 | Tap and tap wrenches UNC UNF and metric | 2 sets | 58 | Hacksaw blade (consumable) | As required |
| 26 | Set of stock and dies-UNC, UNF and metric | 2 sets | 59 | Snip straight and bent 200mm | 2 nos each |
| 27 | Hand reamers adjustable 10.5 to 11.25mm, 11.25 to 12.75mm, 12.75 to 14.25mm, 14.25 to 15.75mm | 2 sets | 60 | Arbor press 1 ton | 1 no |
| 28 | Spark plug cleaner and tester similar to Bosch / champion | 1 no | 61 | Battery tester | 1 no |
| 29 | Work bench each 250 x 120x60 with 4 bench vices 12 cm jaw | 1 no. | 62 | Air impact wrench | 1 no. |
| 30 | Air ratchet | 1 no | 63 | Air chisel | 1no. |
| 31 | Air blow gun | 1 no. | 64 | Tubular spanner 6mm to 22mm set of 8 pieces | 1 set |
| 32 | Marking out table 90 x 90cm | 1 no. | 65 | Tube valve insert key | 2 nos |
| 33 | Two post lifter 3 ton capacity | 1 no. | 66 | Steel Almirah 6' Height | 4 No |

GENERAL INFORMATION FOR BICYCLE AND TRICYCLE REPAIR

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|---|--|
| Name of Sector | Automotive Repair |
| Name of Module | Bicycle & Tricycle Repair |
| MES Code | AUR 704 |
| Competency as per N C O Code | |
| Duration of Course | 500 Hrs |
| Unit size (No. of Trainees) | 20 |
| Power Norms | 3 KW- (a) Class Room: 1 KW (b) Workshop: 2 KW |
| Space Norms(Workshop and Class Room) | (a) Class room: 30 sq.mtr @1.5 sq. mtr per trainee (b) Workshop: 30 Sq. mtr + 10 Sq. mtr (Parking area) |
| Job Profile | Bicycle & Tricycle Mechanic |
| Objective | <p>1.The Trainee should become Bicycle & Tricycle Mechanic with following employability skills</p> <p>i). Safety awareness about work safety, tools, equipments personal safety and environmental safety</p> <p>ii).Quality awareness</p> <p>iii).Basic skills of to do assembly and maintenanceof Bicycle and Tricycle</p> <p>iv). Skills to do minor and major repair works in Bicycle and Tricycle</p> <p>2. Self Employment in the areas of Cycle Repairing and Selling Centre</p> |
| Terminal competency | <p>Successful candidate would be able to do</p> <p>1. Safety signal words</p> <p>2. Safe practice on work</p> <p>3. First aid and fire extinguishers handling of general tools and special tool kit.</p> <p>4. Implementation of quality tools on repair</p> <p>5. Basic fitting works such as marking, punching, hack sawing, filing</p> <p>6. Assembly, general servicing and repair of Bicycle and</p> |

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| | <p>Tri cycle</p> <p>7. Pre-ride check list</p> <p>8. Maintenance and Troubleshooting</p> <p>9. Warranty repairs</p> |
| Instructor Qualification | <p>Degree in Automobile/ Mechanical Engg. With one year relevant experience</p> <p style="text-align: center;">OR</p> <p>Diploma in Mechanical Engineering, with two years relevant Experience in Supervisory level.</p> <p style="text-align: center;">OR</p> <p>Instructor must have ITI (NTC/NAC) in fitter trade with Three years experience in any relevant manufacturing / repair unit</p> |
| Desirable Qualification | Craftsmen Instructor Certificate(CIC) in Fitter trade |

11. COURSE CONTENT:

| Contents | |
|--|---|
| Underpinning Theoretical knowledge (150hrs) | Practical Competencies (350 Hrs) |

Basics and Safety

- Introduction to service manuals of bicycles and tricycles
- Introduction on conventional bicycle and geared bicycle
- Safety rules and traffic symbols for two wheelers
- Nomenclature of different parts of bicycle and tricycle and their locations
- Introduction to operating instructions of motorized tricycle
- Layout of power flow from pedal to wheels
- Safety precautions, use of protective clothing and elementary first aid.
- Types of fire extinguishers and their uses
- Reasons for carrying out good housekeeping practices, need for environmental safety, safe disposal of replaced parts and materials

Tools and equipment

- Functions and uses of various tools and equipment
- Care and use of tools, equipment and materials used in Bicycle & Tricycle Repair
- Selection and correct use of tools
- Study of different types of hardwares and fasteners-screws, bolts, nuts, washers, studs, lock nuts, lock washers, stem wedge cap, plastic caps, split and cotter pins, wire connectors and clamps.
- Working steps on dismantling and assembling
- Study of lubrication schedule- types of chain lube and grease

Basics and safety

- Drive bicycle safely
- Develop safety attitude by using Personal Protective Equipment (PPE), first aid methods, use of fire extinguishers
- Safe disposal of replaced parts/ Materials
- Safety signal words, safety symbols, safety warning and riding safety instructions before using bicycle and tricycle
- Apply good housekeeping practices, proper handling of materials and disposal of waste
- Ability to read and interpret clauses of warranty card

Tools and equipment

- Familiarization with the conventional and special tools, hardware and fasteners
- Identify tools, equipment and materials used in Bicycle & Tricycle repair
- Store/lay materials at work in safe manner
- Practice on cutting works using cutting tools
- Practice on filing using deferent types of files
- Cleaning tools and equipment
- Select proper tools for a particular task
- Care and use of tools and equipment: steel rule, measuring tape, dividers, punches, chisel, hammer, screw drivers, Allen key, vices and clamps, spanners sockets, pliers, Wrenches, torque wrenches, file, feeler gauge, hacksaw, grease gun, snips, hydrometer, wooden/Plastic mallet,

Wheel/ Tyre/ Tube/ brake

- General study of wheels-rims, hub, designation of tyres, maintenance of tyre and tube.
- Procedure of wheel assembly
- Probable cause-effect, remedy of faults in brake systems
- Method of aligning the wheel and balancing
- Procedure for puncture repairing
- Method of testing air leakage
- Tyre inflator and its uses
- Tube valve assembly and its function
- Safety precautions in puncture repair

Dismantling / Assembling

- Procedure to assemble bicycle and tricycle/Motorised Tricycle.
- Brief introduction of bearings-head set, wheel bearings, Pedal bearings, bottom bracket bearings.
- Safety precautions during the assembly of tricycle and bicycle
- Procedure of attach the handle bar, main frame rear frame power trains
- Procedure of connect the two ends of chain/Replacing chain.
- Procedure of brake system Assembly.
- Types of brake system-pad type and band type
- Brief introduction of disc brake calliper and disc brake rotor

Maintenance and trouble shooting

- Need and importance of

Multi meter, Tyre pressure gauge with accessories

Wheel/ Tyre/ Tube/ brake

- Placing drive wheel and non drive wheel on the axle
- Check spin wheels, rims
- Check/ replace spokes and hub bearing
- Wheel alignment and balancing
- Replace/adjust brake levers, cable parts
- Change tyre and tube
- Check tyre inflation, thread, valves
- Repair puncture in bicycle and tricycle

Dismantling / Assembling

- Dismantle the bicycle and tricycle
(Sub assemblies- Handle bar, steering assembly, drive system, brake system, brake system, bottom shell assembly)
- Clean and inspect parts; if necessary, repair/replace defective parts
- Assemble all the parts and check for sub assembly's proper operations

Maintenance and trouble shooting

- Trouble shoot the various problems that

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| <p>maintenance and troubleshooting.</p> <ul style="list-style-type: none"> • Importance of position of the front centre, rear fenders, saddle, saddle stem and pedals. • Probable cause-effect – remedy of faults in brake systems, steering systems, wheels and drive system • Placing accessories on the cycles. • Study pre ride check list-before riding cycles. • Maintenance schedule and procedure for bicycle and tricycle <p>Work estimation</p> <ul style="list-style-type: none"> • Criteria for preparation of an estimate, various types of costs (fixed and variable cost), profit, calculation of total estimated cost | <p>occur during running (Frequent loss of air pressure, chain slipping, wheel wobbling, free wheel, mal functioning, pedals crank slipping, handle bar shaking, brake failure, hard pedalling, noise in running etc.)</p> <ul style="list-style-type: none"> • Lubricate the lubrication points as per the schedule • Check spin wheels, rims, replace/check spokes and hub bearing • Maintenance of bicycle and tricycle (cleaning, periodical check up, lubrication and oiling, air pressure, brake, drive system, tyre, tube, valves) • Replace/ adjust brake levers, pedal, bearing, cables parts • Replace/check/Adjust drive trains- Pedal, Bearing, Crank set and free wheel • Check all parts and accessories are still secure and tight <p>Work estimation</p> <ul style="list-style-type: none"> • List out the materials and spares required for the given repair work • Estimate cost of materials and spares required • Estimate manpower and time required for completing the work • Estimate labour cost, overheads and cost of utilities (power, water) • Prepare an estimate for the repair work including profit |
| <ul style="list-style-type: none"> • Motorised Tricycle (Electric Tricycle) <ul style="list-style-type: none"> • Description/Working principal of switches, wiring circuit, connectors, charging Adapter, Cable Colour code and Size. • Layout of power flow from Motor to | <ul style="list-style-type: none"> • Motorised Tricycle (Electric Tricycle) <ul style="list-style-type: none"> • Familiarize motorised tricycle components i.e motor, charging adapter, drive system. • Practice to assemble/check front Tricycle and pre-assembled rear drive unit (Axle, Motor and Drive Gears) |

Drive wheels.

- To study about the functions of Drive axle, Motor and Drive gears.
- Working of throttle operation.
- To study jump wire testing.
- Brief study about battery

- Check/Install drive chain to operate properly.
- Practice throttle installation- Operate sliding operations, lights function on the monitor.
- Practice to open battery compartment and check/replace battery.
- Practice/Disconnect motor unit from the drive unit.
- Repair puncture in bicycle/ tricycle
- Check the correctness of fault rectified
- Change tyre and tube
- Practice jump wire testing.

• Gear type Bicycle

- Function of gear type bicycles, types of different shifting controls-function of lever, twist grips, triggers, combination shift controls, push buttons
- Working principal and function of derailleur and internal gear hub drive train
- Use of free wheel sprocket cluster, front sprockets or chain
- Purpose of bicycle suspension systems
- Brief introduction of suspension mechanism
- Familiarization with special tool kit of gear type bicycle repair.

• Gear type Bicycle

- Bicycle-Shifting gears-Check/Adjust gear shifting controls.
- Clean, check-levers, twist grips, Triggers, Shift controls and push buttons.
- To check/replace/adjust rear Cassette or free wheel sprocket cluster, front sprocket or chain rings and drive chain.
- Check, adjust the function of derailleur mechanism.
- Check, adjust an internal gear hub drive train shifting mechanism.

LIST OF TOOLS AND EQUIPMENT

| S.No | Description of tools | Quantity proposed for a batch of 20 trainees |
|-------------|---|---|
| 1. | Double end spanner 6 – 27mm | 5 sets |
| 2. | Double end spanner ¼” – 1 1/8” | 5 sets |
| 3. | Ring spanner 6 – 27mm | 5 sets |
| 4. | Ring spanner ¼” – 1 1/8” | 5 sets |
| 5. | Screw driver heavy duty 12” | 10 nos |
| 6. | Phillips screw driver | 5 set |
| 7. | Side Cutting plier 9” | 5 nos |
| 8. | Flat Nose plier 6” | 5 nos |
| 9. | Ball peen hammer 1 lb with handle | 5 nos |
| 10. | Adjustable spanner 20cm long | 5 nos |
| 11. | Pin punch 150 mm | 5 nos |
| 12. | Cold flat chisel 19 mm | 5 nos |
| 13. | Wheel balancing stand with rim bend remover | 2 nos |
| 14. | Nipple key | 5 nos |
| 15. | Adjustable tubular hacksaw frame | 5 nos |

| S.No | Description of tools | Quantity proposed for a batch of 20 trainees |
|-------------|---|---|
| 16. | Tyre inflator foot operated | 2 nos |
| 17. | Tyre inflator hand operated | 2 nos |
| 18. | Anvil 50 kg with stand | 2 nos |
| 19. | Tyre levers | 5 sets |
| 20. | Scissors 9 “ | 2 nos |
| 21. | Rasp cut file 300 mm | 5 nos |
| 22. | End Cutting plier 9” | 5 nos |
| 23. | Box spanner 6 – 27mm | 5 nos |
| 24. | Hook spanner | 5 nos |
| 25. | Circlip plier 150 mm | 5 nos |
| 26. | Face pin wrench for hub shell | 5 nos |
| 27. | Grease gun 1 kg | 2 nos |
| 28. | Oil can 250 ml | 2 nos |
| 29. | Special spanner for fixed bottom race cup and for fork lock | 2 nos |
| 30. | Special spanner for pedal shaft and wheel cone nut | 2 nos |
| 31. | Special spanner for free wheel | 2 nos |
| 32. | Special spanner for fork lock nut, fork stem M25 | 2 nos |
| 33. | Special spanner for bottom bracket, cup, lock ring , free wheel, free wheel body , rear cup adaptor, fork stem M 35 | 2 nos |
| 34. | All in one spanner | 2 nos |
| 35. | Chain tensioner ratchet type and screw type | 2 nos each |
| 36. | Torque Wrench 1.5nm to 30 nm | 3 nos |
| 37. | Steel Rule 30cm | 3 nos |
| 38. | Hydrometer | 2 nos |
| 39. | High rate discharge tester | 2 nos |
| 40. | Multi meter | 2 nos |
| 41. | Cleaning Tray | 5 nos |
| 42. | Bicycle repair tool kit (Gear type) | 2 nos |
| 43. | Water basin | 5 nos |
| 44. | Tyre tube puncture repairing kit | 5 nos |
| 45. | Slip joint multi grip pliers | 2 nos |
| 46. | Drift punch 150 mm | 2 nos |

| S.No | Description of tools | Quantity proposed for a batch of 20 trainees |
|------|-------------------------------------|--|
| 47. | Emery card | 2 nos |
| 48. | Wire brush | 5 nos |
| 49. | Old bicycle for spanner practice | 2 nos |
| 50. | Old tricycle for spanner practice | 2 nos |
| 51. | Wheel assembly | 5 nos |
| 52. | Free wheel assembly | 5 nos |
| 53. | Hub assembly | 5 nos |
| 54. | Children cycle | 2 nos |
| 55. | Sports cycle | 2 nos |
| 56. | Handicapped cycle | 1 no |
| 57. | Gym cycle | 1 no |
| 58. | Gear type Bicycle | 1 no |
| 59. | Motorised Tricycle | 1 no |
| 60. | Air Compressor with all accessories | 1 no |
| 61. | Air inflating nipple | 1 no |
| 62. | Steel Almirah 6' Height | 3 no |

GENERAL INFORMATION FOR REPAIR AND OVERHAULING OF 2W&3W

| | |
|---------------------------------------|---|
| Name of Sector | AUTOMOBILE |
| Name of Module | <u>REPAIR AND OVERHAULING OF 2Wheeler &3 Wheeler</u> |
| MES Code | AUR705 |
| Competency as per N C O Code | |
| Duration of Course | 600 Hrs |
| Entry Qualification of Trainee | 5th Pass + 14 yrs of age + passed in basic automobile servicing of 2w&3w |
| Unit size (No. Of trainees) | 20 |
| Power Norms | 3kw |
| Space Norms (Workshop and Class Room) | 80 sqm +30 sqm parking area |
| Job Profile | Mechanic Two wheeler/Mechanic three wheeler |
| Objective | <p>1. Producing Mechanic Two wheeler/Mechanic three wheeler in automotive workshop by pinning with following Employability skills</p> <p>i)Skills to do major repairing work of 2&3 WHEELERS</p> <p>2.Self employment in the area of Two wheeler and Three wheeler repair work</p> |
| Terminal competency | <p>1. Able to handle special tools</p> <p>2. Measure up to an accuracy of 0.01mm using precision measuring instruments</p> <p>3. Trouble shoot and service petrol and diesel engines</p> <p>4. Service transmission work</p> <p>5. Service steering and suspension work</p> <p>6. Trouble shoot and rectify electrical repair works</p> |
| Instructors Qualification | <p>Degree in automobile Engineering with one year relevant Experience</p> <p>OR</p> <p>Diploma in automobile Engineering with two year relevant Experience</p> <p>OR</p> <p>NTC/ NAC in automobile Trade Group with three years of relevant Experience</p> |
| Desirable Qualification | Craft Instructor Certificate(CIC) |

COURSE CONTENT

| PRACTICAL COMPETANCIES | UNDERPINNING KNOWLEDGE |
|--|--|
| <ul style="list-style-type: none"> ➤ MEASUREMENT UP TO AN ACCURACY OF 0.01MM <ul style="list-style-type: none"> • Measuring with Vernier caliper • Measuring with micrometer • Measuring with bore dial gauge • Measuring with dial test indicator | Measurement-linear-basic units-accuracy-steel rule-precision measuring instruments used in automobile workshops-their description and uses |
| ENGINE OVERHAULING <ul style="list-style-type: none"> • Draining engine oil ➤ SERVICING CLUTCH <ul style="list-style-type: none"> • Disconnecting clutch cable • Removing kick starter (if available) • Removing clutch cover • Dismantling clutch assembly • Inspecting clutch assembly parts • Reassembling clutch assembly | Points to be observed before engine overhauling-Reasons for poor engine performance-effects of worn out clutch plates-procedure for servicing clutch assembly-conclusion with different values |
| <ul style="list-style-type: none"> ➤ REMOVING ENGINE ASSEMBLY <ul style="list-style-type: none"> • Disconnecting fuel lines • Removing spark plug • Disconnecting accelerator cable from carburetor • Disconnecting air intake and exhaust systems • Removing power transmission from the engine • Disconnecting electrical connections from the engine • Removing engine from the vehicle | Details of intake and exhaust system-points to be considered while removing engine from a vehicle |
| <ul style="list-style-type: none"> ➤ DISMANTLING THE ENGINE <ul style="list-style-type: none"> • Dismantling magneto assembly • Removing starter(if available) • Removing timing chain assy • Dismantling cylinder head • Removing cylinder block • Removing oil pump assy • Dismantling crankcase • Dismantling gear box • Removing crank shaft • Dismantling piston and connecting rod | Points to be considered while dismantling the engine-steps to be followed while dismantling the engine-study about the lubricating system in engines-points to be considered while recommending reconditioning the vehicle parts |
| <ul style="list-style-type: none"> ➤ INSPECTING PARTS OF GEAR BOX <ul style="list-style-type: none"> • Dismantling the gear parts • Inspection • Reassembling the gear parts | Functions of gear box-points to be considered while servicing gear box |
| <ul style="list-style-type: none"> ➤ INSPECTING CYLINDER HEAD COMPONENTS <ul style="list-style-type: none"> • Checking head warpage | Effects of worn out head parts-concluding with results and different values-details of variable valve timing |

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|--|--|
| <ul style="list-style-type: none"> • Checking rocker arm components • Inspecting valve, valve seat, valve guide and spring • Inspecting cam shaft • Reassembling cylinder head | |
| <ul style="list-style-type: none"> ➤ INSPECTING CYLINDER BLOCK COMPONENTS <ul style="list-style-type: none"> • Checking crank shaft bearings • Inspecting crank shaft • Checking connecting rod • Measuring cylinder bore • Measuring piston and piston rings | Effects of worn out engine parts-concluding with results and different values |
| <ul style="list-style-type: none"> • Reassembling engine parts | Steps to be followed while reassembling engine |
| <ul style="list-style-type: none"> • Setting valve timing | Importance of valve timing-variable valve timings-steps to be followed while setting valve timing |
| <ul style="list-style-type: none"> • Setting ignition timing | Steps to be followed while setting ignition timing-advance mechanisms-use of timing light |
| <ul style="list-style-type: none"> ➤ SERVICING DISC BRAKE ASSEMBLY <ul style="list-style-type: none"> • Dismantling the parts • Servicing caliber • Inspecting disc brake components • Reassembling • Servicing ABS | Principle of hydraulic brake operation-steps to be followed while servicing disc brake assembly-importance of correct brake oil level-description of ABS-advantages of ABS |
| <ul style="list-style-type: none"> ➤ SERVICING FRONT FORK <ul style="list-style-type: none"> • Dismantling the parts • Inspecting the components • Reassembling | Steps to be followed while servicing front fork assembly-care should be taken while |
| <ul style="list-style-type: none"> ➤ ELECTRICAL <ul style="list-style-type: none"> • Testing ignition system parts • Testing lighting system parts • Testing charging system parts • Testing starting system parts • Servicing digital speedometer | Study about different ignition system, lighting system, charging, starting circuits-its parts and functions Details about digital speedometer |
| <ul style="list-style-type: none"> ➤ DIESEL FUEL SYSTEM <ul style="list-style-type: none"> • Bleeding diesel fuel system • Setting injection timing • Servicing injector • Servicing fuel feed pump | Basic diesel fuel system circuits-importance of correct injection timing |
| <ul style="list-style-type: none"> ➤ PETROL FI SYSTEM <ul style="list-style-type: none"> • Servicing fuel pump • Servicing throttle body • Servicing injectors • Testing sensors and actuators • Trouble tracing with scan tool | FI system circuit-its parts and functions-details of scan tool-possible troubles and its causes |
| <ul style="list-style-type: none"> • Servicing power transmission in3w | Description of power transmission in 3 wheelers |

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| <ul style="list-style-type: none"> • Dismantling wheel bearing, steering stem and ball race, inspect and assemble • Servicing cv joint | Bearing-types9(available in 3 wheelers)-steps to dismantle and assemble-description of CV joint |
|--|---|

TOOLS AND EQUIPMENTS REQUIRED:

| SL NO | LIST OF TOOLS,EQUIPMENTS,MACHINERIES AND VEHICLES | QUANTITY |
|--|--|------------|
| GENERAL TOOLS REQUIRED for 20 trainees(4 trainees/batch) | | |
| 1 | Double ended spanner set 6-32mm | 05set |
| 2 | Ring spanner set 6-32mm | 05 set |
| 3 | Tubular spanners 8,10,12,14,16,17mm | 05 no each |
| 4 | Socket spanners 6-32 mm with T bar and ratchet | 05 set |
| 5 | Allen keys 4-12mm in steps of 2mm | 05 set |
| 6 | Screw driver (flat) 20cm x 9mm blade | 05 no |
| 7 | Screw driver (flat) 30cm x 9 mm blade | 05 no |
| 8 | Screw driver (Philips type) 100 -300mm set of 5 pieces | 05 set |
| 9 | Hammer ball peen 0.75 kg | 05 no |
| 10 | Mallet hammer | 05 no |
| 11 | Hammer rubber | 05 no |
| 12 | Nose plier straight 15 cm | 05 no |

| | | |
|---|---|-----------------|
| 13 | Combination plier 15 cm | 05 no |
| 14 | Circlip plier external & contracting 6" | 05 no each |
| 15 | Circlip plier external & contracting 7" | 05 no each |
| 16 | Drift | 05 no |
| 17 | Feeler gauge 20 blades metric | 05 no |
| 18 | Adjustable spanner 20 cm | 05 no |
| 19 | Spark plug spanner 12,14,17mm | 05 no each |
| 20 | File different shapes and size of 15cm | 05 set |
| LIST OF TOOLS,EQUIPMENTS,MACHINERIES AND VEHICLES | | |
| 21 | Water pump plier | 01 no |
| 22 | Torque wrench 0-50 NM | 01 no |
| 23 | Inspection lamp with guard | 01 no |
| 24 | Thread pitch gauge metric | 01 no |
| 25 | Oil can 0.5 litre capacity | 01 no |
| 26 | Centre punch 10 mm dia x 100mm | 01 no |
| 27 | Digital Tachometer able to measure up to 9999 RPM | 01 no |
| 28 | Compression gauge minimum up to 20 kg/cm ² for petrol and 25 kg/cm ² for diesel | 01 no each |
| 29 | Vacuum gauge | 01 no |
| 30 | Battery charger | 01 no |
| 31 | Digital Multi meter | 01 no |
| 32 | Hydrometer | 01 no |
| 33 | Battery load tester | 01 no |
| 34 | Engine valve removing tool(C clamp) | 01 no |
| 35 | Tappet adjuster | 01 no |
| 36 | Air compressor 200 litres capacity | 01 no |
| 37 | Impact screw driver for flat and Philips type | 01 set |
| 38 | Pneumatic tyre inflator | 01 no |
| 39 | Tyre changer | 01 no |
| 40 | Greasilator | 01 no |
| 41 | 2w lift hydraulic type | 04 nos |
| 42 | 3w lift hydraulic type | 02 nos |
| 43 | Pneumatic tools (connected with air compressor by pipe fittings) | 01 set complete |
| 44 | Universal clamp wrench | 01 No |
| 45 | Clutch puller for available vehicles | 01 No each |
| 46 | Magneto puller for available vehicles | 01 no each |
| 47 | Cleaning tray 45 x 30 cm | 10 nos |
| 48 | Work benches each 250 x 120 x 60 with 4 bench vises 12 cm jaw | 01 set |
| 49 | Spark plug cleaning and testing machine | 01 NO |
| 50 | Bench grinder | 01 no |
| 51 | Tread depth gauge | 01 no |
| 52 | Car washer reciprocating type | 01 no |
| 53 | Wheel trueing machine | 01 no |
| 54 | Timing light | 01 no |
| 55 | Hydraulic Brake bleeding machine | 01 no |
| 56 | Fire extinguisher | 01 no |
| 57 | Steel tool box with lock and key (folding type) 400 x 200 x 150 mm size | 05 boxes |
| 58 | Steel almirah minimum 6' height | 03 nos |

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|----|---|-------------|
| 59 | Hydraulic press 2 ton capacity | 01 no |
| 60 | Vacuum cleaner | 01 no |
| 61 | Moped up to 50 cc 2 stroke with service manual | 01 no |
| 62 | Scooter 4 stroke variable transmission type 100-125 cc with service manual | 01 no |
| 63 | Bike 4 stroke electric start up to 100cc with service manual | 01 no |
| 64 | Bike 4 stroke electric start with ABS up to 150cc with service manual | 01 no |
| 65 | Bike 4 stroke water cooled up to 150cc with service manual | 01 no |
| 66 | Auto rickshaw petrol version 4 stroke with service manual | 01 no |
| 67 | Auto rickshaw diesel version 4 stroke with service manual | 01 no |
| 68 | Recommended special tools for servicing of available vehicles(refer manufacturers service manual) | 01 set each |
| 69 | Vernier caliper with an accuracy of 0.02mm | 01 no |
| 70 | Micrometer outside 0-25mm,25-50mm,50-75mm,75-100mm | 04 nos |
| 71 | Bore Dial gauge 50mm-150mm | 01 set |
| 72 | Dial test indicator with magnetic base 0.01mm accuracy | 01 set |
| 73 | Surface plate with stand 2' x2' | 01 no |
| 74 | V block | 02 nos |
| 75 | Spring tension tester | 01 no |
| 76 | Piston ring expander | 01 no |
| 77 | Piston ring compressor | 01 no |
| 78 | Bearing installer set | 01 set |
| 79 | Scan tool suitable for available vehicles | 01 no |

REDESIGNED MODULES FOR THE SECTOR

OF

AUTOMOBILE

UNDER

MODULAR EMPLOYABLE SKILLS (MES)

Redesigned in - 2014

By
Government of India
Directorate General of Employment & Training
Ministry of Labour & Employment (DGE&T)

GENERAL INFORMATION FOR REPAIR AND OVERHAULING OF CHASSIS SYSTEM (LMV & HMV)

| | |
|-------------------------------------|---|
| Name of Sector | AUTOMOBILE |
| Name of Module | REPAIR AND OVERHAULING OF CHASSIS SYSTEM (LMV & HMV) |
| MES Code | AUR706 |
| Competency as per N C O Code | |
| Duration of Course | 600 Hrs |
| Entry Qualification of Trainee | Minimum 5th Std., 14 years of Age+ AUR102+driving experiences with valid |

| | |
|--------------------------------------|---|
| | driving license /AUR103 |
| Unit size (No. of Trainees) | 20 |
| Power Norms | 6 KW - (a) Class Room: 1 KW (b) Workshop: 5 KW |
| Space Norms(Workshop and Class Room) | 210 sq. m - (a) Class Room: 30 Sq. meter @ 1.5 sq. meter per trainee (b) Workshop: 120 sq. meter + 60 sq. meter (parking area) |
| Job Profile | Service Mechanic |
| Objective | <p>1. Produce Service Mechanic in automotive workshop by pinning with following Employability skills:</p> <p>(i) Safety awareness about work safety, tools, Equipments & Machinery safety, Personal safety, Fire safety and Environmental safety.</p> <p>(ii) Skills to do chassis repair works in 4 wheelers (LMV & HMV).</p> |
| Terminal competency | <ol style="list-style-type: none"> 1. Safe practice on Work 2. Able to do First Aid 3. Handling of General Tools, Special tools, equipments and Machineries available in the Automobile Garage 4 Able to do Transmission work on lmv & hmv 5. Able to do Brake work on lmv & hmv 6. Able to do Steering work on lmv & hmv 7. Able to do Suspension work on lmv & hmv 8. Able to do Wheels & Tyre work. 9. Able to do Vehicle road test |
| Instructor Qualification | <p>Degree in Automobile/ Mechanical Engg.</p> <p>With one year relevant experience</p> <p>OR</p> <p>Diploma in Automobile/ Mechanical Engg.</p> |

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|-------------------------|--|
| | With two years relevant experience OR NTC/NAC in Automobile trade group with three years of relevant experience |
| Desirable Qualification | Craft Instructor Certificate(CIC) |

Course Contents for Module Repair and Overhauling of Chassis System (LMV & HMV) (AUR202)

| Practical Competencies | Underpinning Knowledge(Theory) |
|---|---|
| <p><u>SAFETY:</u></p> <p>Practice Health & Safety – familiarize, select, use, maintain & store – tools, equipments, consumables & clothing safely</p> <p>Interaction with health centre and fire service station to provide demo on First aid and fire safety.</p> | <p>Safe disposal of toxic dust.</p> <p>Safe handling and periodic testing of lifting equipment.</p> <p>Authorization of moving and road test vehicles.</p> <p>Environment control of running indoor engines.</p> <p>Electrical safety</p> |
| <p><u>ELECTRICAL BASIC:</u></p> <p>Practice in joining wire using soldering iron.</p> <p>Identify electrical circuit in vehicle.</p> <p>Measurement of current, voltage and resistance using digital multimeter.</p> <p>Remove and refit Head lamp</p> <p>Check for electrical defects and rectify</p> | <p>Ohm’s Law</p> <p>Series & Parallel resistances circuits</p> <p>Working principle, types & application of capacitors & transistors.</p> <p>Wiring colour-code, reading of engine electrical systems circuits.</p> <p>Conductor and insulator.</p> <p>Usage of Voltmeter, ammeter, ohmmeter, & multimeter,</p> <p>Fault finding in electrical circuits</p> |
| <p><u>HYDRAULICS AND PNEUMATICS:</u></p> <p>Identification of hydraulic and pneumatic components used in vehicle.</p> <p>Tracing of hydraulic circuit of hydraulic power steering.</p> | <p>Pascal law, pressure force viscosity. effect of viscosity with respect to temperature</p> <p>Description and use of gear pump external & internal, vane pump, hydraulic motor and hydraulic symbols.</p> <p>Description use and application of single</p> |

| | |
|---|--|
| <p>Hydraulic/pneumatic brake circuit</p> | <p>acting, double acting & double ended cylinder, directional control valves- 3/2, 4/2, 4/3 way valve, pressure control valve, non return valve, flow control valve in automobile.</p> <p>Pneumatic symbols, description and function of air reciprocating compressor, function of air service unit(FRL – filter, regulator and lubricator)</p> |
| <p><u>TRANSMISSION WORK ON LMV & HMV:</u></p> <p>Identify different parts of chassis</p> <p>Identify different tools & equipments</p> <p>Remove clutch plate from vehicle, check for defects & rectify/replace & refit</p> <p>Remove gear box from vehicle, dismantle, check, rectify, fill lubricating oil & assemble</p> <p>Align gear selector fork</p> <p>Remove CV Joint, Dismantle, lubricate & refit</p> <p>Remove rear axle assembly dismantle of crown wheel, pinion and bearings, clean parts. Check tooth contact in the crown and pinion and adjust backlash & Assemble rear axle assembly</p> | <p>Units & Definition of force, work, power, torque & pressure.</p> <p>Power flow from engine to wheels</p> <p>Description of single plate clutch. Functions of different parts of the clutch assembly. Clutch linings material. Power flow in clutch plate.</p> <p>Clutch operating mechanisms- manual & hydraulic</p> <p>Clutch faults</p> <p>Type of gears and their application- advantages and disadvantages-gear ratio</p> <p>Types of gear box</p> <p>Working principle of constant mesh, synchromesh gear boxes</p> <p>Gear selection mechanism</p> <p>Lubrication of transmission system</p> <p>Gear box faults</p> <p>Types of bearings, maintenance, their characteristics & application</p> <p>Working principle of constant velocity joints</p> <p>Working principle of differential</p> <p>Faults in differential, C.V.Joints & drive shafts</p> |

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|--|---|
| <p><u>BRAKE WORK ON LMV & HMV:</u></p> <p>Check and adjust parking brake and service brakes. Dismantle wheel brake assembly– remove old lining and fit new one</p> <p>Remove and refit vacuum boosters</p> <p>Overhaul – master cylinder, Wheel cylinder & calliper pistons, wheel drum</p> <p>Bleed vacuum assisted hydraulic brakes</p> <p>Overhaul – pneumatic valves, Wheel cylinders & Drum brake/disc brakes</p> <p>Check fail safe system & rectify defects</p> <p>Remove & clean brake drums. Check disc/drum run-out, Fit new cups and brake hoses/pipes –assemble, adjust all wheel brakes and test for brake concern</p> | <p>Forces & moments acting on vehicle, brake slip, braking force co-efficient, time element of braking operation</p> <p>Classification of brake systems, factors affecting the braking distance</p> <p>Comparison between hydraulic & pneumatic brake system.</p> <p>Working principle of brake components – brake booster, tandem master cylinder, caliper assembly, wheel cylinder & different braking force control valves</p> <p>Working principle of brake components – compressor, pressure regulator, different pneumatic valves, brake booster, wheel cylinder</p> <p>Brake linings & pads</p> <p>Brake faults diagnostics and adjustments</p> <p>Introduction to anti-lock braking system (ABS).</p> |
| <p><u>STEERING WORK ON LMV & HMV:</u></p> <p>Check and correct the steering geometry with instruments</p> <p>Remove and refit steering boxes from vehicle</p> <p>Check and top-up oil in steering box.</p> <p>Check and adjusting steering wheel play and backlash.</p> <p>Overhaul hydraulic power assisted steering system – pump, control valve & cylinder.</p> | <p>Introduction, basic types of steering, steering geometry (necessity, types & effects), steering characters (over steer, under steer & neutral steer) & steering linkage</p> <p>Types of steering gear, power assisted steering (hydraulic & electronic)</p> <p>Checks on steering system and fault diagnosis</p> |
| <p><u>SUSPENSION WORK ON LMV & HMV:</u></p> <p>Visual inspection of chassis for crack bent & twists.</p> <p>Overhauling and inspection of shackle, leaf spring, front and rear suspension.</p> <p>Overhauling and inspection of front and rear independent suspension.</p> <p>Removing, inspection and assembling of shock absorber.</p> <p>Lubricating a suspension system.</p> | <p>Components, function and types of each type suspension system:</p> <p>rigid suspension</p> <p>independent suspension</p> <p>electronically controlled air suspension</p> <p>adaptive air suspension</p> |

| | |
|---|---|
| <p>Troubleshooting: wheel hop, ride height (unequal and low), noise under operation, fluid leakage, excessive travel, bounce, worn dampers, worn joints/damaged linkages, vehicle crabbing.</p> | |
| <p><u>WHEELS & TYRES:</u></p> <p>Necessity, functions, designation & defects analysis</p> <p>Procedure for tyre rotation</p> <p>Final road test procedure – observation of Noise, Vibration & harshness from different part of chassis – observation of transmission, brake, clutch, steering & suspension systems for their satisfactory working.</p> | <p>Remove tyre, inspect/check & assemble</p> <p>Rotate the tyres</p> <p>Do Final road test – observe for Noise, Vibration & harshness from different part of chassis – observe for problems in transmission, brake, clutch, and steering & suspension systems & rectify the defect.</p> |

**List of Tools & Equipment for module Repair and Overhauling of Chassis System
(LMV & HMV) (AUR202)**

| Sl. No. | Name of Tool/Equipment | Quantity (nos) | Sl. No | Name of Tool/Equipment | Quantity (nos) |
|---------------------|--|----------------|--------|---|----------------|
| TRAINEES KIT | | | | | |
| 1. | Steel Rule 15 cm inch and metric | 5 nos | 19 | Oil can 0.5 litre cap | 5 nos |
| 2. | Steel Rule 30 cm inch and metric | 5 nos | 20 | Pliers combination 15 cm | 5 nos |
| 3. | Steel measuring tape 10 meter in a case | 5 nos. | 21 | Wire cutter and stripper | 5 nos. |
| 4. | Hammer ball peen 0.75 kg | 5 nos. | 22 | Inspection lamp with guard and wandering lead of 10 ft (consumable) | 5 nos |
| 5. | Socket Spanners with handle, T bar & ratchet | 5 sets | 23 | Horses and wheel chokes | 5 nos |
| 6. | Mallets (wooden/plastic/copper) | 5 nos | 24 | Scriber 15 cm with scribing block universal | 5 nos |
| 7. | Screw driver 20 cm. x 9 mm blade | 5 nos. | 25 | Hacksaw frame adjustable for 30 cm blade | 5 nos |
| 8. | Screw driver 30 cm x 9 mm blade | 5 nos | 26 | Hand vice 37mm | 5 nos |
| 9. | Philips Screw Driver Type set of 5 pieces 100 mm to 300 mm | 5 sets | 27 | Feeler gauge 20 blades (metric) | 5 nos. |
| 10. | Spanner D E set of 12 pieces (6 to 32 mm) | 5 sets | 28 | Steel tool box with lock & key (folding type) size 400x200x150mm. | 5 nos. |
| 11. | Ring spanner set of 12 pieces 6 to 32mm | 5 sets | 29 | Cleaning Tray 45 x 30 cm. | 5 nos |
| 12. | Centre punch Dia.10 mm x 100 mm | 5 nos. | 30 | Allen Key set of 12 pieces (2 mm to 14 mm) | 5 sets |
| 13. | Prick punch 15cm | 5 nos | 31 | File card/cleaner | 5 nos. |
| 14. | Chisel cold flat 20 mm | 5 nos | 32 | Scriber 15cm | 5 nos. |
| 15. | Chisel cross cut 200mm x 6mm | 5 nos | 33 | Safety glasses for grinding | 5 nos. |
| 16. | Hand files 20 cm. Second cut | 5 nos | 34 | Stud extractor ezy out types | 5 sets |
| 17. | Hand files 20 cm. Second cut half round | 5 nos | 35 | Hand file 30 cm. bastard | 5 nos |
| 18. | Hand file 20 cm. Smooth triangular | 5 nos | 36 | Hand file 30 cm. round bastard | 5 nos |

| Sl. No | Name of Tool/Equipment | Quantity (nos) | Sl. No | Name of Tool/Equipment | Quantity (nos) |
|---|--|----------------|--------|--|----------------|
| GENERAL TOOLS EQUIPMENTS AND MACHINERIES | | | | | |
| 1 | Circlip plier 15cm expanding type | 1 no | 42 | Grease gun | 2 nos. |
| 2 | Spanner, adjustable 20 cm. | 1 no | 43 | Sheet metal gauge | 1 no. |
| 3 | Torque wrench 5 - 35 Nm, 12 - 68 Nm, 50 – 225 Nm. | 1 set | 44 | Crow bar | 1no |
| 4 | Plier round nose 15cm | 2 nos | 45 | Pneumatic brake system on a bed board | 1no |
| 5 | Pipe wrench 350mm | 1 no. | 46 | Drum brake assembly | |
| 6 | Vice grip pliers | 2 nos | 47 | Tubeless tyre of cars | 1 no |
| 7 | Circlip pliers Expanding and contracting type 15 cm and 20 cm each | 1 each | 48 | C clamp 100mm, 150mm, 200mm | 2 each |
| 8 | Screw pitch gauge | 1 no | 49 | Solid tyre | 1 no |
| 9 | Fire bucket (4 nos.) with stand | As required | 50 | Tubeless tyre of cars | 1 no |
| 10 | Hollow punch set of seven pieces 6 to 15 mm | 1 set | 51 | Cut section model of cross ply and radial tyres. | 1 no |
| 11 | Letter punch 4mm | 1 set | 52 | Pullers screw powered 2 mm with bearing puller attachment | 1 no |
| 12 | Tread depth gauge | 2 nos | 53 | Screw jack one tone, capacity double lift | |
| 13 | Disk brake with caliper assembly | | 54 | Tachometer - to read upto 10000 rpm | 1 no |
| 14 | Battery charger 12V- 36 V | 1 no | 55 | Battery 12 V (consumable 2 yrs span) | 2 nos |
| 15 | Portable electric drill 6 mm | 1 no | 56 | Hydrometer | 2 nos |
| 16 | Battery tester | 1 no | 57 | Fire Extinguisher | As required |
| 17 | Plum bop | | 58 | Tyre repair kit | 1 set |
| 18 | Angle plate adjustable 250 x 150 x 175 | 1 no. | 59 | Nitrogen inflator with Tyre Pressure gauge | 1 no |
| 19 | Latest 4 Wheelers of different make (one LMV & one HVM) along with workshop manuals, common exhaust system | 1 each | 60 | Trolley type portable air compressor single cylinder with 45 liters capacity air tank, along with accessories & with working pressure 6.5 kg/sq cm | 1 no |
| 20 | Different types of | As | 61 | Tyre changer | 1 no |

| | | | | | |
|----|---|-------------|----|--|-------------|
| | gaskets(consumable) | required | | | |
| 21 | Different types of oil seal(consumable) | As required | 62 | Tube vulcanizing machine | 1 no |
| 22 | Marking material (consumable) | As required | 63 | Tyre vulcanizing machine | 1 no |
| 23 | "V" Block 75 x 38 mm pair with Clamps | 2 nos | 64 | Drilling machine bench to drill up to 12mm dia along with accessories | 1 no |
| 24 | Drill Twist (assorted) | As required | 65 | Grinding machine (general purpose) D E pedestal with 300mm dia wheels rough and smooth | 1 no |
| 25 | Tap and tap wrenches UNC UNF and metric | 2 sets | 66 | Hacksaw blade (consumable) | As required |
| 26 | Set of stock and dies-UNC, UNF and metric | 2 sets | 67 | Snip straight and bent 200mm | 2 nos each |
| 27 | Surface plate 60cm x 60cm | 1 no. | 68 | Arbor press 1 ton | 1 no |
| 28 | Hand reamers adjustable 10.5 to 11.25mm, 11.25 to 12.75mm, 12.75 to 14.25mm, 14.25 to 15.75mm | 2 sets | 69 | Triple leg grip puller with bearings attachment screw/hydraulic Powered max. Spread 80, 160, 250, 450 mm | |
| 29 | Work bench each 250 x 120x60 with 4 bench vices 12 cm jaw | 1 no. | 70 | Air impact wrench | 1 no. |
| 30 | Air ratchet | 1 no | 71 | Air chisel | 1no. |
| 31 | Air blow gun | 1 no. | 72 | Tubular spanner 6mm to 22mm set of 8 pieces | 1 set |
| 32 | C. V. Joint units of 3 different types | 4 sets | 73 | Tube valve insert key | 2 nos |
| 33 | Two post lifter 3 ton capacity | 1 no. | 74 | Circlip plier 15cm contracting type | 1 no |
| 34 | Surface gauge with dial test indicator plunger type 0.01mm | 1 no | 75 | Bearing puller screw powered/ hydraulic powered with attachments Max spread 80, 200 and 300mm | 1 no |
| 35 | Plier side cutting 15cm | 1 no | 76 | Chain and pulley block 3000 kg. Capacity electric type | 1 no. |
| 36 | Plier flat nose 15cm | 1 no | 77 | Tandem master cylinder with booster | 1 no |
| 37 | Drift punch copper 15cm | 1 no | 78 | Wheel cylinder | 1 no |
| 38 | Synchromesh gear box of LCV | 1 no. | 79 | Hydraulic jack with trolley capacity 3 Ton | 1 no |
| 39 | Straight edge gauge | 1 no | 80 | Fuel feed pump | 1 no. |
| 40 | Tyre pressure gauge with | | 81 | Wheel spanner | 1 set |

| | | | | | |
|----|---|-------|----|-------------------------|-------|
| | accessories | | | | |
| 41 | Cut section model of sliding mesh gear box of LMV | 1 no. | 82 | Valve key inserter | 02 no |
| | | | 83 | Steel Almirah 6' Height | 04 no |

REDESIGNED MODULES FOR THE SECTOR

OF

AUTOMOBILE

UNDER

MODULAR EMPLOYABLE SKILLS (MES)

Redesigned in - 2014

By

Government of India

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE

Directorate General of Employment & Training

Ministry of Labour & Employment (DGE&T)

EN-81, SECTOR-V, SALT LAKE CITY,

Kolkata-700091

**GENERAL INFORMATION FOR REPAIR AND OVERHAULING OF ENGINE SYSTEM
(PETROL & DIESEL)**

| | |
|---|--|
| Name of Sector | AUTOMOBILE |
| Name of Module | REPAIR AND OVERHAULING OF ENGINE SYSTEM (PETROL & DIESEL) |
| MES Code | AUR708 |
| Competency as per N C O Code | |
| Duration of Course | 600 Hrs |
| Entry Qualification of Trainee | Minimum 5th Std., 14 years of Age+ AUR102+driving experiences with valid driving license /AUR103 |
| Unit size (No. of Trainees) | 20 |
| Power Norms | 6 KW - (a) Class Room: 1 KW (b) Workshop: 5 KW |
| Space Norms(Workshop and Class Room) | 210 sq. m - (a) Class Room: 30 Sq. meter @ 1.5 sq. meter per trainee (b) Workshop: 120 sq. meter + 60 sq. meter (parking area) |
| Job Profile | Engine Mechanic(Petrol/Diesel) |
| Objective | <p>1.Produce Engine Mechanic in automotive workshop by pinning with following Employability skills:</p> <p>(i) Safety awareness about work safety, tools, Equipments & Machinery safety, Personal safety, Fire safety and Environmental safety.</p> <p>(ii) Skills to do Engine repair works in 4</p> |

| | |
|--------------------------|---|
| | <p>wheelers (Petrol & Diesel).</p> <p>iii) Skills to do FIP repair work</p> <p>2. Self Employment in the area of FIP WORK</p> |
| Terminal competency | <p>1. Safe practice on Work</p> <p>2. Able to do First Aid</p> <p>3. Handling of General Tools, Special tools, equipments and Machineries available in the Automobile Garage</p> <p>4 Able to do Engine dismantling, inspection and repair / recondition work</p> <p>5. Able to do fault diagnosis using engine scanner(On Board Diagnostic system)</p> <p>6. Able to do Fuel injection pump work</p> |
| Instructor Qualification | <p>Degree in Automobile/ Mechanical Engg.</p> <p>With one year relevant experience</p> <p>OR</p> <p>Diploma in Automobile/ Mechanical Engg.</p> <p>With two year relevant experience</p> <p>OR</p> <p>NTC/NAC in Automobile trade group with three years of relevant experience</p> |
| Desirable | Craft Instructor Certificate(CIC) |

Course Contents for Module Repair and Overhauling of Engine System (Petrol & Diesel) (AUR204)

| | |
|-------------------------------|---------------------------------------|
| Practical Competencies | Underpinning Knowledge(Theory) |
|-------------------------------|---------------------------------------|

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|---|---|
| <p><u>SAFETY:</u></p> <p>Practice Health & Safety – familiarize, select, use, maintain & store – tools, equipments, consumables & clothing safely</p> <p>Interaction with health centre and fire service station to provide demo on First aid and fire safety, use of fire extinguishers</p> <p>Measurement practice on engine components by use of different measuring instruments</p> | <p>Safe disposal of toxic dust, safe handling and periodic testing of lifting equipment, Authorization of moving and road test vehicles, Environment control of running indoor engines, Electrical safety</p> <p>Definition & Importance of Quality Control, Quality Assurance, Quality circle.</p> <p>Familiarization of workshop manual.</p> <p>Study of measuring instruments.</p> |
| <p><u>ELECTRICAL BASIC:</u></p> <p>Practice in joining wire using soldering iron.</p> <p>Construction of simple electrical circuit.</p> <p>Measurement of current, voltage and resistance using digital multimeter.</p> <p>Practice continuity test for fuses jumper wires, fusible link, circuit breakers</p> <p>Check electrical circuit with a test lamp perform voltage drop test in circuits using multimeter.</p> <p>Measure current flow using multimeter/ammeter.</p> | <p>Ohm's Law</p> <p>Series & Parallel resistances circuits</p> <p>Working principle, types & application of capacitors & transistors,</p> <p>Wiring colour-code, reading of engine electrical systems circuits</p> <p>Conductor and insulator.</p> <p>Voltmeter, ammeter, ohmmeter, multimeter,</p> |
| <p><u>ENGINE REPAIR WORK</u></p> <p>Select proper materials for gaskets and packing</p> <p>Select Locking devices and find their applications</p> <p>Identify differences between Petrol & diesel Engines.</p> <p>Identify differences between carburettor engine & MPFI Engines.</p> <p>Identification of sensors used in the MPFI & CRDI Engine</p> <p>Remove broken studs</p> <p>Remove engine from vehicle</p> <p>Drain engine oil and coolant</p> <p>Water wash engine / decrease</p> | <p>Lubrication & cooling systems</p> <p>Layout in Carburettor engine – starting, ignition, charging, fuel supply systems</p> <p>Layout in MPFI engine –air induction, starting, ignition & fuel supply systems</p> <p>Sensors used in the MPFI Engine and its function</p> <p>Layout in diesel engine –fuel supply systems</p> <p>Direct injection, Indirect injection, common rail direct injection(CRDI) Systems</p> <p>Sensors used in the CRDI Engine and its function</p> <p>Different valve operating mechanisms- Vaiable valve timing technology & Valve</p> |

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| <p>Dismantle complete engine and their components</p> <p>Check / test – compression pressure, cylinder head & block warpage, valve leak, lubricating oil pressure, bearing (oil) clearance, measure bore & take decision for further action, ring end gap & side clearance, fuel pressure regulator in MPFI engine, inlet manifold vacuum, cam & crank shaft bend & valve timing</p> <p>Service inlet and exhaust manifolds</p> <p>Remove, clean, check & overhaul engine sub assemblies / components</p> <p>Remove, clean, check & overhaul electrical components</p> <p>Dismantle, clean, assemble and check injectors</p> | <p>timing diagram</p> <p>Procedure for handling & reading – Torque wrenches & multimeter</p> <p>Procedure for removing engines from the vehicle</p> <p>Working principle, Different types & application of - starter motor, alternator, carburettor, FIPs, Injectors, filters, fuel pumps, liners, pistons, piston rings, valves, valve drives, bearings used on engines, MPFI system components</p> <p>Procedure for – dismantling, checking, assembling & testing of starter motor & cooling fan motor</p> <p>Procedure for – dismantling, checking, assembling & testing of alternator</p> <p>Turbocharger function,Types and its working.</p> |
| <p><u>ENGINE INSPECTION & RECONDITION</u></p> <p>Measure the bore and take the decision</p> <p>Replace – liner, valve guide, piston wrings</p> <p>Do valve lapping & valve grinding</p> <p>Overhaul piston and connecting rod assembly</p> <p>Assemble the engine,</p> <p>Fill up oil & coolant after preparing in correct proportion</p> <p>Start the engine and set idle rpm</p> <p>Fault Diagnosis using engine scanner</p> <p>Find the fault on the given engine and rectify the defect</p> | <p>Procedure for checking/testing – compression pressure, cylinder head & block warpage, valve leak, lubricating oil pressure, bearing (oil) clearance, bore measurement, ring end gap & side clearance, fuel pressure regulator in MPFI engine, inlet manifold vacuum, cam & crank shaft bend & valve timing</p> <p>Procedure for – dismantling, checking, assembling & testing of petrol engines</p> <p>Procedure for – dismantling, checking, assembling & testing of diesel engines</p> <p>Latest emission norms</p> <p>Controls available to meet the norms & their working principle.</p> <p>Brief description about onboard diagnostic system(OBD)</p> |
| <p><u>FIP WORK</u></p> <p>Wash / Clean FIP and Injectors</p> <p>Check the FIP on calibration bench and assess the condition</p> <p>Dismantle FIP using special tools</p> | <p>Fuel supply layouts in diesel engines</p> <p>Nomenclature of different types of fuel injection pumps</p> <p>Working principle of FIP</p> <p>Components of an FIP and detailed</p> |

| | |
|---|---|
| Clean and inspect Parts of each components | functioning of each one of them |
| Replace defective components | Differences between different types of fuel injection pumps |
| Assemble FIP using special tools | Working principle of Injection Timers and Governors |
| Calibrate FIP using calibration test bench | Brief on the FIP Test rig & calibration charts |
| Test the Injectors using Injector Tester | Procedure for phasing & calibration of an FIP |
| Replace defective nozzles using special tools | Purpose, types, construction & operation of Injectors and nozzles |
| Assemble injectors and test | Procedure for testing the Injectors as per specification |

List of Tools & Equipment for module Repair and Overhauling of Engine System

(Petrol & Diesel) (AUR708)

| Sl. No. | Name of Tool/Equipment | Quantity (nos) | Sl. No | Name of Tool/Equipment | Quantity (nos) |
|---------------------|--|----------------|--------|---|----------------|
| TRAINEES KIT | | | | | |
| 1. | Steel Rule 15 cm inch and metric | 5 nos | 19 | Oil can 0.5 litre cap | 5 nos |
| 2. | Steel Rule 30 cm inch and metric | 5 nos | 20 | Pliers combination 15 cm | 5 nos |
| 3. | Steel measuring tape 10 meter in a case | 5 nos. | 21 | Wire cutter and stripper | 5 nos. |
| 4. | Hammer ball peen 0.75 kg | 5 nos. | 22 | Inspection lamp with guard and wandering lead of 10 ft (consumable) | 5 nos |
| 5. | Socket Spanners with handle, T bar & ratchet | 5 sets | 23 | Horses and wheel chokes | 5 nos |
| 6 | Mallets (wooden/plastic/copper) | 5 nos | 24 | Scriber 15 cm with scribing block universal | 5 nos |

| | | | | | |
|-----|--|--------|----|---|--------|
| 7. | Screw driver 20 cm. x 9 mm blade | 5 nos. | 25 | Hacksaw frame adjustable for 30 cm blade | 5 nos |
| 8. | Screw driver 30 cm x 9 mm blade | 5 nos | 26 | Hand vice 37mm | 5 nos |
| 9. | Philips Screw Driver Type set of 5 pieces 100 mm to 300 mm | 5 sets | 27 | Feeler gauge 20 blades (metric) | 5 nos. |
| 10. | Spanner D E set of 12 pieces (6 to 32 mm) | 5 sets | 28 | Steel tool box with lock & key (folding type) size 400x200x150mm. | 5 nos. |
| 11. | Ring spanner set of 12 pieces 6 to 32mm | 5 sets | 29 | Cleaning Tray 45 x 30 cm. | 5 nos |
| 12. | Centre punch Dia.10 mm x 100 mm | 5 nos. | 30 | Allen Key set of 12 pieces (2 mm to 14 mm) | 5 sets |
| 13. | Prick punch 15cm | 5 nos | 31 | File card/cleaner | 5 nos. |
| 14. | Chisel cold flat 20 mm | 5 nos | 32 | Scriber 15cm | 5 nos. |
| 15. | Chisel cross cut 200mm x 6mm | 5 nos | 33 | Safety glasses for grinding | 5 nos. |
| 16. | Hand files 20 cm. Second cut | 5 nos | 34 | Stud extractor ezy out types | 5 sets |
| 17. | Hand files 20 cm. Second cut half round | 5 nos | 35 | Hand file 30 cm. bastard | 5 nos |
| 18. | Hand file 20 cm. Smooth triangular | 5 nos | 36 | Hand file 30 cm. round bastard | 5 nos |

| Sl. No | Name of Tool/Equipment | Quantity (nos) | Sl. No | Name of Tool/Equipment | Quantity (nos) |
|---|--|----------------|--------|---|----------------|
| GENERAL TOOLS EQUIPMENTS AND MACHINERIES | | | | | |
| 1 | Circlip plier 15cm expanding type | 1 no | 58 | Grease gun | 2 nos. |
| 2 | Spanner, adjustable 20 cm. | 1 no | 59 | Sheet metal gauge | 1 no. |
| 3 | Torque wrench 5 - 35 Nm, 12 - 68 Nm, 50 – 225 Nm. | 1 set | 60 | Crow bar | 1no |
| 4 | Plier round nose 15cm | 2 nos | 61 | Battery charger 12V- 36 V | 1 no |
| 5 | Pipe wrench 350mm | 1 no. | 62 | Tachometer - to read upto 10000 rpm | 1 no |
| 6 | Vice grip pliers | 2 nos | 63 | Screw jack one tone, capacity double lift | |
| 7 | Circlip pliers Expanding and contracting type 15 cm and 20 cm each | 1 each | 64 | C clamp 100mm, 150mm, 200mm | 2 each |

| | | | | | |
|----|---|-------------|----|--|-------------|
| 8 | Screw pitch gauge | 1 no | 65 | Battery 12 V (consumable 2 yrs span) | 2 nos |
| 9 | Fire bucket (4 nos.) with stand | As required | 66 | Hydrometer | 2 nos |
| 10 | Hollow punch set of seven pieces 6 to 15 mm | 1 set | 67 | Portable electric drill 6 mm | 1 no |
| 11 | Letter punch 4mm | 1 set | 68 | Pullers screw powered 2 mm with bearing puller attachment | 1 no |
| 12 | Battery tester | 1 no | 69 | Fire Extinguisher | As required |
| 13 | Angle plate adjustable 250 x 150 x 175 | 1 no. | 70 | Nitrogen inflator with Tyre Pressure gauge | 1 no |
| 14 | Injector test bench along with a set of special tools for repairing different types injectors | 1 no. | 71 | Trolley type portable air compressor single cylinder with 45 liters capacity air tank, along with accessories & with working pressure 6.5 kg/sq cm | 1 no |
| 15 | Different types of gaskets(consumable) | As required | 72 | Straight edge gauge | 1 no |
| 16 | Different types of oil seal(consumable) | As required | 73 | Fuel feed pump | 1 no |
| 17 | Marking material (consumable) | As required | 74 | Drift punch copper 15cm | 1 no |
| 18 | "V" Block 75 x 38 mm pair with Clamps | 2 nos | 75 | Drilling machine bench to drill up to 12mm dia along with accessories | 1 no |
| 19 | Drill Twist (assorted) | As required | 76 | Grinding machine (general purpose) D E pedestal with 300mm dia wheels rough and smooth | 1 no |
| 20 | Tap and tap wrenches UNC UNF and metric | 2 sets | 77 | Hacksaw blade (consumable) | As required |
| 21 | Set of stock and dies-UNC, UNF and metric | 2 sets | 78 | Snip straight and bent 200mm | 2 nos each |
| 22 | Surface plate 60cm x 60cm | 1 no. | 79 | Arbor press 1 ton | 1 no |
| 23 | Hand reamers adjustable 10.5 to 11.25mm, 11.25 to 12.75mm, 12.75 to 14.25mm, 14.25 to 15.75mm | 2 sets | 80 | Triple leg grip puller with bearings attachment screw/hydraulic Powered max. Spread 80, 160, 250, 450 mm | 1 no. |
| 24 | Work bench each 250 x 120x60 with 4 bench vices 12 cm jaw | 1 no. | 81 | Air impact wrench | 1 no. |
| 25 | Air ratchet | 1 no | 82 | Air chisel | 1no. |
| 26 | Air blow gun | 1 no. | 83 | Tubular spanner 6mm to | 1 set |

| | | | | | |
|----|---|--------|-----|---|--------|
| | | | | 22mm set of 8 pieces | |
| 27 | C. V. Joint units of 3 different types | 4 sets | 84 | Tube valve insert key | 2 nos |
| 28 | Two post lifter 3 ton capacity | 1 no. | 85 | Circlip plier 15cm contracting type | 1 no |
| 29 | Surface gauge with dial test indicator plunger type 0.01mm | 1 no | 86 | Bearing puller screw powered/ hydraulic powered with attachments Max spread 80, 200 and 300mm | 1 no |
| 30 | Plier side cutting 15cm | 1 no | 87 | Chain and pulley block 3000 kg. Capacity electric type | 1 no. |
| 31 | Plier flat nose 15cm | 1 no | 88 | Hydraulic jack with trolley capacity 3 Ton | 1 no |
| 32 | Telescopic gauge | | 89 | Internal Micrometer 5mm to 30mm | 1 no |
| 33 | Outside Micrometer 0 to 25mm | 1 no | 90 | Depth micrometer 0 to 25mm | 1 no |
| 34 | Outside Micrometer 25 to 50mm | 1 no | 91 | Thread Micrometer 0 to 25mm | 1 no |
| 35 | Outside Micrometer 50 to 75mm | 1 no | 92 | Vernier Caliper 200mm | 1 no |
| 36 | Outside Micrometer 75 to 100mm | 1 no | 93 | Dial vernier calliper 300mm | 1 no |
| 37 | Dial gauge type 1 Gr. A(complete with clamping devices and stand) | 1 no | 94 | Vernier depth gauge 0 - 150mm | 1 no |
| 38 | Surface gauge with dial test indicator plunger type 0.01mm | 1 no | 95 | Vernier height gauge 500mm | 2 nos |
| 39 | Cylinder bore gauge capacity 20 to 160mm | 1 no | 96 | Engineers Stethoscope | 4 nos |
| 40 | Vacuum gauge to read 0 to 760mm of Hg | 1 no | 97 | Distributors | 2 nos |
| 41 | Spanner for spark plugs 14 mm | 1 no | 98 | Carburettor (two different types) | 1 each |
| 42 | Valve spring compressor | 1 no | 99 | Different types of Injectors | 1 each |
| 43 | Tool valve grinding, suction type(consumable tool) | 1 no | 100 | Valve seat cutting tools complete with guides and pilot bar (all angles) in a box | 1 set |
| 44 | Engine management system's sensors and actuators | 1 set | 101 | Compression testing gauge to read 0 to 115 kg/sq cm | 1 no |
| 45 | Valve key inserter | 1 no | 102 | Piston ring filer | 1 no |
| 46 | Screw jack 1 ton capacity double lift | 1 no | 103 | Stud remover | 1 no |
| 47 | Piston ring compressor & | 1 no | 104 | DMM auto range | 1 no |

| | | | | | |
|----|---|--------|-----|---|-----------|
| | ring expander | | | | |
| 48 | Pliers water pump 250mm long | 1 no | 105 | Injectors. of diesel engines | 1 no |
| 49 | Petrol injector | 1 no | 106 | Petrol fuel pump of MPFI system | 1 no |
| 50 | Piston ring compressors | 1 no | 107 | Valve spring lifter | 1 no |
| 51 | Fuel injection pump one with pneumatic governor, one with RQ governor and one with RSV governor | 1 no | 108 | Triple leg grip puller with bearing attachment screw/hydraulic powered max. Spread 80, 160, 50 450mm | 1 no |
| 52 | Petrol engine (4 strokes, Multi Cylinder) of different makes in running condition. (3nos. with MPFI System & 1 Nos. with Carburettor) | 4 no | 109 | Diesel engine (4 stroke, Multi Cylinder) of different makes in running condition (CRDI engine(Vehicle type) -01No, Stationary engine-01 No, Truck engine-01 No) | 1 no Each |
| 53 | Cut model of 4 stroke petrol engine on stand | 1 no | 110 | Nipple forming tool to form nipple on high pressure pipe lines 6.8 and 10 mm dia | 1 no |
| 54 | Cut model of 4 stroke diesel engine on stand | 1 no | 111 | Injector testing set (hand operated) | 1 no |
| 55 | Engine cranker with 12V and 24 V Ac to DC Power supply system | 1 no | 112 | Injector dismantling jig with mounting bench | 1 no. |
| 56 | Engine scanner | 1 no | 113 | Injector holders | 1 no |
| 57 | Different types of Fuel Injection Pumps | 1 each | 114 | FIP test Bench along with a set of special tools for repairing & Testing different types of FIPs | 1 no. |
| | | | 115 | Steel Almirah 6' Height | 4 no |

GENERAL INFORMATION FOR AUTO BODY REPAIR, DENTING & PAINTING

| | |
|---------------------------------------|--|
| Name of Sector | AUTOMOBILE |
| Name of Module | AUTO BODY REPAIR, DENTING & PAINTING |
| MES Code | AUR709 |
| Competency as per N C O Code | |
| Duration of Course | 600 Hrs |
| Entry Qualification of Trainee | 5th Pass + 14 yrs of age + passed in basic automobile servicing four wheeler AUR102 + driving experiences with valid driving license /AUR103 |
| Unit size (No. Of trainees) | 20 |
| Power Norms | 7 KW |
| Space Norms (Workshop and Class Room) | 190 Sqm |
| Job Profile | Mechanic Auto Body Repair /Mechanic Auto Body Painting |
| Objective | <p>1. Producing Mechanic Auto Body repair, Mechanic Auto Body Painting in automotive workshop by pinning with following Employability skills</p> <p>(i) Safety awareness about work safety, tools, Equipments & Machinery safety, Personal safety, Fire safety and Environmental safety.</p> <p>ii) Skills to do Auto Body repairing work of four WHEELERS</p> <p>iii) Skills to do Auto Body denting & Painting work of four WHEELERS</p> <p>2. Self employment in the area of Auto body repair, Denting & painting</p> |
| Terminal competency | 1. Safe practice on Work |

| | |
|---------------------------|--|
| | <p>2. Able to do First Aid</p> <p>3. Handling of General Tools, Special tools, equipments and Machineries available in the Automobile body repair, denting & painting shop</p> <p>4 Able to do Auto body repair work on LMV & HMV</p> <p>5. Able to do Denting work on LMV & HMV</p> <p>6. Able to do Painting work on LMV & HMV</p> |
| Instructors Qualification | <p>Degree in automobile Engineering with one year relevant Experience</p> <p>OR</p> <p>Diploma in automobile Engineering with two year relevant Experience</p> <p>OR</p> <p>NTC/ NAC in automobile Trade Group with three years of relevant Experience</p> |
| Desirable Qualification | Craft Instructor Certificate(CIC) |

COURSE CONTENT

| PRACTICAL COMPETANCIES | UNDERPINNING KNOWLEDGE(THEORY) |
|---|--|
| <p>AUTO BODY REPAIR</p> <ul style="list-style-type: none"> ➤ Practice health & safety-familiarize, select, proper use, maintain and store – tools, equipments, Consumables clothing safety ➤ Simple basic practices on computer-reading service manuals, collision repair manuals and colour matching guide ➤ Identification of different types of body, chassis and drive lines ➤ Identification of location of parts and panels ➤ Practice on operating the air compressor ➤ Practice on periodical maintenance of air compressor ➤ Inspect and decide whether it can be repaired or replaced ➤ Remove and refit body panels, doors, floors, wheel boxes and fenders ➤ Practice on removing and refitting wind shield glasses ➤ Practice on arc welding on vehicle body ➤ Practice on gas welding, gas brazing, gas soldering and gas cutting on vehicle body ➤ Practice on resistance, spot, seam and butt welding on vehicle body ➤ Practice on MIG welding ➤ Practice on plasma welding ➤ Practice on minor repair of auto body-cut open, beat out, strip out old paint, make smooth surface by using different grades of sanders, apply putty on affected area and applying primer(repair damaged body which is ready for final paint) ➤ Apply base coat painting ➤ Fit check the repaired components for alignment | <ul style="list-style-type: none"> ➤ Safety precautions and first aid. Proper use, care and maintenance of tools and equipments. ➤ Introduction on types, function of body and panels ➤ Procedure for inspection, removing and refitting of body components-panels, doors and other body parts ➤ Arc welding-basic electricity and welding power source. electrodes-types, description and specification.arc welding procedure ➤ Gas welding-gas welding, brazing and soldering procedures ➤ Description of gas cutting ➤ Resistance welding-resistance welding process-spot, seam and butt welding ➤ Details of Mig welding ➤ Method of fixation of wind screen glass ➤ Procedure for cut open, beat out dents, stripping of old paints, sanding at different stages, smooth surface preparation at different stages, putty application & primer application at different stages of affected area(chronological order for repair of auto body)fitment of repaired part and aligning to the original shape |
| <p>AUTO BODY PAINTING</p> <ul style="list-style-type: none"> ➤ Practice health & safety-familiarize, select, proper use, maintain and store – tools, equipments, Consumables clothing safety ➤ Practice on removing paint from the damaged area | <ul style="list-style-type: none"> ➤ Safety precautions and first aid. Proper use, care and maintenance of tools and equipments ➤ Personal safety – three key areas of risk eyes, skin and inhalation ➤ Details of personal protective equipments- |

| | |
|---|---|
| <ul style="list-style-type: none"> ➤ Practice on mixing and applying body filler ➤ Practice on sanding(block) ➤ Practice on mixing and applying putty ➤ Practice on applying primer ➤ Practice on feather edge sanding and masking ➤ Base coat application ➤ Surface cleaning and degreasing ➤ Second and third coat application ➤ Preheating the vehicle and cooling ➤ Cutting,scuffing,rubbing and polishing ➤ Inspecting the painted area | <p>RPE,PPE</p> <ul style="list-style-type: none"> ➤ Details of ingredients of paint ➤ Procedure of refinishing process ➤ Selection of consumable for doing painting work ➤ Procedure for doing painting(in chronological order),selection of materials,tools and equipments-application of body filler for surface preparation, sanding on the affected area for smooth surface preparation, primer coating on the affected area, preparing affected surfaces for base coating, applying Base coat painting ,clear coat painting for metallic paints, rubbing and polishing. ➤ Application of paint production treatment/anti rust treatment ➤ Procedure for inspection of painting work and fixing the wind screen glass ➤ Details of spray gun-types-standard air gap design-different sizes of nozzles ➤ Details of different types sanding equipments ➤ Different types of sand paper-grades ➤ Possible defects in painting objects,causes and its cure |
|---|---|

TOOLS & EQUIPMENTS (SUGGESTED) IN AUTO BODY REPAIR

| s.n | Item | s.n | Item |
|------------|---|------------|--|
| 1 | Steel Rule 300mm | 37. | Vernier bevel protractor |
| 2 | Steel Tape 2 meters | 38. | Try square 200 mm Blade |
| 3 | Wing Divider 200mm | 39. | Ring spanner set at 12 metric 6 mm to 32 mm |
| 4 | Spring Dividers 150mm | 40. | Adjustable Spanner 10 cm |
| 5 | Ordinary Wooden Mallet 50mm | 41. | File flat 250mm second cut and smooth |
| 6 | Cross Peen Hammer 0.25 Kg with handle | 42. | File flat 250mm smooth |
| 7 | Ball peen Hammer 0.5 Kg with handle | 43. | File flat 300mm bastard |
| 8 | Protractor with blade 150mm | 44. | File half round 300mm smooth |
| 9 | Scriber 150mm x 3mm (Engineers) | 45. | Round File 2 nd Cut 250mm |
| 10 | Soldering copper 0.2 Kg | 46. | Triangular File Smooth 250mm |
| 11 | Goggles | 47. | Square File 2 nd Cut 250mm |
| 12 | Gloves | 48. | Hacksaw frame 300mm adjustable |
| 13. | Apron | 49. | Hand Groover 3mm, 4mm, 5mm |
| 14. | Spark lighter | 50. | Combination Plier |
| 15. | Hammer Chipping 0.25 Kg | 51. | Grip Wrench 200mm |
| 16. | Tin Man's 450 mm x 600mm | 52. | Soldering Copper Hatchet type 500gms |
| 17. | Sheet Metal Gauge | 53. | Pneumatic riveting gun |
| 18. | Stake Round and Bottom | 54. | Trammel Point (with beam 600mm) |
| 19. | Half Moon Stake | 55. | Vernier Caliper (0mm-150mm) |
| 20. | Funnel Stake | 56. | Micrometer outside (0 to 25mm) |
| 21. | Anvil Face Stake | 57. | Raspcut file 250mm |
| 22. | Tinmans Horse | 58. | D.E. Spanner (6mm to 32mm) (set of 12 spanner) |
| 23. | Hammer Peaning with handle | 59. | Scriber 150 mm |
| 24. | Hammer Creasing with handle | 60. | Safety Glasses |
| 25. | Hammer Planshing with handle | 61. | Hand vice 50mm |
| 26. | Hammer Block with handle | 62. | Steel wire Brush 50mmx150mm |
| 27. | Soft Hammers (Brass, Copper, Lead, Rubber and Rawhide heads with handle) | 63. | Rivet sets snap and Dolly combined 3mm, 4mm, 6mm |
| 28. | Sher Tinmans 300mm | 64. | Leather Apron |
| 29. | Snips straight 250mm | 65. | Tongs, Close mouth and pick up (1 each) |
| 30. | Right cut snips 250mm | 66. | Portable Electric drill (Single phase) with drill bits |
| 31. | Left cut snips 250mm | 67. | Pillar type drilling machine 12mm with drill bits |
| 32. | Hand Shear Universal 250mm | 68. | Crow bar 910 x25mm |
| 33. | Punch Round 3mm, 4mm &6mm Dia | 69. | Pop rivet gun |
| 34. | Centre Punch 100mm | 70. | Lazy Tong |
| 35. | Gloves for Welding (Leather and Asbestos) | 71. | Screw Driver 250mm |
| 36. | Chisel cold flat 25mm x250mm | 72. | 'C' Clamp 150mm |

| | | | |
|-----|---|-----|--|
| 73. | Liquified Petroleum Gas (LPG) Cylinder, Regulator and Torch with Burner | 83. | Wooden Rule 450mm |
| 74. | Bench lever shears 250mm Blade x 3mm Capacity | 84. | Portable Nibbler |
| 75. | Air Compressor with accessories | 85. | Welding Transformer (300 Amps) with accessories |
| 76. | Spray Gun (Painting) 500ml | 86. | Gas Welding Table 1220mm x760mm |
| 77. | Guillotine shearing Machine foot operation (1mt x 18G Capacity) | 87. | Spot Welding Machine with complete accessories |
| 78. | Oxy-acetylene welding equipment with complete accessories (Low & high pressure) | 88. | Tin smiths bench folder 600 x 1.6mm |
| 79. | D.E. Grinder Pedestal motorized 200mm | 89. | Suitable Work Tables with vices |
| 80. | Anvil 50 Kgs with Stand | 90. | Polishing cloth standard size |
| 81. | Bench vice | 91. | LCV Condemned |
| 82. | Buffing and Polishing Machine | 92. | Consumables |

ADDITION IN EQUIPMENTS

1. AUTO BODY DENTING MACHINE – 01 NO
2. COLLISION REPAIR MACHINE – 01 NO
3. TROLLEY TYPE HYDRAULIC CRANES – 01 NO

TOOLS & EQUIPMENTS (SUGGESTED) FOR AUTO BODY PAINTING

| | | | |
|---|---------------------------------|----|--|
| 1 | General tools | 8 | Sanding emery 40G, 80G, 120G, 220G, 400G, 600G, 1500G, 2000G |
| 2 | LCV Condemned vehicle body | 9 | Primer, Hardener & thinner |
| 3 | Air Compressor with accessories | 10 | Paints |
| 4 | Spray Gun (Painting) 500ml | 11 | Poly urethane body filler |
| 5 | Buffing and Polishing Machine | 12 | Rubbing & polishing compounds |
| 6 | Bench vice | 13 | Polishing cloth standard size |
| 7 | Consumables | 14 | |

ADDITIONAL TOOLS TO BE ADDED:

1. RESPIRATOR – 05 NOS
2. SAFETY SHOES - 01 NO EACH
3. SHIELD FACE PROTECTOR – 01 NO EACH
4. AIR FED MASK -01 NO EACH
5. ELECTRONIC WEIGHING MACHINE – 01 NO
6. STEEL ALMIRAH 6' HEIGHT-03 NO

GENERAL INFORMATION FOR REPAIR OF AUTO ELECTRICAL, ELECTRONICS & AIRCONDITONING

| | |
|---|---|
| Name of Sector | AUTOMOBILE |
| Name of Module | Repair of Auto electrical, electronics & air Conditioning system |
| MES Code | AUR 707 |
| Competency as per N C O Code | |
| Duration of Course | 600 Hrs |
| Entry Qualification of Trainee | Minimum 8th Std., 14 years of Age+ AUR102+driving experiences with valid driving license /AUR103 |
| Unit size (No. of Trainees) | 20 |
| Power Norms | 4KW - (a) Class Room: 1 KW (b) Workshop: 3 KW |
| Space Norms(Workshop and Class Room) | 140 sq. m - (a) Class Room: 30 Sq. meter @ 1.5 sq. meter per trainee (b) Workshop: 100 sq. meter + 10 sq. meter (parking area) |
| Job Profile | Auto Electrician/Automotive Air condition Mechanic |
| Objective | <p>1).The Trainee should become Auto electrician/ Automobile Ac mechanic with following employability skills</p> <p>i) safety awareness about work safety, tools , Equipments & Machinery safety, Personal safety and Environmental safety</p> <p>ii). Quality awareness</p> <p>iii). Skills to do Auto electrical, electronics & air conditioning repair works in 4 wheelers</p> <p>2). Self Employment in the areas of Auto electrical workshop Such as</p> <p>Battery service centre,</p> <p>ii) Starter motor, Alternator Service centre</p> <p>iii) Automobile air conditioning service centre</p> |
| Terminal competency | <p>Successful candidate would be able to do</p> <ol style="list-style-type: none"> 1. Safe practice on Work 2. First Aid on Electrical shock 3. Handling of General Tools, Special tools, equipments and Machineries available in the Automobile Garage 4. Implementation of Quality tools on work 5. Read and Draw the wiring Diagram |

| | |
|--------------------------|---|
| | <p>6. Forming of parallel, series and combined circuits</p> <p>7. Use of Electrical meters like DMM, Volt meter, Ammeter, & Ohm meter</p> <p>8. Tracing of wiring circuit using colour code</p> <p>9. Testing of Different Electrical components such as Resistors, Capacitors, Fuses, Switches, Circuit protector, solenoids and Relays</p> <p>10. Testing of Electronic components such as Diodes, Transistors, ICs, Thyristors, SCR, Triac, Diac, etc</p> <p>11. Perform Battery Diagnosis and Service</p> <p>12. Perform Charging system Diagnosis and Repair</p> <p>13. Perform Starting system Diagnosis and Repair</p> <p>14. Perform Ignition system Diagnosis and Repair</p> <p>15. Perform Lighting system Diagnosis and Repair</p> <p>16. Perform Horn, Wiper, Gauges and Accessories Diagnosis and Repair</p> <p>17. Perform Onboard Diagnosis and Service</p> <p>18. Perform comfort system Diagnosis and Repair</p> |
| Instructor Qualification | <p>Degree in Automobile/ Mechanical Engg. With one year experience</p> <p>OR</p> <p>Diploma in Automobile/ Mechanical Engg. With two year experience</p> <p>OR</p> <p>NTC/NAC in Automobile trade group with three years of experience</p> |
| Desirable Qualification | Craft Instructor Certificate(CIC) |

COURSE CONTENT:

| Practical Competencies | Underpinning Knowledge(Theory) |
|---|--|
| <p><u>SAFETY:</u> Description of safety equipments, their use, Safety rules to observe in Automobile repair workshop. Accident and their causes.</p> | <p>Importance of safety and general precautions to be observed in the shop.</p> <p>Electrical safety.</p> <p>Fire extinguishers used for different</p> |

| | |
|---|---|
| <p>Use of fire extinguishers.</p> <p>Familiarization of tools and machinery available in the shop – their use and their up keep. Importance of cleanliness of work spot, tools, jacks, trays and horses etc. Electrical safety aspects and importance of earthing.</p> <p>Demo on first aid for electrical shock.</p> | <p>types of fire.</p> <p>Storing and handling of inflammable materials.</p> <p>Elementary First Aid.</p> <p>Housekeeping - 5S concept.</p> |
| <p><u>AUTO ELECTRICAL:</u></p> <p>Identify different electrical parts of a vehicle</p> <p>Make joints on simple strapped conductors, sieving or taping with insulation tape, Measure conductor using wire gauge</p> <p>Practice Soldering on wire joints,</p> <p>Solder and crimp of lugs with wire ends</p> <p>Measure voltage drop, total resistance, current flow in different line by connecting two or three resistors in parallel and series using a battery, bulb / motor / resistors – reconcile Ohm’s law.</p> <p>Check blowing of fuse with wires short-circulated.</p> <p>Identify various electrical equipments on the mock up wiring board i.e. starter motor, dynamo control box etc., Follow up starting system wiring, Identify marking on terminal joints, Remove and repeat connections. Do Similar practice on charging system wiring.</p> <p>Checking of circuit breakers and relays</p> <p>Construct simple circuit by using relay</p> <p>Test / check –alternator output voltage, circuit voltage drop, and trouble shooting in a charging system.</p> <p>Dismantling alternators and components tests – diodes, rotor condition, rotor winding insulation & rotor condition.</p> <p>Trace starter circuit in a vehicle Dismantle starter and check each component, Repair the faults, assemble and check starter motor on a test rig.</p> <p>Check spark plugs, HT leads, ignition coil and condenser</p> <p>Test the batteries with Hydrometer and battery tester; prepare electrolyte (follow safety rules), top up battery with distilled water, and Connect</p> | <p>Familiarization with tools and equipments used in auto electrical and their care & maintenance.</p> <p>Signs and symbols used in Electrical & electronics</p> <p>Voltage, Current and Resistance and its units.</p> <p>Effects of resistance on the length and cross sectional area of a conductor, conductors and insulators</p> <p>Cumulative resistance of parallel and series connected circuits, Exercises on series and parallel circuits. The parts of a simple electrical circuit</p> <p>Ohm’s law – Exercises on Ohm’s law.</p> <p>Introduction on Magnetism</p> <p>Usage of multimeter, Method of using AVO meter</p> <p>Semiconductor</p> <p>Type of solder and flux required for soldering aluminum and copper conductor. Introduction to equipment used for soldering.</p> <p>Description/working principles, types, uses, location & checking of – switches, Circuit protectors, relays, solenoids, resistors, diodes, connectors, spark plugs (explain radio interference suppression) & condensers</p> <p>Description / working principles, types, uses, location, maintenance & checking of various automobile electrical equipments – starter motor, alternator, wiper motor, horn</p> |

| | |
|---|---|
| <p>batteries for charging.</p> | <p>& battery Cables colour codes & sizes.</p> |
| <p><u>AUTO ELECTRONICS:</u> Construct a simple electronic circuits using electronic trainer kit (to study the components functions). Assemble and study rectifier circuits and power supplies- measure outputs Construct simple logic circuits using digital trainer kit Check ignition coil of E-DIS (Electronic distributor less Ignition system) Check sensors & actuators using engine scanner / DMM Check the different modes/ strategies of Electronic Control Assembly, Reset keep alive memory/ ECA Check different wiring / circuits and rectify the defect</p> | <p>Function, types, uses, location & checking of – Basic electronics devices such as transistors, ICs, Thyristors, Triac, Diac, etc. Simple electronics circuits such as oscillators amplifiers, rectifier circuits, & power supplies Principles of Digital electronics. Number systems and Truth table concept and application, logic gates and their applications, Simple digital circuits. Demonstration of digital trainer kits Demonstration on micro processor kits and familiarization with different related devices Demonstration and familiarization with automobile micro processor system Working principle of instruments and gauges Working principle of sensors – throttle position (Potentiometer), Air temperature (Thermistor), Engine coolant temperature, Air temperature, manifold absolute pressure (Piezo-Resistive & Piezo-electric type), vehicle speed, Camshaft and crank shaft position sensors (magnetic pick up type) Construction and working principle of actuators –idle air control valve, injector & EGR cutout solenoid valve (explain duty cycle) Basic structure and operation of a microcomputer Explanation of simple electronic circuits</p> |
| <p><u>AIR CONDITIONING:</u> Identify various components of air condition system on the mock-up board Identify various electrical equipments i.e. junction</p> | <p>Signs and symbols used in Air conditioning system</p> |

box, ground connections, switches, modules & sensors on vehicle

Measure voltage, resistance & continuity in different lines for air conditioning system (climate control) – reconcile Ohm's law.

Check of circuit breakers and relays

Check duty of idle air control valve with ac on & off with different engine RPM

Remove compressor from the vehicle, dismantle, check, rectify the defect, assemble & refit to the vehicle

Remove expansion valve from the system, dismantle, check, rectify the defect, & refit into the system

Remove evaporator & heater cores from the vehicle, dismantle, check, rectify the defect, assemble & refit to the vehicle

Check condenser on the vehicle, & rectify the defect

Check the drive system & adjust if required

Check Belt tension

Check Gap in electromagnetic clutch

Remove & refit heater control module

Test the system for leaks

Evacuate/drain the system

Charge / fill the system

Find the Faults & rectify in the climate control system

Fundamentals of air conditioning:

Introduction – purpose, basic operation of refrigeration cycle, basic components & circuits (with fixed orifice tube & thermal expansion valve-Mechanical & Electrical circuits), use of thermometer and pressure gauges,

Definition of technical terms – pressure, temperature, heat (heat, quantity, specific heat & heat transfer), Humidity, change of state & pressure temperature relation.

Refrigeration cycle – high pressure side & low pressure side

Characteristics of R12 & R134a.

Compressor lubrication.

Cooling load and capacity.

a/c systems – car air conditioning types & features(dash type, all season type & dual air conditioner type), heater-cooler independent system, reheat air condition system, semi air-mix type, full air-mix type, automatic temperature control systems

Description/working principles of Heater Control Module

Importance of sensors for air conditioning system - throttle position (Potentiometer), Air temperature (Thermistor), Engine coolant temperature (NTC type), crank shaft position / engine speed sensors (magnetic pick up type)

Construction and working principle of actuators – coolant diversion valve(for heating the cabin) & idle air control valve (Electronic controlled engines) & duty cycle

Description / Reading of wiring diagram

Description & operation of **Main Functional parts**–Compressor, Condenser, Evaporator, and Expansion Valve/valve - Different types of above components

Description & operation of **Other Functional parts** – magnetic clutch, receiver/drier, blower motor, condenser

fan, thermostat, pressure switches & magnetic valve(for dual air conditioner)

Repair

Procedure for evacuating / draining the system, finding the leak & charging the system

Procedure for Fault finding (Trouble shooting charts) & rectification in car air conditioning

Procedure for dismantling, checking, assembling different components of the system

Difference between manual & automatic air conditioning / climate control systems

Air distribution of air conditioning system & different types of actuation of distribution doors

**LIST OF TOOLS AND EQUIPMENTS FOR REPAIR OF AUTO ELECTRICAL,
ELECTRONICS & AIRCONDITIONING**

| TRAINEES KIT | | | | | |
|---|--|----------------|--------|---|----------------|
| Sl. No | Name of Tool/Equipment | Quantity (nos) | Sl. No | Name of Tool/Equipment | Quantity (nos) |
| 01 | Ball Peen Hammer 0.75 Kg | 05No | 10 | Hand file 20cm second cut | 05No |
| 02 | Cold Flat Chiesel 19mm | 05No | 11 | Ring spanner set of 12 pieces-6 mm -32 mm | 05No |
| 03 | Centre Punch 10 mm dia x 100mm | 05No | 12 | Double ended Spanner 6 to 32 mm - set of 12 nos | 05 No |
| 04 | Insulated Screw driver 30 cm x 9mm blade | 05No | 13 | Electrician testing pencil 100-500V(line/neon Tester) | 05 No |
| 05 | Insulated Screw driver 20 cm x 9mm blade | 05No | 14 | Philips Screw Driver set of 5 pieces 100mm – 300mm | 05 No |
| 06 | Wire cutter & stripper | 05No | 15 | Feeler gauge 26Blades(metric) | 05 Sets |
| 07 | Steel rule 30mm | 05No | 16 | Allen key set 12 pieces (2mm to 14mm) | 05 sets |
| 08 | Plier combination 15cm | 05No | 17 | Star Allen keys | 05 sets |
| 09 | Steel tool box with lock & key (folding type) size 400x200x150mm | 05No | 18 | Circlip plier(external & internal) 150mm and 200mm (one in each type) | 05 sets |
| SHOP OUTFIT AND MEASURING INSTRUMENT | | | | | |
| Sl. No | Name of Tool/Equipment | Quantity (nos) | Sl. No | Name of Tool/Equipment | Quantity (nos) |
| 1 | Hand vice 37 mm | 2 No | 47 | Tripod axle stand adjustable 1500 kg capacity | 2 No |
| 2 | Prick punch 15 cm | 2 No | 48 | accumulator / drier | 2 sets |
| 3 | Chisel cross cut 200mm x 6 mm | 2 No | 49 | Leak detectors – electronic & UV lamp | 1 no each |
| 4 | Ball Peen Hammer 0.5 Kg | 2 No | 50 | condensers | 2 sets |
| 5 | Hammer copper 1 Kg with handle | 2 No | 51 | compressors of different types | 2 sets |
| 6 | Hack saw frame for 30 | 2 No | 52 | expansion valves of | 2 sets |

| | | | | | |
|----|--|-----------|----|--|-----------|
| | cm blade | | | different types | |
| 7 | Hollow punch 6,7,8,9,10 and 12 mm set | 1NO | 53 | evaporators of different types | 2 sets |
| 8 | Flat File 35 cm bastard | 2 No | 54 | air distribution doors of different types | 2 sets |
| 9 | Flat File 25 cm second cut | 2 No | 55 | coolant control valves (heater control) | 2 sets |
| 10 | Micrometer Outside 0-25mm, 25- 50mm | 1NO each | 56 | A/C control assemblies of different types | 2 sets |
| 11 | Soldering iron 120 watts | 5 No | 57 | switches of different types (HP & LP Switches) | 2 sets |
| 12 | Nose Pliers (round and straight) 150 mm and 200mm | 2 No Each | 58 | Thermistors | 2 sets |
| 13 | Grip wrench | 2 No | 59 | Heater control modules(E & C Unit) | 2 sets |
| 14 | Thread pitch gauge | 2 No | 60 | Blower motor | 2 sets |
| 15 | Stud remover | 2 No | 61 | Receiver/drier | 2 sets |
| 16 | Spanner T. flocks for screwing up and up-screwing inaccessible positions | 2 No | 62 | AC alternator slip ring puller | 1 No |
| 17 | Cleaning tray 45 x 30cm | 5No | 63 | AC alternator slip ring press tool | 1 no |
| 18 | Oil cane 0.5 litres | 2 No | 64 | Car stereo | 1No |
| 19 | Snip (straight & bent) | 1No Each | 65 | Battery 12V (Lead acid & Alkaline) | 2 no each |
| 20 | General purpose puller | 1No | 66 | Electronic engine control module | 2 no |
| 21 | Stud extractors | 1 set | 67 | Starter motor axial type, pre- engagement type & Co-axial type | 1 each |
| 22 | Poker | 5 No | 68 | Electrical horn(different types) | 2 no Each |
| 23 | Double open ended ignition spanner set (of BA- 0 x 1to 8x9 set of 5) | 1 set | 69 | Wiper motor assemblies | 2 no |
| 24 | Spanner Clyburn 15 cm | 1 No | 70 | Engine Scanner | 1 No |
| 25 | Adjustable spanner 20 cm | 1 No | 71 | Anti theft devices | 1 no |
| 26 | Spark plug spanner 10 mm &14 mm . | 1 No Each | 72 | Melting pot | 1 no |
| 27 | Magneto spanner set with 8 spanners 1 set | 1 set | 73 | Grease Gun | 1 no |
| 28 | Socket spanner set with handle, T- bar and ratchet | 1 set | 74 | Pulley set universal for bearing & bushes (set) | 1 set |
| 29 | Drift copper (10 mm x 150 mm) | 1 No | 75 | Pulley puller | 1 no |
| 30 | Double open ended | 1 set | 76 | Glow plug | 4 no |

| | | | | | |
|----|--|-----------|----|--|-----------|
| | spanner set (10.5mm x 12 mm; 10.5mm x 18 mm set of four) | | | | |
| 31 | Hydrometers | 12 No | 77 | Glow plug tester | 1 no |
| 32 | Spring tension tester | 1 No | 78 | Torque wrenches 5035 Nm, 12- 68 Nm | 1 No Each |
| 33 | Digital multi meters | 5 No | 79 | Horn relay | 4 no |
| 34 | Alternator regulator tester | 1 No | 80 | Engine control sensors 8 types | 1 no each |
| 35 | Distributor tester | 1 no | 81 | Five Point relays | 4 nos |
| 36 | Continuity meter | 1 No | 82 | Four Point relays | 4 nos |
| 37 | Clip on meter Digital and Analog | 1 each | 83 | Executive Auto Electrical tool kit | 1 No |
| 38 | Tachometer | 1 No | 84 | Volt meter 50 V/DC | 4 no |
| 39 | Spark Plug tester "NEON" type | 1 No | 85 | Ammeter 300A/60A DC with external shunt | 4No |
| 40 | Battery tester | 1 No | 86 | DC Ohmmeter 0 to 300 ohms, mid scales at 20 ohms | 4 NO |
| 41 | Starter motor & alternator | 2 No each | 87 | Steel Almirah 6' Height | 4 No |
| 42 | Crimping Tool | 2 No | | | |
| 43 | Pipe Wrench 350 mm | 1 No | | | |
| 44 | Hydraulic jack | 1 No | | | |
| 45 | Torque wrenches of different capacity | 1 No Each | | | |
| 46 | Inspection lamp with guard and wandering lead of 100 ft | 1 No | | | |

| GENERAL INSTALLATION/MACHINERIES | | |
|----------------------------------|--|----------------|
| Sl. No | Name of Tool/Equipment | Quantity (nos) |
| 1 | Drilling Machine (Bench) 12 mm dia | 1 |
| 2 | Growler | 1 |
| 3 | Battery charger 12V – 36 V | 1 |
| 4 | Electrical test bench | 1 |
| 5 | Starter test bench | 1 |
| 6 | Air conditioned MPFI vehicle with accessories | 1 |
| 7 | LMV Diesel with dual air conditioning system along with special tools for removing and refitting air conditioning system & work shop manuals | 1 |
| 8 | Mock-up board with semi-automatic air conditioning system | 1 |
| 9 | Service units with set of Compound pressure gauges-Recovery Machine & charging Unit | 1 |
| 10 | Air Compressor 45 lit capacity | 1 |
| 11 | Work bench 250cmx12cmx60 cm with four 6" bench vice | 1 |
| 12 | Mock layout of a motor car electrical system-Working model | 1 |

| | | |
|----|---|-------------|
| 13 | Grinding machine(General purpose)D.E pedestal with 300 mm Dia wheels rough and smooth | 1 |
| 14 | Demonstration board of 2 Wheeler Ignition system, ignition coil | 1 |
| 15 | Demonstration board of 4 Wheeler electronic Ignition system, ignition coil | 1 |
| 16 | Functional/experiment model of different type of sensors. | 1 |
| 17 | Experimental trainer kits for Auto electronics | As required |
| 18 | Head light Aligner | 1 |

AUTOMOTIVE REPAIR

UNDER
MODULAR EMPLOYABLE SKILLS (MES)

2014

By
Government of India
Directorate General of Employment & Training
Ministry of Labour & Employment (DGE&T)

GENERAL INFORMATION FOR BASIC CAR SERVICING

| | |
|-------------------------------------|----------------------------|
| Name of Sector | AUTOMOTIVE REPAIR |
| Name of Module | BASIC CAR SERVICING |
| MES Code | AUR 710 |
| Competency as per N C O Code | |
| Duration of Course | 1000 Hrs |

| | |
|--------------------------------------|--|
| Entry Qualification of Trainee | Minimum 10th Std Pass., 18 years of Age |
| Unit size (No. of Trainees) | 30 |
| Power Norms | 6 KW - (a) Class Room: 1 KW (b) Workshop: 5 KW |
| Space Norms(Workshop and Class Room) | 210 sq. m - (a) Class Room: 30 Sq. meter @ 1.5 sq. meter per trainee (b) Workshop: OEM authorized service Workshop |
| Job Profile | Service Mechanic -Junior |
| Objective | 1. Produce Service Mechanic Junior in automotive workshop by pinning with following Employability skills: (i) Skills to do general servicing and maintenance of cars. (ii) Basic Computer Awareness (iii) Behavioral and Communication skills |
| Terminal competency | 1. Safe work practice 2. Vehicle driving 3. Handling of General Tools, Special tools, equipments and Machineries available in the Automobile Garage 4. General Servicing, minor repair works and maintenance of Cars |
| Instructor Qualification | Degree in Automobile/ Mechanical Engg. With one year relevant experience OR Diploma in Automobile/ Mechanical Engg. With two year relevant experience OR NTC/NAC in Automobile trade group with three years of relevant experience |
| Desirable Qualification | Craft Instructor Certificate(CIC) |

Course Contents for Module -1 Basic car Servicing

| Practical Competencies | Underpinning Knowledge(Theory) |
|---|--|
| <p><u>Workshop Safety</u></p> <ul style="list-style-type: none"> • Safety attitude develop by using of Personal Protective Equipments (PPE). • First-Aid methods | <p><u>Workshop Safety</u></p> <ul style="list-style-type: none"> • Familiarization with the institute, importance of the course. • Occupational health and safety. • Accidents- Definition types and |

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| <ul style="list-style-type: none"> • Use of fire extinguishers. • Safe disposal of used oil and Battery. | <p>causes.</p> <ul style="list-style-type: none"> • First-Aid, nature and causes of injury and utilization of first-aid. • Safety: - its importance, classification, personal, general, workshop and Vehicle safety. • General safety precaution observed in the institute and section, safety rules for bench work. • Safety signs and norms. • Fires: - types, causes, use of fire extinguisher, how to use. • Use of personal protective Equipments (PPE), standardization. • Environmental safety - safe disposal of waste oil and Battery |
| <p><u>Behavioral Training:</u></p> <ul style="list-style-type: none"> • Aptitude developing exercises • Communication skill developing exercises | <p><u>Behavioral Training:</u></p> <ul style="list-style-type: none"> • Psychology: definition of psychology, definition of education, training, knowledge, skill, attitude, aptitude, teaching and learning. • Personal hygiene: definition, methods of maintaining cleanliness, conditions of maintaining disinfected/germ free health • Motivation:- definition, kinds of motivation, elements of motivation, use of motivation, techniques, sources of motivation, methods of motivation, maintaining learners interest, causes of loss of interest. • Communication:- Elements of communication, procedure step in |

communication, media, classification, 5W's and 1H in communication 7C's in communication, credibility gap, listening, tips for improving communication skills, barriers in communication.

- Workshop discipline and culture:- Rules to be followed in the workshop. Organization Structure. Nature of work is to be done. Role and duties in the workshop

Technical English

- Read a technical text
- Writing a letter
- Read and write Service Job card, Service and owner's manual, Service bulletins, Circulars and notices

Technical English

Group: A (Glossary)

- Introduction: Difference between general English and technical English
- Application of technical English at work
- Glossary of technical terms used in the industry.

Group: B (Basic grammar)

- Articles (a, an, the)
- Editing (Correcting of passages with changing of words like – articles, preposition, verbs, tenses etc.)
- Omission (Correcting of passages with putting new and right words)
- Syntax (Agreement between

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| | <p>subject and verb)</p> <ul style="list-style-type: none"> • Use of preposition (fill in the blanks) • Tense (knowledge of all kind of tenses-Present past future) <p><u>Group: C (writing skill)</u></p> <ul style="list-style-type: none"> • Report writing(making a report of a topic) • Letter writing(writing official and formal letters) <p><u>Group: D (Reading section)</u></p> <ul style="list-style-type: none"> • Read technical texts and give answers. |
| <p><u>Basic Computer Awareness</u></p> <ul style="list-style-type: none"> • Booting The Computer , Opening Windows Menus, using the mouse, refresh computer desktop using right click of the mouse, copy the file into hard disk, create a directory in hard disk, use my documents, use start menu for opening an application, to open a document recently written, change control panel settings for display, change the volume, Familiarize with Keyboard and Keys. • Techniques of changing Desktop Screen properties, Control Panel User Accounts, customizing icons, writing a sample text using Notepad, Using Paint for drawing figures to get accustomed with mouse, saving a file. Using Windows Explorer, Install a software, Remove a Software, Add new hardware to the system (like a Printer, Change the system date and Time, changing | <p><u>Basic Computer Awareness</u></p> <ul style="list-style-type: none"> • Familiarizing With Disk Drives, Booting Of a Computer System, Left Click And Use Of Operating Systems Like Windows XP, , Windows 7, Menu System, Tool Bars, File Structures, Directories, • Use of desktop , control panel settings, Explorer, regional settings, creating shortcuts, • Creating sample documents using MS WORD. Text wrapping, Text Formatting, Changing Letters to different case, drawing table, Page formatting, using different Font Types, Printing a document • Using Excel as spread Sheet, Familiarizing with Cells, Formulae, Text , Numbers, and date, , Copying Formulae, Text and Numbers, Using borders, Merging Cells, Unmerging, Changing Cell width, Row height, Printing an area of the sheet, Options of Printing like |

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| <p>the Regional Settings of the system like country, Currency , Date Format , Using Start Menu, Creating Desktop Short Cuts</p> <ul style="list-style-type: none"> • Open internet explorer, ,receive and send emails from the account. Search using Yahoo and Google for certain topics, download a file from the internet, and save it. | <p>fit to paper, shrinking, etc , Using different Sheets in a work book, changing Colour of cells, fonts, text .</p> <ul style="list-style-type: none"> • Study of Internet Explorer, Modem, Settings in the IE and Modem, Dial Up and Broadband connections, Outlook Express, Viewing Email from the web site and Outlook Express, Creating email Accounts, using search engines |
| | <p><u>Workshop Calculation & Science</u></p> <ul style="list-style-type: none"> • Units & Measurements – Systems of units, Fundamentals and derived units Conversion of units and applied problems. FPS, CGS, MKS and SI units • Plotting and reading of simple graph. • Ratio and Percentage – Direct – Indirect Calculate the Percentage of Metal removal by machining and metal added by welding • Trigonometry: trigonometrically ratios and simple formulae, calculate the area of triangle by using trigonometry and application of Pythagoras theorem, calculate height and distance by using trigonometry. • Definition –Force, Pressure, and their units, problems • simple machines • Classification of ferrous and non-ferrous metal and alloys. Physical and mechanical properties of metal |

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| | <ul style="list-style-type: none"> • Meaning of H.P.,I.H.P., B.H.P., and F.H.P. and CC and Torque. <p><u>Engineering Drawing</u></p> <ul style="list-style-type: none"> • Introduction to Engineering Drawing and its importance. Different types of standards used in engineering drawing. • Practice : Layout of drawing sheet • Types of lines – Thickness, shade of lines and its General applications. • Draw figures involving horizontal, vertical and inclined lines • Type of Angle, Triangles and their types. • Lettering styles- Single stroke letters, Gothic letters as per IS standard. Lettering practice • Dimensioning- Types of dimension, elements of dimensions, Methods of indicating Values, Arrangement and indication of dimensions. • Free hand sketching of straight lines, rectangular, circles, squares, Polygons, ellipse. Prepare proportionate free hand sketches of plane figures. Sketch horizontal, vertical and inclined line by free hand, Draw circles by free hand using square and radial line method, Draw arcs and ellipse by free hand • Electrical symbols and reading of wiring Diagram and circuit diagram |
| Practice on using all kind of workshop equipments e.g. Lift, air compressor, car | |

washer, pneumatic gun, torque wrench and special tools.

Basics of Automobiles

- Identification of different types of vehicle.
- Identification of Vehicle Identification Number, Chassis No. & Engine no
- Identification of different types of engine components.
- Replace – air cleaner, oil filter & fuel filter
- Apply Grease to parts / through greasing points (if necessary)
- Check power plug and inspect H.T. cables
- Clean, Check and Adjust spark plug
- Ignition Timing checking on Petrol vehicle with timing light & Ignition timing adjustment
- Checking of valve clearance and adjusting valve tappet clearance according to the manufacturers specification
- Emission Testing on petrol & diesel vehicles with the help of exhaust gas analyzer
- Engine Vacuum Test, Compression Pressure Test, Engine Oil Pressure Test

Basics of Automobiles

- Knowledge about automobile industry
- Basic automotive terms and familiarisation to various types of vehicles
- Career path for the trainee in the Dealership
- Understanding working of 2 stroke and 4 stroke engines
- Types of fuel used in vehicles, spark ignition and compression ignition engines
- Understanding of technical terms and definitions e.g. Wheel base and track, compression ratio, Stoichiometric ratio
- Understanding of various components viz. Battery, Tyre, Spark plug, Air Filter, Fuel filter, Oil filter, Injector, Body parts, etc
- Knowledge of vehicle assembly and Plant visit
- Engine series & types
- Vehicle Driving learning
- Automobile Maintenance schedule, requirement of periodic maintenance, Familiarisation with work done during service
- Familiarisation with different tools, basic equipments & measuring instruments used in workshop

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| <p><u>Vehicle washing</u></p> <ul style="list-style-type: none"> • Procedure to clean the vehicle • Steps to be followed for cleaning the vehicle before and after the service | <p><u>Vehicle washing</u></p> <ul style="list-style-type: none"> • Vehicle cleaning procedure with Air blow • Vehicle cleaning procedure of underbody and engine room washing • Vehicle cleaning procedure of engine room drying and floor mat cleaning • Vehicle cleaning procedure of spare wheel and dickey cleaning • Vehicle cleaning procedure of top wash • Vehicle cleaning procedure of engine room cleaning • Vehicle cleaning procedure of Interior & Exterior cleaning • Vehicle cleaning procedure of Glass cleaning • Waxing procedure |
| <p><u>Vehicle Service Process</u></p> <ul style="list-style-type: none"> • Personal & Vehicle Safety procedure • PDI & Periodic Maintenance Schedule of various MSIL models • Air Filter - Working, • Fuel Filter - Working, • Engine Lubrication System • Spark Plug - Function, Type of spark plugs, • Engine cooling system - working and parts of cooling system • Valve clearance adjustment - Valve clearance checking process, Tappet adjustment on engine • Emission control and standard • Ignition timing adjustment & inspection, | <p><u>Vehicle Service Process</u></p> <ul style="list-style-type: none"> • Personal & Vehicle Safety procedure followed in shop floor • PDI & Periodic Maintenance Schedule of various MSIL models • Air Filter - Cleaning process, Replacement Period & Process • Fuel Filter - Replacement process, Replacement period, water draining (diesel vehicles) • Engine Oil & Filter replacement • Spark Plug - Replacement, cleaning and testing process • Engine cooling system - Coolant replacement process • Valve clearance adjustment - Valve clearance checking process, Tappet adjustment on engine • Emission checking process & Testing (Petrol & Diesel vehicles) • Ignition timing checking process on Petrol vehicle with timing light. |

LIST OF TOOLS,EQUIPMENTS,MACHINERIES AND VEHICLES

| SL NO | TOOLS,EQUIPMENTS,MACHINERIES AND VEHICLES | QTY |
|--------------|--|------------|
| 1 | Double ended spanner set 6-32mm | 05set |
| 2 | Ring spanner set 6-32mm | 05 set |
| 3 | Tubular spanners 8,10,12,14,16,17mm | 05 no each |
| 4 | Socket spanners 6-32 mm with T bar and ratchet | 05 set |
| 5 | Allen keys 4-12mm in steps of 2mm | 05 set |
| 6 | Screw driver (flat) 20cm x 9mm blade | 05 no |
| 7 | Screw driver (flat) 30cm x 9 mm blade | 05 no |
| 8 | Screw driver (Philips type) 100 -300mm set of 5 pieces | 05 set |
| 9 | Hammer ball peen 0.75 kg | 05 no |
| 10 | Mallet hammer | 05 no |
| 11 | Hammer rubber | 05 no |
| 12 | Nose plier straight 15 cm | 05 no |
| 13 | Combination plier 15 cm | 05 no |
| 14 | Circlip plier external & contracting 6" | 05 no each |
| 15 | Circlip plier external & contracting 7" | 05 no each |
| 16 | Feeler gauge 20 blades metric | 05 no |
| 17 | Adjustable spanner 20 cm | 05 no |
| 18 | Spark plug spanner 12,14,17mm | 05 no each |
| 19 | File different shapes and size of 15cm | 05 set |
| 20 | Pneumatic Gun | 5 nos |
| 21 | Battery gun | 5 nos |
| 22 | Socket set | 5 nos |
| 23 | Screw Bit set | 5 nos |
| 24 | Torque wrench 0-50 NM | 01 no |
| 25 | Digital Multi meter | 01 no |
| 26 | Tappet adjuster | 01 no |
| 27 | Air compressor 200 litres capacity | 01 no |
| 28 | Impact screw driver for flat and Philips type | 01 set |
| 29 | Pneumatic tyre inflator | 01 no |
| 30 | Measuring Jars (Different capacity) | 01 Set |
| 31 | 2 post lift (3 ton capacity) | 2 nos |

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| 32 | Desktop computers for Basic training | 10 nos |
| 33 | Engine (Petrol MPFI) for dismetling and assembly | 2 nos |
| 34 | Engine (Diesel DDIS) for dismetling and assembly | 2 nos |
| 35 | Transmission for assembly and disassembly training | 2 nos |
| 36 | 4 Wheeler vehicle | 2 nos |
| | List of Machine and equipments at the Dealer workshop | |
| 1 | TWO POST LIFT | 2 Nos |
| 2 | WHEEL ALIGNER | 1 No. |
| 3 | WHEEL BALANCER | 1 No. |
| 4 | TYRE CHANGER | 1 No. |
| 5 | A/C RE-CYCLING EQUIPMENT | 1 No. |
| 6 | EXHAUST GAS ANALYZER (4 GAS) | 1 No. |
| 7 | SMOKE METER | 1 No. |
| 8 | AIR COMPRESSOR | 1 No. |
| 9 | CAR WASHER | 1 No. |
| 10 | VACUUM CLEANER | 1 No. |
| 11 | Hydraulic Washing Hoist | 1 No. |
| 12 | Under Chasis Washing System | 1 No. |
| 13 | Soap Foam Sprayer | 1 No. |
| 14 | OMS | 1 No. |
| 15 | EXPRESS SERVICE BAY TOOL TROLLEY | 1 No. |
| 16 | BRAKE BLEEDING EQUIPMENT | 1 No. |
| 17 | DRIVE LINE SERVICE EQUIPMENT - (transmission oil drain & dispensing equipment) | 1 No. |
| 18 | COOLANT TRANSFUSION MACHINE | 1 No. |
| 19 | FUEL AND AIR INDUCTION EQUIPMENT (Cleaning/ Decarbonising of Fuel and air intake system) | 1 No. |
| 20 | FUEL CONSUMPTION TESTER (for both petrol and diesel vehicle) | 1 No. |
| 21 | Battery Tester | 1 No. |
| 22 | Green Power Jump Starter | 1 No. |
| 23 | Methane Gas Leakage Detector | 1 No. |
| 24 | HEAD LAMP ALIGNER | 1 No. |
| 25 | Fuel Injector Cleaning Equip. | 1 No. |
| 26 | Natural Air Exhaust System | 1 No. |
| 27 | Exhaust Extraction System | 1 No. |
| 28 | General Tools | 1 No. |
| 29 | Special Tools | 1 No. |
| 30 | Measuring Instruments (| 1 No. |

AUTOMOTIVE REPAIR

UNDER

MODULAR EMPLOYABLE SKILLS (MES)

2014

By

Government of India

Directorate General of Employment & Training

Ministry of Labour & Employment (DGE&T)

GENERAL INFORMATION FOR ADVANCED CAR REPAIR

| | |
|--------------------------------------|--|
| Name of Sector | AUTOMOTIVE REPAIR |
| Name of Module | Automotive Service and Repair advance level 1 |
| MES Code | AUR 811 |
| Competency as per N C O Code | |
| Duration of Course | 1000 Hrs |
| Entry Qualification of Trainee | Minimum 10th Std Pass., 18 years of Age + AUR 710 |
| Unit size (No. of Trainees) | 20 |
| Power Norms | 6 KW - (a) Class Room: 1 KW (b) Workshop: 5 KW |
| Space Norms(Workshop and Class Room) | (a) Class Room: 30 Sq. meter @ 1.5 sq. meter per trainee (b) Workshop: OEM authorized service Workshop |
| Job Profile | Service Mechanic |
| Objective | 1. Produce Service Mechanic for automotive workshop by pinning with following Employability skills: (i) Skill to carry out running repair of brake, steering and electrical systems of passenger cars |
| Terminal competency | 1. Diagnosis, repair and maintenance of vehicle brake, steering and electrical systems |
| Instructor Qualification | Degree in Automobile/ Mechanical Engg. With one year relevant experience OR Diploma in Automobile/ Mechanical Engg. With two year relevant experience OR NTC/NAC in Automobile trade group with three years of relevant experience |
| Desirable Qualification | Craft Instructor Certificate(CIC) |

Course Contents for Module -2 Advanced Car Repair

| Practical Competencies | Underpinning Knowledge(Theory) |
|---|---|
| <p>Wheel alignment</p> <ul style="list-style-type: none"> • Check tyres, wheel bearings, ball joints, control arms bushings, shock absorbers, struts & power steering. • Identify components, brief working principle & operation of computerized wheel aligner • Procedure for taking readings,– take a print out. • Procedures for test drive to confirm the repairs. <p>Steering System</p> <ul style="list-style-type: none"> • Check and correct the steering geometry with instruments • Remove and refit steering boxes from vehicle • Check and top-up oil in steering gear box. • Troubleshooting of steering system <p>Brake system</p> <ul style="list-style-type: none"> • Check and adjust parking brake and service brakes. Dismantle wheel brake assembly– remove old lining and fit new one • Remove and refit vacuum boosters • Overhaul – master cylinder, Wheel cylinder & calliper pistons, wheel drum • Bleed vacuum assisted hydraulic brakes • Overhaul – Wheel cylinders & Drum brake/disc brakes • Check fail safe system & rectify defects | <ul style="list-style-type: none"> • Basics about different type of tyre & wheels used in vehicles, Function of tyre & wheel in vehicle • Wheel Alignment & Wheel Balancing • Requirement of maintaining correct tyre pressure • Tyre rotation, requirement & process (all models) • Steering system Inspection & adjustment process • Introduction, basic types of steering, steering geometry (necessity, types & effects), steering characters (over steer, under steer & neutral steer) & steering linkage • Types of steering gear, power assisted steering (hydraulic & electronic) • Checks on steering system and fault diagnosis • Forces & moments acting on vehicle, brake slip, braking force coefficient, time element of braking operation • Classification of brake systems, factors affecting the braking distance • Comparison between hydraulic drum brake & disc brake system. • Working principle of brake components – brake booster, tandem master cylinder, caliper assembly, wheel cylinder & different braking force control valves • Brake linings & pads • Brake faults diagnostics and adjustments • Introduction to anti-lock braking system (ABS). • Transmission oil replacement - |

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| <ul style="list-style-type: none"> • Remove & clean brake drums. Check disc/drum run-out, Fit new cups and brake hoses/pipes –assemble, adjust all wheel brakes and test for brake concern • Transmission oil replacement in different vehicles • Suspension system and inspection, explanation on parts and system • Belt inspection & replacement, • Head light beam inspection and adjustment process • Under body & engine room components location and importance and torque. • Battery - electrolyte level (top up) removal & installation process • Engine Vacuum Test, Compression Pressure Test, Engine Oil Pressure Test • Reading wiring diagrams • Voltage measurement, current & Resistance measurement • Battery - Function, Testing & charging procedure • Components of starting system | <p>explanation & process of replacement</p> <ul style="list-style-type: none"> • Suspension system and inspection, explanation on parts and system • Types of belts & inspection process • Head light beam inspection process • Under body & engine room components • Battery - Function & Testing • Engine Vacuum, Compression Pressure and Engine Oil Pressure specifications, • Electrical terms & measurement, parallel & series circuits & Electrical symbols, Wiring diagrams • Function of multimeter, Use of multimeter, • Battery - Function, Testing & charging procedure • Starting system |
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| LIST OF TOOLS,EQUIPMENTS,MACHINERIES AND VEHICLES | | |
|--|--|------------|
| Course AUR 105 and AUR 206 Automotive Repair Level 1, 2 and 3 | | |
| SL NO | TOOLS,EQUIPMENTS,MACHINERIES AND VEHICLES | QTY |
| 1 | Double ended spanner set 6-32mm | 05set |
| 2 | Ring spanner set 6-32mm | 05 set |
| 3 | Tubular spanners 8,10,12,14,16,17mm | 05 no each |
| 4 | Socket spanners 6-32 mm with T bar and ratchet | 05 set |
| 5 | Allen keys 4-12mm in steps of 2mm | 05 set |
| 6 | Screw driver (flat) 20cm x 9mm blade | 05 no |
| 7 | Screw driver (flat) 30cm x 9 mm blade | 05 no |
| 8 | Screw driver (Philips type) 100 -300mm set of 5 pieces | 05 set |
| 9 | Hammer ball peen 0.75 kg | 05 no |
| 10 | Mallet hammer | 05 no |
| 11 | Hammer rubber | 05 no |
| 12 | Nose plier straight 15 cm | 05 no |
| 13 | Combination plier 15 cm | 05 no |
| 14 | Circlip plier external & contracting 6" | 05 no each |
| 15 | Circlip plier external & contracting 7" | 05 no each |
| 16 | Feeler gauge 20 blades metric | 05 no |
| 17 | Adjustable spanner 20 cm | 05 no |
| 18 | Spark plug spanner 12,14,17mm | 05 no each |
| 19 | File different shapes and size of 15cm | 05 set |
| 20 | Pneumatic Gun | 5 nos |
| 21 | Battery gun | 5 nos |
| 22 | Socket set | 5 nos |
| 23 | Screw Bit set | 5 nos |
| 24 | Torque wrench 0-50 NM | 01 no |
| 25 | Digital Multi meter | 01 no |
| 26 | Tappet adjuster | 01 no |
| 27 | Air compressor 200 litres capacity | 01 no |
| 28 | Impact screw driver for flat and Philips type | 01 set |
| 29 | Pneumatic tyre inflator | 01 no |
| 30 | Measuring Jars (Different capacity) | 01 Set |
| 31 | 2 post lift (3 ton capacity) | 2 nos |

| | | |
|----|---|--------|
| 32 | Desktop computers for Basic training | 10 nos |
| 33 | Engine (Petrol MPFI) for dismetling and assembly | 2 nos |
| 34 | Engine (Diesel DDIS) for dismetling and assembly | 2 nos |
| 35 | Transmission for assembly and disassembly training | 2 nos |
| 36 | 4 Wheeler vehicle | 2 nos |
| | List of Machine and equipments at the Dealer workshop | |
| 1 | TWO POST LIFT | 2 Nos |
| 2 | WHEEL ALIGNER | 1 No. |
| 3 | WHEEL BALANCER | 1 No. |
| 4 | TYRE CHANGER | 1 No. |
| 5 | A/C RE-CYCLING EQUIPMENT | 1 No. |
| 6 | EXHAUST GAS ANALYZER (4 GAS) | 1 No. |
| 7 | SMOKE METER | 1 No. |
| 8 | AIR COMPRESSOR | 1 No. |
| 9 | CAR WASHER | 1 No. |
| 10 | VACUUM CLEANER | 1 No. |
| 11 | Hydraulic Washing Hoist | 1 No. |
| 12 | Under Chasis Washing System | 1 No. |
| 13 | Soap Foam Sprayer | 1 No. |
| 14 | OMS | 1 No. |
| 15 | EXPRESS SERVICE BAY TOOL TROLLEY | 1 No. |
| 16 | BRAKE BLEEDING EQUIPMENT | 1 No. |
| 17 | DRIVE LINE SERVICE EQUIPMENT - (transmission oil drain & dispensing equipment) | 1 No. |
| 18 | COOLANT TRANSFUSION MACHINE | 1 No. |
| 19 | FUEL AND AIR INDUCTION EQUIPMENT (Cleaning/ Decarbonising of Fuel and air intake system) | 1 No. |
| 20 | FUEL CONSUMPTION TESTER (for both petrol and diesel vehicle) | 1 No. |
| 21 | Battery Tester | 1 No. |
| 22 | Green Power Jump Starter | 1 No. |
| 23 | Methane Gas Leakage Detector | 1 No. |
| 24 | HEAD LAMP ALIGNER | 1 No. |
| 25 | Fuel Injector Cleaning Equip. | 1 No. |
| 26 | Natural Air Exhaust System | 1 No. |
| 27 | Exhaust Extraction System | 1 No. |
| 28 | General Tools | 1 No. |
| 29 | Special Tools | 1 No. |
| 30 | Measuring Insturments (| 1 No. |

REDESIGNED MODULES FOR THE SECTOR

OF

AUTOMOTIVE REPAIR

UNDER

MODULAR EMPLOYABLE SKILLS (MES)

2014

By

Government of India
Directorate General of Employment & Training
Ministry of Labour & Employment (DGE&T)

GENERAL INFORMATION FOR ADVANCED CAR REPAIR

| | |
|---|--|
| Name of Sector | AUTOMOBILE |
| Name of Module | Automotive Service and Repair advance level 2 |
| MES Code | AUR 812 |
| Competency as per N C O Code | |
| Duration of Course | 1000 Hrs |
| Entry Qualification of Trainee | Minimum 10th Std Pass., 18 years of Age + AUR 710 |
| Unit size (No. of Trainees) | 20 |
| Power Norms | 6 KW - (a) Class Room: 1 KW (b) Workshop: 5 KW |
| Space Norms(Workshop and Class Room) | (a) Class Room: 30 Sq. meter @ 1.5 sq. meter per trainee (b) Workshop: OEM authorized service Workshop |
| Job Profile | Service Mechanic |
| Objective | 1. Produce Service Mechanic for automotive workshop by pinning with following Employability skills: (i) Skill to carry out disassembly assembly and repair of Petrol and Diesel engines. |
| Terminal competency | 1. Diagnosis, repair and maintenance of Petrol and Diesel Engines |
| Instructor Qualification | Degree in Automobile/ Mechanical Engg. With one year relevant experience OR Diploma in Automobile/ Mechanical Engg. With two year relevant experience OR NTC/NAC in Automobile trade group with three years of relevant experience |
| Desirable Qualification | Craft Instructor Certificate(CIC) |

Course Contents for Module -3 Advanced Car Repair

| Practical Competencies | Underpinning Knowledge(Theory) |
|---|--|
| <p><u>Petrol Engine</u></p> <ul style="list-style-type: none"> • Identification of petrol Engine components. • Practice on starting and stopping of petrol engines. Observe and report the reading of Tachometer, Odometer, temp and Fuel gauge under ideal and on load condition. • Removing a petrol engine from a motor vehicle. Dismantling cylinder head for Inspection. • Practice on Removing of piston and connecting rods from engine • Checking Cylinder bore wear for ovality and taper. Piston ring, Piston as per service manual. • Checking valves and valve springs, assembling valves and cylinder head and adjusting tappet clearance in engine. | <ul style="list-style-type: none"> • Classification of Engines • Basic Engine Terminology • Comparison between Petrol Engine & Diesel Engine • VVT System • Emission Standards • Valve clearance Adjustment <p><u>Petrol Engine</u></p> <ul style="list-style-type: none"> • 4-stroke spark-ignition engines- Basic 4-stroke principles. • Spark-ignition engine components- Basic engine components, Engine cams & camshaft, Engine power transfer, and Engine components. • Intake & exhaust systems - Carbureted systems, Electronic fuel injection systems, Exhaust systems. Intake system components, Air cleaners, • Carburetor , EFI system components and sensors. • Gasoline Fuel Systems : Description of Gasoline fuel, Gasoline fuel characteristics, Stoichiometric ratio, , Fuel supply system, |
| <p><u>Electronic fuel injection (EFI)</u></p> <ul style="list-style-type: none"> • Cleaning of fuel tank, checking for leaks in Fuel tank. • Identification of various components of MPFI system. • Testing of MPFI components and replacement if necessary. • Check delivery from fuel Pump. | <p><u>Electronic fuel injection (EFI)</u></p> <ul style="list-style-type: none"> • Introduction to Electronic fuel injection (EFI) fuel supply system , Basic EFI principles, Air supply, Air volume, Multi-point injection systems (MPI/MPFI), Simultaneous injection, Efficient combustion • EFI fuel supply system components - Fuel pumps, Fuel filters, Tanks & lines, Fuel lines, Fuel rail, Fuel pressure regulator, Injectors, EFI sensors, , Idle Air control devices, |

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| <p><u>EFI Engine Management</u></p> <ul style="list-style-type: none"> • Identification of Electronic control Unit. • Set up for testing, Testing of Electronic Control Circuit. • Fault finding in Electronic circuit and remedies using diagnostic tool. • Identification of various sensors installed in engine & it's mounting. • Checking instruments & Gauges on dash board. • Rectify replace defective gauges. • Testing of Temperature sensor, Pressure sensor, potentiometer, magnetic induction sensor, cam position sensor, crankshaft position sensor. | <p><u>EFI Engine Management</u></p> <ul style="list-style-type: none"> • Introduction to EFI Engine Management - EFI operation Modes of EFI, Electronic fuel injection, Idle speed control systems, Feedback & looping, Cold start systems, , Electrical functions, EFI wiring diagram • Electronic control unit (ECU) - EFI system ECU, Electronic control unit settings, Malfunction indicator lamp. • Description of Onboard diagnostic system. Importance of Diagnostic Trouble Code (DTC) & its general format. Use of diagnostic tool and retrievals of codes. • EFI sensors- Intake Temperature sensor, Mass airflow sensor, Manifold absolute pressure sensor, Throttle position sensor, Exhaust gas oxygen sensor, Crank position sensor, Hall effect voltage sensor, |
| <p>•</p> <p><u>Diesel Engine</u></p> <ul style="list-style-type: none"> • Check / test – compression pressure, lubricating oil pressure • Dismantle complete engine and their components • Check / test cylinder head & block warpage, valve leak, bearing (oil) clearance, measure bore & take decision for further action, Replace – liner, valve guide, piston rings, check ring end gap & side clearance, check cam & crank shaft bend & valve timing • Service inlet and exhaust manifolds • Overhauling of cylinder head assembly, Use of service manual for clearance and other parameters, Practice on removing rocker arm assembly manifolds. • Practice on removing the valves | <p>•</p> <p><u>Diesel Engine</u></p> <ul style="list-style-type: none"> • Description and Constructional feature of Cylinder head, Importance of Cylinder head design, Type of Diesel combustion chambers, Effect on size of Intake & exhaust passages, Head gaskets. • Importance of Turbulence. Turbocharger & Oil Cooler • Valves & Valve Trains- Description and Function of Engine Valves, different types, materials, Type of valve operating mechanism, Importance of Valve seats, Valve seats inserts in cylinder heads, importance of Valve rotation, Valve stem oil seals, size of Intake valves, Valve trains, Valve- timing diagram, concept of Variable valve timing. Description of Camshafts & drives , Description of Overhead camshaft, importance of Cam lobes, Timing |

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| <p>and its parts from the cylinder head, cleaning. Inspection of cylinder head and manifold surfaces for warping, cracks and flatness. Checking valve seats & valve guide – Replacing the valve if necessary. Testing leaks of valve seats for leakage – Dismantle rocker shaft assembly -clean & check rocker shaft-and levers, for wear and cracks and reassemble. Check valve springs, tappets, push rods, tappet screws and valve stem cap. Reassembling valve parts in sequence, refit cylinder head and manifold & rocker arm assembly, adjustable valve clearances, starting engine after adjustments.</p> | <p>belts & chains, Timing belts & tensioners.</p> <ul style="list-style-type: none"> • Procedure for – dismantling, checking, assembling & testing of diesel engines |
| <p><u>Diesel Fuel Systems-</u></p> <ul style="list-style-type: none"> • Practice on removing & Cleaning fuel tanks, checking leaks in the fuel lines. • studying the fuel feed system in diesel engines, draining of water from water separators. • Bleeding of air from the fuel lines, Servicing primary & secondary filters. • Removing a fuel injection pump from an engine-refit the pump to the engine re- set timing - fill lubricating-oil start and adjust slow speed of the engine. • Practice on overhauling of injectors and testing of injector. • General maintenance of Fuel Injection Pumps (FIP). | <ul style="list-style-type: none"> • <u>Diesel Fuel Systems-</u> • Description and function of Diesel fuel injection, fuel characteristics, concept of Quiet diesel technology & Clean diesel technology. • <u>Diesel fuel system components</u> – Description and function of Diesel tanks & lines, Diesel fuel filters, water separator, Lift pump, Plunger pump, Priming pump, • Inline injection pump, Distributor-type injection pump, Diesel injectors, Glow plugs. • <u>Electronic Diesel control-</u> Electronic Diesel control systems, Common Rail Diesel Injection (CRDI) system, Hydraulically actuated electronically controlled unit injector (HEUI) diesel injection system. Sensors, actuators and ECU (Electronic Control Unit) used in Diesel Engines. • Immobilizer Control System • |
| <p><u>Troubleshooting on Engine:</u></p> <ul style="list-style-type: none"> • Practice on troubleshooting in cars for Engine Not starting – Mechanical & Electrical causes, High fuel consumption, Engine overheating, Low Power Generation, Excessive oil consumption, Low/High Engine Oil Pressure, Engine Noise. | <p><u>Troubleshooting on Engine :</u></p> <ul style="list-style-type: none"> • Causes and remedy for Engine Not starting – Mechanical & Electrical causes, High fuel consumption, Engine overheating, Low Power Generation, Excessive oil consumption, Low/High Engine Oil Pressure, Engine Noise. |

LIST OF TOOLS,EQUIPMENTS,MACHINERIES AND VEHICLES

| SL NO | TOOLS,EQUIPMENTS,MACHINERIES AND VEHICLES | QTY |
|--------------|--|------------|
| 1 | Double ended spanner set 6-32mm | 05set |
| 2 | Ring spanner set 6-32mm | 05 set |
| 3 | Tubular spanners 8,10,12,14,16,17mm | 05 no each |
| 4 | Socket spanners 6-32 mm with T bar and ratchet | 05 set |
| 5 | Allen keys 4-12mm in steps of 2mm | 05 set |
| 6 | Screw driver (flat) 20cm x 9mm blade | 05 no |
| 7 | Screw driver (flat) 30cm x 9 mm blade | 05 no |
| 8 | Screw driver (Philips type) 100 -300mm set of 5 pieces | 05 set |
| 9 | Hammer ball peen 0.75 kg | 05 no |
| 10 | Mallet hammer | 05 no |
| 11 | Hammer rubber | 05 no |
| 12 | Nose plier straight 15 cm | 05 no |
| 13 | Combination plier 15 cm | 05 no |
| 14 | Circlip plier external & contracting 6" | 05 no each |
| 15 | Circlip plier external & contracting 7" | 05 no each |
| 16 | Feeler gauge 20 blades metric | 05 no |
| 17 | Adjustable spanner 20 cm | 05 no |
| 18 | Spark plug spanner 12,14,17mm | 05 no each |
| 19 | File different shapes and size of 15cm | 05 set |
| 20 | Pneumatic Gun | 5 nos |
| 21 | Battery gun | 5 nos |
| 22 | Socket set | 5 nos |
| 23 | Screw Bit set | 5 nos |
| 24 | Torque wrench 0-50 NM | 01 no |
| 25 | Digital Multi meter | 01 no |
| 26 | Tappet adjuster | 01 no |
| 27 | Air compressor 200 litres capacity | 01 no |
| 28 | Impact screw driver for flat and Philips type | 01 set |
| 29 | Pneumatic tyre inflator | 01 no |
| 30 | Measuring Jars (Different capacity) | 01 Set |
| 31 | 2 post lift (3 ton capacity) | 2 nos |

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| 32 | Desktop computers for Basic training | 10 nos |
| 33 | Engine (Petrol MPFI) for dismetling and assembly | 2 nos |
| 34 | Engine (Diesel DDIS) for dismetling and assembly | 2 nos |
| 35 | Transmission for assembly and disassembly training | 2 nos |
| 36 | 4 Wheeler vehicle | 2 nos |
| | List of Machine and equipments at the Dealer workshop | |
| 1 | TWO POST LIFT | 2 Nos |
| 2 | WHEEL ALIGNER | 1 No. |
| 3 | WHEEL BALANCER | 1 No. |
| 4 | TYRE CHANGER | 1 No. |
| 5 | A/C RE-CYCLING EQUIPMENT | 1 No. |
| 6 | EXHAUST GAS ANALYZER (4 GAS) | 1 No. |
| 7 | SMOKE METER | 1 No. |
| 8 | AIR COMPRESSOR | 1 No. |
| 9 | CAR WASHER | 1 No. |
| 10 | VACUUM CLEANER | 1 No. |
| 11 | Hydraulic Washing Hoist | 1 No. |
| 12 | Under Chasis Washing System | 1 No. |
| 13 | Soap Foam Sprayer | 1 No. |
| 14 | OMS | 1 No. |
| 15 | EXPRESS SERVICE BAY TOOL TROLLEY | 1 No. |
| 16 | BRAKE BLEEDING EQUIPMENT | 1 No. |
| 17 | DRIVE LINE SERVICE EQUIPMENT - (transmission oil drain & dispensing equipment) | 1 No. |
| 18 | COOLANT TRANSFUSION MACHINE | 1 No. |
| 19 | FUEL AND AIR INDUCTION EQUIPMENT (Cleaning/ Decarbonising of Fuel and air intake system) | 1 No. |
| 20 | FUEL CONSUMPTION TESTER (for both petrol and diesel vehicle) | 1 No. |
| 21 | Battery Tester | 1 No. |
| 22 | Green Power Jump Starter | 1 No. |
| 23 | Methane Gas Leakage Detector | 1 No. |
| 24 | HEAD LAMP ALIGNER | 1 No. |
| 25 | Fuel Injector Cleaning Equip. | 1 No. |
| 26 | Natural Air Exhaust System | 1 No. |
| 27 | Exhaust Extraction System | 1 No. |
| 28 | General Tools | 1 No. |
| 29 | Special Tools | 1 No. |
| 30 | Measuring Instruments | 1 No. |

AUTOMOTIVE REPAIR

UNDER

MODULAR EMPLOYABLE SKILLS (MES)

2014

By

Government of India
Directorate General of Employment & Training
Ministry of Labour & Employment (DGE&T)

GENERAL INFORMATION FOR ADVANCED CAR REPAIR

| | |
|--------------------------------------|--|
| Name of Sector | AUTOMOTIVE REPAIR |
| Name of Module | Automotive Service and Repair advance level 3 |
| MES Code | AUR 813 |
| Competency as per N C O Code | |
| Duration of Course | 1000 Hrs |
| Entry Qualification of Trainee | Minimum 10th Std Pass., 18 years of Age + AUR 710 |
| Unit size (No. of Trainees) | 20 |
| Power Norms | 6 KW - (a) Class Room: 1 KW (b) Workshop: 5 KW |
| Space Norms(Workshop and Class Room) | (a) Class Room: 30 Sq. meter @ 1.5 sq. meter per trainee (b) Workshop: OEM authorized service Workshop |
| Job Profile | Service Mechanic |
| Objective | 1. Produce Service Mechanic for automotive workshop by pinning with following Employability skills: (i) Skill to carry out disassembly assembly and repair of Chassis transmission and HVAC systems |
| Terminal competency | 1. Diagnosis, repair and maintenance of Chassis transmission and HVAC systems. |
| Instructor Qualification | Degree in Automobile/ Mechanical Engg. With one year relevant experience OR Diploma in Automobile/ Mechanical Engg. With two year relevant experience OR NTC/NAC in Automobile trade group with three years of relevant experience |
| Desirable Qualification | Craft Instructor Certificate(CIC) |

Course Contents for Module - Advanced Car Repair

| Practical Competencies | Underpinning Knowledge(Theory) |
|---|---|
| <p><u>CHASSIS SYSTEM</u></p> <ul style="list-style-type: none"> • Identify different parts of chassis • Identify different tools & equipments • Function of Clutch, Various Type of Clutch release mechanism • Remove clutch plate from vehicle, check for defects & rectify/replace & refit • Clutch play Adjustment procedure • Remove gear box from vehicle, dismantle, check, rectify, fill lubricating oil & assemble • Align gear selector fork • Remove CV Joint, Dismantle, lubricate & refit • Remove rear axle assembly dismantle of crown wheel, pinion and bearings, clean parts. Check tooth contact in the crown and pinion and adjust backlash & Assemble rear axle assembly • Check and correct the steering geometry with instruments • Remove and refit steering boxes from vehicle • Check and top-up oil in steering box. • Check and adjusting steering wheel play and backlash. • Overhaul hydraulic power assisted steering system – pump, control valve & cylinder. • Repair Electronic power steering system • Overhauling and inspection of shackle, leaf spring, front and rear suspension. | <ul style="list-style-type: none"> • Units & Definition of force, work, power, torque & pressure. • Power flow from engine to wheels • Description of single plate clutch. Functions of different parts of the clutch assembly. Clutch linings material. Power flow in clutch plate. • Clutch operating mechanisms-manual& hydraulic • Clutch faults • Type of gears and their application-advantages and disadvantages-gear ratio • Types of gear box • Working principle of synchromesh gear boxes • Gear selection mechanism • Lubrication of transmission system • Gear box faults • Types of bearings, maintenance, their characteristics & application • Working principle of constant velocity joints • Working principle of differential • Faults in differential, C.V.Joints & drive shafts • Function of Steering system • Rack & Pinion Steering System • Hydraulic Power Steering System • Electronic Power Steering System • Wheel Alignment - Camber, Caster & Toe-in , Toe adjustment Front & Rear Wheels • Function of Suspension System • Components of Suspension |

- Overhauling and inspection of front and rear suspension.
- Removing, inspection and assembling of shock absorber and strut assy and other suspension parts.
- Lubricating a suspension system.
- Identifying and Troubleshooting of NVH problems in vehicles

Heating Ventilation Air Conditioning (HVAC)

- Identification of Air conditioning components, Performance test on A/c unit,
- Checking Charged state of refrigerant, Inspecting & adjusting an engine drive belt, Replacing an engine drive belt.
- Checking a heating system, Compressor rotation test, air Gap check,
- Refrigerant recovery –evacuating –charging of A/c system. Replenishing compressor oil level.
- HVAC Troubleshooting, diagnosis and repair for
- No cooling or warm air,
- Cool air comes out only intermittently,
- Insufficient cooling,
- Abnormal noise from compressor,
- Magnetic clutch, condenser, evaporator, Blower motor.
- Diagnosis test for AC Performance
- High and low pressure test

System

- Types of Suspension Systems
- Inspection of Suspension System
- Noise vibration and harshness (NVH) Basics
- Cycle
- Frequency (Hertz)
- Amplitude
- Free Vibration
- Forced Vibration
- Natural Frequency
- Resonance
- Damping
- Road test procedure for identifying NVH related problems

Heating Ventilation Air Conditioning (HVAC)

- AC System Layout & Components explanation
- Location of various AC components in vehicle
- Auto AC
- Diagnosis & Repair of AC system
- Recharging AC refrigerant using recovery machine
- Compressor oil (Lubricant), property and quantity.
- AC system performance inspection
- Heating Ventilation Air Conditioning (HVAC) legislation, Vehicle heating, ventilation & cooling systems, Basic air-conditioning principles, Air-conditioning capacity, Air-conditioning refrigerant, Humidity
- Description and function of Fixed orifice, Control devices, Thermostatic expansion valve system, Thermal expansion valves, Air-conditioning

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| | <p>compressors, Condensers & evaporators, Receiver drier, Lines & hoses, thermostat, Refrigerants, Pressure switches, Heating elements</p> <ul style="list-style-type: none"> • Air-conditioning ECU, Ambient air temperature sensor, Automatic climate control sensors, Evaporator temperature sensor, Blower speed control, Ventilation systems. |
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