

**MAHARASHTRA STATE BOARD OF VOCATIONAL EDUCATION EXAMINATION, MUMBAI -51**

1	Name of Syllabus	C.C. IN Mechanic Auto Engineering (306205)																																																													
2	Max. No's of Student	25 students.																																																													
3	Duration	1 YEAR																																																													
4	Type	Full Time																																																													
5	No Of Days / Week	6 Days																																																													
6	No Of Hours /Days	7 Hrs																																																													
7	Space Required	Lab = 200 Sq feet Class Room = 800 Sq feet TOTAL = 1000 Sq feet																																																													
8	Entry Qualification	S.S.C. passed																																																													
9	Objective Of Syllabus/ introduction	To enable the students to get skill in Auto Engg.																																																													
10	Employment Opportunity	<b>a) Wage employment</b> 1. General Auto mechanic 2. Diesel fuel system service mechanic 3. L.P.G. System service mechanic 4. Vehicle Service Technician 5. Auto fitter in manufacturing concern in assembly shop or testing shop 6. Inspector in Auto Manufacturing industry 7. Dealer's service mechanic 8. Spare parts sales assistant/manufacturer's representative 9. Vehicle surveyor and loss assessor 10. Craft Instructor (Auto) 11. Driver <b>b) Self employment</b> 1. General Mechanic 2. Diesel fuel system service mechanic 3. Auto Machinist 4. Vehicle operator 5. Spare parts salesman/Dealer's representative 6. Vehicle surveyor or loss assessor.																																																													
11	Teacher's Qualification	Diploma in AUTO/ MECHANICAL Engg. Or Equivalent with at least 2nd class from a Govt. Recognized board/university.																																																													
12	Training System	<b>Training System Per Week</b> <table><tr><td>Theory</td><td>Practical</td><td>Total</td></tr><tr><td>18 Hours</td><td>24 Hours</td><td>42 Hours</td></tr></table>						Theory	Practical	Total	18 Hours	24 Hours	42 Hours																																																		
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**1. Workshop Environment**

- 1.1 Familiarization with workshop Environment
- 1.2 Discipline
- 1.3 Workshop Ethics
- 1.4 Workshop Layout
- 1.5 Safety Precaution
- 1.6 Elementary First Aid.

**2. Fitting**

- 2.1 Fitting operation and its use in engineering
- 2.2 Description of hand tools used in fitting shop like hammers, ball peen, soft face and mallet cross peen etc. Pliers – straight nose, circlip, grip, combination, cutting etc. Chisels types Cross cut, diamond point, cow mouth, hot, cold etc. Files its types rasp, triangular, square, half round, knife edge.etc. Hacksaw - Fix and adjustable Spanners- double ended, socket, open ended, pipe wrench etc. pneumatic tools used in garage scrapers, scribes Allen keys sockets.

**3. Gauges and Measuring Instruments**

- 3.1 Measuring and marking tools. Dial Indicator, Inside and outside Micrometer, Vernier caliper Feeler gauge, Depth gauge, Screw pitch gauge, Tyre pressure gauge Hydrometer, Cylinder Compression gauge, Surface plate, Angle plate 'V' Block, Torque wrench.
- 3.2 Test equipments Vacuum gauge, condenser and coil tester, Wheel alignment gauge, Timing light, Toe in gauge, Spark plug tester, Voltmeter and ammeter High rate battery cell tester, Multimeter, Tachometer, Vacuum gauge.

**4 General Tools and special tools**

- 4.1 Bearing puller, Piston ring expander, Piston ring compressor and ring fitting jig Connecting rod aligner, Valve lifter, Valve seat cutter, Stud remover, Stud extractor, Clutch dismantling fixture, Valve guide extractor, Exhaust gas analyzer, Smoke tester, Tap and Dies, Reamers, Soldering iron.

**5. Painting**

- 5.1 Painting and their applications colour codes as per ISI spray painting process.
- 5.2 Surface preparation
- 5.3 Tools and equipment
- 5.4 Modern spray painting booth
- 5.5 Surface coating Techniques.

**6. Machining**

- 6.1 Introduction - Lathe
- 6.2 Simple Operation on lathe like step and taper turning, Constructional details and working principle of lathe.
- 6.3 Introduction of grinder Constructional details and working principle of pedestal grinder
- 6.4 Introduction of drill machine and its types. Constructional details and working principle of bench drill machine.

**7. Welding**

- 7.1 Welding processes and its applications
- 7.2 Gas welding Working principle and various techniques
- 7.3 Equipment used, Gas cutting, Filler rods and fluxes
- 7.4 Arc welding, working principle and various techniques
- 7.5 Equipment used, Welding electrodes
- 7.6 Safety in welding processes, Welded joints and common defects
- 7.7 Soldering and Brazing

**8. Garage Equipment**

- 8.1 Simple jack, Car washing machine, Hydraulic jack, Compressor

**PART B**

**Paper - II: Auto Transmission System**

**1. Clutches**

- 1.1 Purpose of clutch, types of clutches.
- 1.2 Coil pressure spring type, diaphragm type, semi centrifugal type, Hydraulic type, single plate, multi plate clutch etc. Detail study of all types of clutch.

**2. Transmission**

- 2.1 Purpose of transmissions, Gears and torque, operation of transmission, Gear shifting, synchronizers, purpose of over drive mechanism,

2.2 Types of gear boxes such as sliding mesh gear box, constant mesh gear box, synchromesh with the attachment of over drives.

2.3 Introduction to automatic transmission system, fluid coupling.

### **3. Drive lines**

3.1 Function of propeller shaft.

3.2 Type of drive, Hotchkiss drive and torque tube drive, front wheel drive, Types of universal joint.

### **4. Rear axle and differentials**

4.1 Function of differentials, standard differentials, non-slip differentials, differentials gearing, double reduction differentials study of final drive.

4.2 Types of rear axles, such as semi floating, three quarter floating, full floating axle.

### **5. Automotive springs and suspension**

5.1 Types of spring such as coil, leaf and torsion bar, stabilizer, types of suspension.

5.2 Independent front suspension, purpose of shock absorber shock absorber operation, shock absorber types. Friction type hydraulic parallel cylinder, opposed cylinder and vane type, plastic suspension, Air suspension etc.

### **6. Steering system**

6.1 Function of steering system, parts in steering system.

6.2 Steering geometry camber angle, caster angle, king pin inclination, included angle

6.3 Ackerman principle

6.4 TOE IN and TOE OUT, steering linkages, steering lock, steering gears, power steering

6.5 Steering attachment with front axle.

### **7. Automotive Brakes**

7.1 Mechanical Brake, Hydraulic Brake, Vacuum and hydraulic servo brakes, power brake, detailed working and operation of hydraulic brakes

7.2 Brake adjustments, bleeding of hydraulic brakes

7.3 Constructional details of master cylinder, wheel cylinder, disc brake.

7.4 Detailed study of disc brake.

### **8. Automotive chassis**

8.1 Frame and chassis, types of chassis, frames, body.

8.2 Channel section, 'I' section, box type, unitized construction of body, mounting of units and sub-units on the frame, checking alignment of chassis.

### **9. Wheels and tyres**

9.1 Types of tyres, solid tyres, pneumatic tyres, tubeless tyres.

9.2 Air pressures in tyres, tyres construction mountings of tyres.

9.3 Tyres inspection, tyre removal, rotating tyres, defects in tyres due to over inflation and under inflation.

9.4 Types of wheels, split type, disc, pressed steel, features of wired and spoke wheels.

9.5 Repairs of tyres and tubes such as vulcanizing, tyre retarding.

### **Engg Drawing – Drawing / Sketching of different Tools , Instruments & Parts**

## **PRACTICAL - I - Workshop Technology Engg. Drawing**

### **PART A**

#### **Practical**

1. To draw sketches of hand tools and measuring tools and instruments used in modern garages such as hammers, chisels, pliers and spanners etc.
2. Demonstration in use of following instruments and sketching Inside and outside micrometer, Vernier caliper, Multimeter, Caliper.
3. Demonstration : use of the following instruments and sketching Piston ring compressor Piston ring expander Cylinder compression gauge, Vacuum gauge.
4. Demonstration : use of the following instruments and sketching Condenser and coil tester Hydrometer High rate battery cell tester, Growler machine.
5. Demonstration in use of following instruments and sketching, Exhaust gas analyzer, Smoke tester
6. Practice in tapping threads
7. To conduct scrapping exercise to learn to remove dust and rust surfaces. To conduct exercise to remove excess material etc. from material surface by chipping
8. Use of dies for cutting external threads
9. To prepare a job involving denting surface, preparation of painting
10. To prepare a job on different operation like lathe involving step turning, taper turning etc.
11. To learn various safety measures used in welding shop
12. To prepare a job involving gas welding and electric arc welding
13. To make three exercises on gas welding use of flux familiarization of different types of flames and soldering practice.
14. To check electrical Component with help of multimeter Resistance of coil, CDI unit battery charging current continuity in electrical connections
15. Visits - (a) Fabrication workshop (b) Mechanical workshop - Lathe, Grinder CNC etc.(c) Modern spray painting shop (d) Automobile parts, tools manufacturing units (2 visits).

### **PART B**

1. Dismount and dismantle multi plate clutch of Hero Honda/Honda Activa/Yamaha/Suzuki/any 4-stroke two-wheeler clean, inspect report on condition of all parts repair and refit it.
2. Dismount and dismantle signal plate clutch of any four-wheeler, clean, inspect report on the condition of all parts, repair and reassemble it.
3. Dismantle gear box used in any four-stroke two -wheeler /Hero Honda/ Yamaha/Suzuki/Bajaj/any four-stroke vehicle inspect all parts repair and reassemble it.
4. Dismantle, synchromesh gear box, clean, inspect and report on the condition of all parts repair and refit it.
5. Remove propeller shaft assembly from four-wheeler. Make overhaul of Universal joint, lubricate and refit assembly.
6. Dismount different units from vehicle, dismantle, report on condition of all parts and refit it.
7. Dismantle front axle with independent suspension, inspect, report on condition of parts repair and refit it properly.
8. Dismantle steering mechanism of Mahindra Maruti/Sumo/Ambassador/any four wheeler clean, inspect, report condition of each part, lubricate and refit it. Make overhauling of steering gearbox.
9. Make ram servicing of 4-wheeler and two-wheeler clean them with high pressure air and lubricate all points.
10. Study / dismantle power steering system.
11. Remove wheel bearing from spindle, clean, inspect, report on condition of bearing, spindle hub lubricate and refit it with specified torque.
12. Remove wheel from vehicle separate tyre and tube from disc, test for leakage make use of hot patch machine and refit all parts.
13. Inspect and make overhaul of complete, mechanical brake system used in two wheeler.
14. Draw circuit diagram of hydraulic brake system used in Mahindra jeep/Maruti/Fiat cars. Write construction and working. Make overhauling of Master Cylinder and wheel cylinder.
15. Dismantle the front wheel, handle bar assembly of a two-wheeler, clean, inspect, report on the condition, repair reassemble and lubricate.
16. Visit to vulcanizing unit and tyre retarding unit.
17. Visit to wheel balancing and wheel alignment unit.

## **THEORY - II - Otto and Diesel Cycle**

### **PART A**

#### **1. Introduction**

- 1.1 General Introduction of the vehicle. Types of vehicles and classification of engine
- 1.2 Description and construction of I.C. engine and its parts, 4 stroke cycle engine
- 1.3 Important parts used in 4 stroke cycle engine.

#### **2. Construction of I.C. Engine**

- 2.1 Otto cycle, Construction and working of petrol engine, meaning of spark ignition (S.I.),
- 2.2 Diesel cycle, Construction and working of diesel engine meaning of compression ignition (C.I.),
- 2.3 Difference between S.I. and C.I. engine.
- 2.4 Study of Otto and diesel cycle.

#### **3. Working of I.C. engine**

- 3.1 Two and four stroke cycle, construction and working of two and four stroke cycle S.I. engine
- 3.2 Description and working of Diesel engine. (C.I.)
- 3.3 Merits and demerits of 2 stroke and 4 stroke cycle
- 3.4 Differentiate between 2 stroke and 4 stroke cycle.

#### **4. Merits and demerits of auto engine**

- 4.1 Construction and working of multi cylinder engine
- 4.2 Classification of engines
- 4.3 Merits and demerits of multi cylinder and single cylinder engine (Petrol and diesel engine)

#### **5. Valve and valve mechanism**

- 5.1 Construction and working of valve actuating mechanism.
- 5.2 Description of parts such as valve springs, valve seat, valve lock, valve guide, tappets, push rod.
- 5.3 Valve timing diagram. For 4 stroke petrol and diesel engines. Valve clearances. Valve timing devices, timing gears, chain and sprocket wheel, Belt and pulley.
- 5.4 Study of O.H.V. and O.H.C. engine.

#### **6. Automotive ignition system**

- 6.1 Necessity of ignition systems, requirements.
- 6.2 Types of ignition system. Spark ignition, compression ignition, Battery ignition and Magneto ignition, Electronic ignition system.
- 6.3 High tension magneto and low tension magneto, Flywheel magneto.

#### **7. Automotive Cooling system**

- 7.1 Function and working of cooling system.
- 7.2 Types of cooling system. Air cooling and water cooling.
- 7.3 Components, use of radiator, Importance of thermostat in the cooling system, pressurized cooling system, Use of water pump and its drive mechanism.

#### **8. Automotive Lubrication system**

- 8.1 Use of lubricant, necessity.
- 8.2 Information of multigrade oil, Grease and importance of correct quantity and replacement frequencies.
- 8.3 Types of lubricating system. Gravity feed, splash, force feed, oil pressure gauge and oil relief valve, Importance of oil filter, Use of oil seals in engine, construction of lubricating oil pump and its drive mechanism, Dry sump lubricating system, Petroil lubricating system. Parts in lubricating system.

### **PART B**

#### **1. Availability of heat**

- 1.1 Basic law of heat transfer
- 1.2 Law of energy conservation
- 1.3 Transformation of heat energy into mechanical energy in I.C. engine, measurement of engine work done. Mechanical equivalent of heat.
- 1.4 Dissipation of heat, Dissipation methods
- 1.5 P. V. Diagram of four-stroke Otto cycle and Diesel cycle.

#### **2. Engine Measurement**

- 2.1 Work, energy, power, torque, Bore and stroke, Piston displacement, compression ratio, volumetric efficiency etc. measurement.
- 2.2 S.A.E., horse power, I.H.P., B.H.P., F.H.P., efficiency, thermal efficiency, Mechanical efficiency, overall efficiency, Mean effective pressure.

#### **3. Automotive engine fuels**

- 3.1 Gasoline, causes of knocking, detonation and pre ignition, octane and cetane numbers, quality of petrol fuel

- 3.2 High speed diesel, butane, propane, liquid petroleum gas and Nitrogen its qualities
- 3.3 Detail study of Fuel economy calorific value of fuel.
- 3.4 Detail study of CNG, Ethanol mixed fuels
- 4. Automotive fuel systems of petrol engine.**
  - 4.1 Purpose of fuel system and its components
  - 4.2 Fuel filters and screens, fuel gauges, fuel pumps and its types, air cleaners
  - 4.3 Fundamentals of carburetor, carburetion, atomization, evaporation carburetor circuits and its types Multipoint fuel injection system (Construction and working M.P.F.I.)
  - 4.4 Super charger, turbo charger and exhaust system.
- 5. Diesel engine fuel supply system**
  - 5.1 Diesel engine fuel supply system and its components
  - 5.2 H.S.D. fuel system and its properties.
  - 5.3 FIP for single cylinder and multi cylinder engine.
  - 5.4 Testing of atomizer and F.I. pump.
  - 5.5 Direct injection (D.I.) System. Merits and demerits of D.I. System.
- 6. The Electric System**
  - 6.1 Battery - Lead acid and dry charged battery and its types.
  - 6.2 Battery Maintenance / servicing-check electrolyte level, specific gravity terminal voltage.
  - 6.3 Purpose of battery, testing and charging procedure.
  - 6.4 Cranking motor, function of cranking motors, basic motor, principles, motor construction, drive arrangement, inertia drive, overrunning clutch, cranking motor controls.
- 7. The Charging Circuits**
  - 7.1 Function of generator, generator principles, construction, working.
  - 7.2 Alternator (AC generator), AC Generator principles, construction, working.
  - DC generator AC Generator. regulation.
  - 7.3 Cut out relay, ammeter, rectifier.
- 8. Advanced features in modern car**
  - 8.1 Air conditioning cycle, construction and working of simple air conditioning system used in Automobile, component of AC system.
  - 8.2 Power windows, central locking system, steering lock.
  - 8.3 Wind screen wiper, wind screen washer, Heating system.
  - 8.4 Computerize engine analysis.

## **PRACTICAL - II - Otto and Diesel Cycle**

### **PART A**

1. Dismantle 4-stroke single cylinder air cooled petrol engine from two-wheeler dismantle the engine, observe each part and refit it. (Hero Honda/4 S/Suzuki/ any Two wheeler vehicle.)
2. Dismantle 4-stroke multi cylinder water cooled petrol engine, observe constructional features of each part and refit it. (Fiat, Ambassador, Maruti etc.)
3. Dismantle 4-stroke multi cylinder water cooled diesel engine, observe constructional features of each part and refit it. (Ambassador, Mahindra, Sumo or Maruti etc.)
4. Dismantle 2 stroke petrol engine, observe constructional features of each part and refit it.
5. To dismantle scooter/ motorcycle handle bar assembly, clean, prepare an inspection report on the condition of parts, lubricate and reassemble.
6. Dismantle ignition system of Hero Honda/Suzuki/ any two wheeler, make your to familiar about each part, observe its constructional features and refit it.
7. To dismount, dismantle and to study the construction and working of water pump. To clean, inspect, repair, assemble and refit.
8. To study the constructional features of different types of radiators used in Indian automobiles. Flush the radiator and check for leakage.
9. To study the working of the pressurized water cooling system used in Maruti cars.
10. To study and draw the layout of the lubrication system of a multi-cylinder engine particularly tracing the path of lubricating oil flow.
11. To study the construction and working of a lubricating oil pump by dismounting, dismantling, assembling and refitting.
12. To service silencer - Dismantle from vehicle, clean and decarbonizes, refit on the vehicle.
13. To dismantle and reassemble scooter and motor cycle engine - use special tools, inspect and prepare a report on the condition of parts, replace defective parts and start the engine after reassembly.
14. To dismantle control cables and replace with new ones, brake cable, Accelerator cable and clutch cable of two-wheeler.
15. To service telescopic front fork assembly drain front suspension oil, dismantle with the help of special tools, inspect and prepare report on condition of parts reassemble and fill recommended quantity oil.
16. To service valve and valve mechanism dismantle cylinder head, clean, prepare inspection report and reassemble with the help of special tools adjust the tappet clearance.
17. i) One visit to two-wheeler manufacturing Industry.  
ii) Four visits to different modern garages and service centers.

### **PART B**

1. Dismantle Mechanical fuel pump, inspect all parts, and report on condition of each part suggest remedies and rectify it, refit the pump in proper sequence.
2. Tune up carburetor of Hero Honda/Suzuki/ any 4-stroke two-wheeler.
3. To tune up carburetor of Maruti/Fiat/Ambassador, any four wheeler petrol engine.
4. Study in detail M.P.F.I. (Multi Point Fuel Injection) used in modern Maruti range of vehicles. Discuss the advantages and disadvantages of it.
5. To draw and study ignition circuit of Maruti/Fiat/Ambassador/any 4 - w h e e l e r. Dismantle ignition circuit report on condition on each part, repair and refit it.
6. To conduct major tune up of Maruti/Fiat/any car.
7. Dismount feed pump from fuel injection pump dismental, clean, inspect, report on condition of parts and remedial measures, repair, reassemble and refit on injection pump.
8. Dismount fuel injection pump assembly from engine of Sumo/Ambassador/Any diesel car dismental parts, clean, inspect and report on condition on parts, rectify defect, reassemble, test and refit.
9. Dismount injector assembly from a diesel engine of four-wheeler, dismental, clean, inspect, report on condition of component rectify defect reassemble test and adjust and refit on engine.
10. Test given battery for its condition with high rate battery cell tester, hydrometer for specific gravity.
11. Dismantle cranking motor, inspect all the parts report on condition, suggest remedies repairs and refit it.

12. Dismantle alternator, inspect all parts, repair and refit it, differentiate between alternator and dynamo.
13. Study, sketch and dismantle electrical circuit diagram of two-wheeler.
14. Study, sketch and dismantle electrical circuit diagram of four-wheeler.
15. Dismantle multi cylinder diesel engine of four-wheeler clean component, inspect report on condition of parts, suggest remedies, rectify, refit engine and start.
16. Study Air conditioning system of car.
17. Dismantle a used battery to know the internal construction of battery plate groups, battery separators.
18. Conduct phasing and calibration of a 4/6 cylinder fuel injection pump, refit on vehicle, bleed the system and run the engine.
19. Conduct visit fuel injection pump testing unit.
20. Collect information about new technology in automobile such as  
16-valve engine in Maruti car or any similar car  
b) Catalytic converter c) Gas kit
21. 2- visits to two-wheeler modern garage. 2- visits to four-wheeler modern garage  
Equipped with computerized engine analyzer and wheel alignment.

## **THEORY – III - Transmission system and Garage Management**

### **PART A**

#### **Section - A : Basic Engineering Drawing**

##### **1. Introduction**

- 1.1 Introduction
- 1.2 Layout of drawing sheet
- 1.3 Description of drawing instruments and their correct method of use.

##### **2. Planning and layout of drawing**

- 2.1 Planning and layout of drawing
- 2.2 Standard size of drawing sheet and their planning as per IS -696 -1972.

##### **3. Lines, Lettering, Dimensioning**

- 3.1 Lines, Lettering, Dimensions and symbols
- 3.2 Different types of lines and their uses
- 3.3 Practice of writing single stroke, capital and lower capital letters.

##### **4. Pictorial view and orthographic projections**

- 4.1 Pictorial view and orthographic projections. First and third angle methods of projection, concept of plan, elevation
- 4.2 Preparation of orthographic projections from the isometric drawings.
- 4.3 Projection of point, line, plane and solid by first and third angle.

##### **5. Orthographic Projections of Auto parts**

- 5.1 Orthographic Projections of Automobile parts and their assemblies like Piston, Connecting rod, crank shaft, camshaft, valves, Rocker arm, universal joint, spark plug, injectors, master cylinder, Air cleaner and wheel cylinder etc.

##### **6. Screw Threads**

- 6.1 Nomenclature of screw threads, definitions and meaning of various elements of a thread pitch, depth of thread, lead, right hand and left hand thread, major and minor diameter etc.
- 6.2 Various threads sections like B.S.W. Buttress, ACME, Metric, Knuckle, square, plane washer, star washer etc.

##### **7. Fasteners**

- 7.1 Study of nut-bolts, like hexagonal, square and round headed bolts, studs, nuts, set screws, and foundation bolts.
- 7.2 Locking devices like lock nut, split pin, castle nut, keys and engine foundation bolts, rivets, riveted joint.

##### **8. Pictorial Drawing**

- 8.1 Isometric drawing and isometric projection procedure for drawing.
- 8.2 Drawing symbols used in Auto electrical systems.

##### **9. Introduction to computer Aided drafting (Auto cad)**

- 9.1 Create, open, save, print a drawing file in CAD software.
- 9.2 Drawing various entities like line, circle, rectangle, ellipse, arc etc in drawing file.
- 9.3 Editing existing drawing file.



## **Section - B : Vehicle Rules**

### **1. Categories of vehicle**

1.1 Various automotive vehicles Light Motor vehicle, Medium Motor vehicle, Heavy Motor vehicle, Stage carriage, Public carrier, Private carrier, Invalid carrier etc.

### **2. Motor vehicle rules**

2.1 Motor vehicle rules related to - Number plate of vehicle, Location of light and marking. Minimum space required for passenger, gang way, floor to ceiling front and rear overhang. Safety aspect in terms of condition of tyre, brake, steering system. Prescribed forms for driving license, registration, permit, fitness certificate. Rules related to driving habits, offence and penalties regarding driving of vehicle.

2.2 Description of about safety precautions such as air bags, seat belt, collapsible steering etc.

### **3. Road signs and Safe driving**

3.1 Traffic sign found installed on the road.

3.2 Signaling by driver and what it communicates to other road users.

### **4. Environment pollution**

4.1 Pollution control norms (Euro norms).Necessity of Euro norms. Unleaded petrol, speed petrol, CNG. Introduction of new Auto world operated on Battery.

4.2 Fuel saving tips.

4.3 Role of every person and automobile industry to control pollution.

### **5. Insurance**

5.1 Insurance purpose and provision.

5.2 Types of insurance, third party insurance and comprehensive insurance.

### **6. Road transport**

6.1 Transportation role of transportation in industrial growth, growth of transportation, modes of transport.

6.2 Rules regarding transport vehicle carrying hazardous gases, chemical flammable gases.

## **PART B**

### **1. Vehicle Maintenance**

1.1 Study of different vehicle maintenances such as operative, periodic and brake down

1.2 General Service procedure for two-wheeler and four-wheeler, Study of faults.

### **2. Engine Faults**

2.1 Engine does not turn over

2.2 Engine does not start

2.3 Engine runs but misfires

2.4 Engine lacks power

2.5 Engine overheats

2.6 Engine is noisy

2.7 Engine stalls and back fires.

### **3. Fuel system**

3.1 Excessive fuel consumption

3.2 Smoky Exhaust

3.3 Poor acceleration and lack of power

3.4 Stalling of engine.

### **4. Lubrication system**

4.1 Excessive Oil consumption

4.2 Low Oil Pressure

4.3 Excessive oil pressure.

### **5. Cooling system**

5.1 Engine Overheat

5.2 Engine warm up slowly

5.3 Cooling system leaks.

### **6. Electrical system**

6.1 Cranking motor

6.2 Generator / Alternator

6.3 Ignition system.

### **7. Chassis**

#### **7.1 Clutch Faults**

1. Clutch slip while engaging

2. Clutch grabs or chatters

3. Clutch spins or drags

4. Clutch noisy

5. Clutch pedal pulsation

## **7.2 Gear box Troubles**

1. Transmission noisy
2. Hard gear shifting
3. Slip in gears.
4. Chattering & grabbing of gears.

## **7.3 Differential Troubles**

1. Continuous noise in the differential
2. Knocking in differential unit
3. Growling while rounding a curve

## **7.4 Suspension system**

1. Spring noises
2. Hard and rough ride
3. Vehicle sway
4. Sagging of spring
5. Steering difficulties
6. Distortions in frame and body.

## **8. Steering and front suspension system**

- 8.1 Hard steering
- 8.2 Car wandering
- 8.3 Car pulling to one side
- 8.4 Front wheel shimmy
- 8.5 Wheel tramp
- 8.6 Excessive play in steering system.

## **9. Brake**

- 9.1 Hard Brake
- 9.2 Brake pedal goes to floor
- 9.3 Spongy brakes
- 9.4 Noisy brake.

## **10. Wheels**

- 10.1 Tyre wear types
- 10.2 Tyre cracks
- 10.3 Improper tyre contact to floor.

## **11. Engine reconditioning process**

- 11.1 Cylinder boring
- 11.2 Crankshaft grinding
- 11.3 Valve grinding, valve lapping, Head facing valve seat fitting
- 11.4 Cylinder blocks line boring.

## **12. Air Conditioning system**

- 12.1 A.C.System not working
- 12.2 Low cooling
- 12.3 A.C. gas leaks.

## **13. Human relation and psychology**

- 13.1 Factor improving human relation
- 13.2 Individual traits / differences
- 13.3 Group working.

## **14. Factor governing motivation and moral**

- 14.1 Motivation by (a) Threat (b) Bargaining (c) Reward
- 14.2 Morals by leadership qualities.

## **15. Types of leadership**

- 15.1 Auto creative
- 15.2 Demo creative
- 15.3 Free rein.

## **16. Store keeping**

- 16.1 Duties of store keeper.
- 16.2 Method of store keeping.

## **17. Salesmanship**

- 17.1 Duties of salesmen
- 17.2 Personal qualities of salesman
- 17.3 Advertising and publicity.

## **18. Book keeping**

- 18.1 Registers to be maintained
- 18.2 Methods of accounting transactions
- 18.3 Profit and loss accounts.

## **19. Shop act provisions**

- 19.1 Shop act - Trade act, 1948.

## **20. Garage layout**

20.1 Draw different layout, Systematic provision of all shops, Modern garages.

## **21. Opportunities in automobile sector**

21.1 Give information. Discuss wage and self employment opportunities in Automobile sector.

The Automobile Service business

1. The Automotive Industry
2. Opportunities in the Automotive Service Business
3. Service Station
4. Automotive Dealers
5. Independent Garages
6. Specialty shops
7. Fleet garages
8. Parts Dealer
9. Department, Accessory and Automotive supply store.

## **PRACTICAL - III - Transmission system and Garage Management**

### **PART A**

#### **Section - A : Basic Engineering Drawing**

1. Drawing the layout of sheet and learn the use of instrument.
2. Drawing of lines, lettering and dimensioning
3. Drawing of orthographic projection of plane figures
4. Drawing of orthographic projection of lines and pictorial views.
5. Sectional view of different screw thread with nomenclature
6. Drawing of different types of bolts, nuts, washers, used in automobile vehicle
7. Drawing of stud screw and set screw.
8. Drawing of keys in position (square, woodruff and tangential key)
9. Isometric view of simple objects and auto parts
10. Orthographic projection on computer aided graphic package, Create, open, save, print a drawing file in CAD software, Drawing various entities like line, circle, rectangle, ellipse, arc etc. in drawing file Editing existing drawing file.

#### **Section - B : Vehicle Rules**

11. Study of Motor Vehicle Act, 1988
12. Study different forms prescribed by regional transport authority for obtaining -
  - a) Driving license
  - b) Fitness Certificate
  - c) Permit
13. Study and draw neat sketches of different road signals and sign
14. Study of safety devices used in Automobile cars and rules related it
15. Study and draw neat sketches of driver signals
16. Visit to R.T.O. (Regional Transport Office)
17. Visit to PUC centre.

### **PART B**

1. Service a four-wheeler vehicle with washing, greasing, oil changing etc.
2. Test a four cylinder engine compression and vacuum, to check it with the specification and draw your conclusions.
3. Adjust the gap of C.B. point, spark plug and adjust the ignition using timing light.
4. Service dynamo, check armature on growler check brushes and springs.
5. Service alternator.
6. Carry out brake servicing-oil top up, brake bleeding etc.
7. Check head light, parking light, indicators and replace bulbs if fused, set head light beams.
8. Inflate tyres with specified pressure and tighten all wheel nuts.
9. Carry out road test and check exhaust for emission of carbon monoxide.
10. Check the camber and caster angle on camber tester and inclination gauge.
11. Test toe-in on toe in inclination gauge and correct it as per specification.
12. Study and prepare a simple profit and loss statement.
13. Prepare costing and estimate statement for repair job.
14. Visit to garage for spot survey of accidental vehicle and prepare project on insurance procedure.
15. Fill up various store registers and cards.
16. Road test and driving practice.
17. Fuel consumption test trial - First complete engine tune up of Motor cycle/Scooter (4 stroke) adjust all cable plays, check tyre pressure and then conduct fuel consumption test trial.

### Reference Books

1. Each manufacturer bring out booklets titled as 'Owner's manual' brochures on maintenance etc.
2. Manufacturers, printed workshop manuals, wall charts etc. approach can be made to acquire them progressively
3. a) Tata-McGraw Hill, New Delhi b) Taraporewala and Sons, Bombay - Automobile Engineering
4. M/s Khanna Publishers, New Delhi -Automobile Engineering
5. The Motor cycle - L.Herman, Asia Publishing House
6. Moped Repair Hand book - Paul Dempsey, TAS BKS Blue Ridge Summit P.A.
7. Motor cycle overhauls - W.C.Hay, Craft Pitmans
8. Motor cycle mechanics - George Leer and L.S.Moshev Prentice Hall, New Jersey
9. Introduction to Auto Mechanics Gibbs and Meyer Pub-Canfield Press, Santrancisco
10. Automotive mechanics - S.Srinivasan, Pub. Tata McGraw Hill
11. Auto Engg.R.B.Gupta, Surya Prakashan, 16/7698, New Market, New Rohtak Road, New Delhi-5
12. Automotive Engineers - H.E.Ellinger, D.B.Taraporewala and Sons, Bombay
13. Car Repairs and Maintenance - A.W.Judge, Pitman Publishing House
14. Automobiles Electrical Maintenance - A.W.Judge, Pitman Publishing House
15. Auto Brakes and Brake Testing - M.Platt
16. Work book for Automotive Service Trouble shooting William H.House
17. Motor in safety- Learn safe Driving - A Gannet Publication
18. Auto Steering Braking Suspension, Stain Abbey
19. Automotive Machines - William and Crows

### VOCATIONAL SUBJECTS 140 VOLUME – I

20. Automobile Engineering - G.B.S.Narang
21. Automobile Engineering - Jospeth Hitler
22. Automobile Engineering - Mathur
23. Automobile Engineering - Kripal Singh
24. Automobile Engineering - Khanna

### List of Tools and Equipments

1. Double ended spanner (Merit size) 8 to 32 mm
2. Double ended spanner (RSF size) 9 to 25 mm
3. Double ended spanner 8 to 32 mm
4. Adjustable spanner 20 cm
5. Spark plug spanner 14 mm
6. Spanner socket set of 8
7. Spanner T flex for screwing up and unscrewing in 1 inaccessible position
8. Allen key set metric
9. Allen key set inch size
10. Circlip pliers
11. Combination pliers
12. Pipe wrench
13. Nose pliers (Straight and Round)
14. Screw drivers of 6 different sizes
15. Torque wrench 0 to 67.5 kg.m.
16. Valve spring lifter
17. Valve seat cutting tools complete with guides and pilot bar (all angles)
18. Stud extractor
19. Compression gauge
20. Vacuum gauge
21. Piston ring expander and remover
22. Cylinder bore gauge capacity 6.25 to 15 cm.
23. Pressure grease gun
24. Feeler gauge lengthier type
25. Bearing puller (different sizes)
26. Wheel alignment gauge
27. Tube vulcanized
28. Connecting rod aligner
29. Mechanical jack
30. Hydraulic jack
31. Car washing machine
32. Model of four-stroke petrol engine
33. Model of four-stroke diesel engine
34. Model of two-stroke petrol engine
35. Sectionalized petrol engine

36. Sectionalized Diesel engine
37. Sectionalized gear box
38. Sectionalized differential assembly
39. Model of Ignition system
40. Model of brake assembly with master cylinder
41. Old unserviceable engine 4-stroke petrol engine
42. Old unserviceable engine 4-stroke diesel engine
43. Old unserviceable engine 2-stroke petrol engine
44. Old unserviceable carburetor of-  
i) Hero Honda ii) Honda activa iii) Kinetic Honda iv) Scooter v) Maruti Car vi) Fiat
45. Old unserviceable fuel injection pump
46. Old unserviceable nozzles
47. Old unserviceable front axle
48. Old unserviceable rear axle
49. Special punch for fitting bearing
50. Special punch for fitting oil seals
51. Oil can plugged type
52. Value Die
53. Unserviceable bearing roller
54. Timing light
55. Mileage checking gauge
56. Electronic unit and H.T. Coil checking mc
57. Blow stove (for soldering)
58. Wheel spanner cross type
59. Pneumatic gun 2
60. Spring balance - 50 kg

**Vehicles:**

1. Old unserviceable scooter shaft drive (two-stroke)
2. Old unserviceable motor cycle (four-stroke)
3. Old jeep Diesel -
4. Old Car Petrol -

**Safety equipments:**

1. Goggles for grinder
2. Goggles for welding
3. Welding glass shield
4. Apron
5. Hand gloves
6. Fire extinguisher (foam type)
7. Fire extinguisher
8. First aid box
9. Stretcher
10. Sand bucket
11. Pad locks
12. Metal Racks
13. Barrier cream

**List of Equipments**

***Tools For Instructor For Training***

1. Hammer Ball peen 0.75 kg. 01
2. Hammer cross peen 0.75 kg. 01
3. Hammer Ball peen 2.00 kg. 01
4. Chisel cold flat 19 mm 01
5. Chisel cold cross out 9 x 3 mm 01
6. Chisel half round 9 mm 01
7. Hammer plastic 50 gm. 01
8. Hammer copper 1 kg.
9. Hacksaw frame adjustable for 20.30 cm blades
10. Centre punch
11. Steel rule 15 cm English and Metric
12. Steel rule 100 cm English and Metric
13. Hand Brace 1/4"
14. Bench vice 5"
15. Vice jaw damp
16. File flat 18" rough, 2nd cut smooth
17. File half round 10" rough 2nd cut
18. File triangular 10" 2nd cut smooth
19. File round 10" 2nd cut smooth

20. Scrapper flat
21. Scrapper half round
22. File brush
23. Tool box
24. G.I.Tray (different sizes)
25. Oil can
26. Wall charts for various parts, system of the engine
27. Pipe vice (small)
28. Anvil
29. Small Furnaces
30. Sledge hammers
31. Scriber
32. Letter punch
33. Number punch

***Machines and equipments***

1. Bench drilling machine medium size
2. Centre Lathe 6 feet / 1.5 meter
3. Pedestal grinder 1 HP motor wheel 10 inches
4. Arc welding set
5. Gas welding set
6. Wire Brush
7. Chipping hammers
8. Blow Lamp
9. Cleaning brush
10. Compressor

***Tools For Instructor For Training***

11. Painting brush
12. Spray painting gun
13. Battery charger unit
14. Tube vulcanizing machine
15. Floor brush
16. Taps and dies complete set in box
17. Twist drill metric 3mm x12mm x1mm-2 sets
18. B,BSW,BSF Metric and American
19. Hand Reamer or parallel shank 7.5 to 12mm by 1.5mm
20. Hand reamer taper pin 7.5 to 12 by 1.5mm
21. HSS Hand reamer taper pin 7.5 to 12mm by 1.5 mm
22. Exhaust gas analyzer
23. Nozzle tester
24. Computer -
25. 6 v, 12 v. D.C. Battery (lead acid / dry battery)
26. Micrometer - Inside / Outside
27. Arbor press
28. Special purpose tools as per manufacturer of two wheeler and four wheeler.
29. Printer 01 No.

***Measuring Instruments and Inspection Equipments:***

1. Outside caliper 6" 150 mm
2. Inside caliper 6" 150 mm

***Tools For Instructor For Training***

3. Vernier caliper 150 mm
4. Depth gauge
5. Dial Indicator range 5 mm
6. Try square 100
7. Straight edge 500 mm
8. Steel tape 5 meter
9. Pair of V Blocks
10. Special gauge for crown wheel and pinion adjustment
11. Surface gauge
12. Magnifying glass
13. Steel cupboard
14. Tyre pressure gauge
15. Screw pitch gauge
16. Tachometer
17. Multimeter
18. Angle plate
19. Surface plate

### ***Electrical Items***

1. Heater
2. Soldering iron
3. Inspection Lamp

### ***Tools For Instructor For Training***

4. Electrical wire 50 mtr
5. Insulation Tape
6. Growler
7. Soldering flux
8. Voltmeter - DC - 25 volt
9. Ammeter
10. Hydrometer
11. High rate battery cell tester
12. Coil and condenser tester
13. Spark plug cleaning and testing machine
14. Electrical Accessories:
  - i) Electrical horn
  - ii) Horn relay
  - iii) Electric bulbs different types
  - iv) 12 v Head light side beam
  - v) Electrical wiper unit
  - vi) Electrical 12 v flasher
  - vii) Electrical fuel pump
15. Dual Angle Tachometer

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