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AUTO MECHANICS

SCHEME OF EXAMINATION

There will be three papers, Papers 1, 2 and 3 all of which must be taken. Papers 1 and 2 shall be a composite paper to be taken at one sitting.

PAPER 1: will consist of forty multiple-choice objective questions all of which are to be answered in 1 hour for 40 marks.

PAPER 2: will consist of five essay questions. Candidates will be required to answer any four questions in 1½ hours for 60 marks.

PAPER 3: will consist of two practical tests both of which must be carried out by candidates in 2 hours for 100 marks.
For the practical test, schools will supply materials needed locally.

EXAMINATION SYLLABUS

S/NO.	TOPIC	THEORY	PRACTICAL
1	WORKSHOP REGULATIONS AND SAFETY	1.1 Instructions in basic safety rules relating to personnel, tools, equipment and environment. 1.2 Types of fire extinguishers. Foam, dry powder, sand, water and wet-blanket types	1.1.1 Identification and safety devices e.g. goggles, shield, 1.2.1 Demonstration/ use of extinguishers.
2	BASIC TOOLS, INSTRUMENTS AND EQUIPMENT	2.1 Use of basic tools e.g. hand tools and power tools. 2.2 Use of measuring instruments 2.3 Use of basic equipment e.g. jacks, hoist, air-compressors, etc.	2.1.1. Identification of tools. 2.2.1 Identification of measuring instruments 2.3.1 Identification of basic equipment
3	LAYOUT OF A MOTOR VEHICLE	3.1 Layout of a conventional motor vehicle. 3.2. Functions of the main components. 3.3 Drive arrangements: Front engine rear wheel drive, rear engine rear wheel drive, front engine front wheel drive, four-	3.1.1 Inspection of the layout of a motor vehicle. 3.2.1 Identification of main components 3.3.1 Inspection of the drive arrangements.

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		wheel drive.	
4	<p>ENGINE</p> <p>(a) Main Components</p> <p>(b) Principles of operation.</p> <p>(c) Types of engine</p> <p>(d) Crank arrangement and firing order.</p> <p>(e) Valve-operating mechanism</p>	<p>4.1 Classification of engine (petrol and diesel engine) and their main parts.</p> <p>4.2 Arrangement and functions of the main components: Cylinder head and cover; cylinder block, connecting rod, piston and rings, spark plug (petrol) fuel injection pump and injector (diesel), valve, valve springs, oil seal, camshaft/arms.</p> <p>4.3 Two stroke and four stroke cycle petrol and diesel engine.</p> <p>4.4 Advantages and disadvantages of petrol and diesel engines.</p> <p>4.5 Single and multi-cylinder engines.</p> <p>4.6 Crank arrangement and cylinder in-line engines. firing orders: 2, 4 and 6 V-4,V-6 and 4-cylinder horizontally-opposed engines.</p> <p>4.7 Functions and operation of valve operating mechanisms. Drives layout, main components, 4-cylinder 12 – and 16 - valve engine. Valve timing including calculation of valve opening and closing periods.</p>	<p>4.2.1 Identification of components.</p> <p>4.2.2 Decarbonization</p> <p>4.3.1 Identification of and four stroke</p> <p>4.5.1 Inspection and engines accordi</p> <p>4.5.2 Compression te</p> <p>4.5.3 Measurement of crank-journals</p> <p>4.6.1 Determination of firing order thro</p> <p>opening.</p> <p>4.6.2 Fault diagnosis</p> <p>4.7.1 Identification of components.</p> <p>4.7.2 Valve adjustme</p> <p>4.7.3 Fault diagnosis</p>
5	FUEL SUPPLY SYSTEMS	5.1 Fuels and combustion: elements of combustion; air-fuel ratios; types and	5.1.1 Checking fuel system troubles.

		<p>properties of fuel-petrol and diesel.</p> <p>5.2 Petrol: Layout and operation of petrol supply system-gravity and force-feed systems: simple carburetor, multi-jet carburetor. Air filters/cleaners. Mechanical and electrical fuel pumps. Advantages and disadvantages.</p> <p>5.3 Petrol-injection system: Merits and demerits. Electronic Fuel (Petrol) injection (EFI).</p> <p>5.4 Diesel: Layout of a diesel supply system: elementary treatment of injection pumps and injectors. Cold starting devices.</p>	<p>5.1.2 Inspection of ex normal air-fuel worn engine.</p> <p>5.2.1 Inspection layo supply system: dismantling, reassembling of pump.</p> <p>5.2.2 Fault diagnosis.</p> <p>5.2.3 Dismantling, in reassembling of a 5:3:1 Identify the ma</p> <p>5.4.1 Inspection of v injection pump injectors and bl</p>
6	EXHAUST SYSTEM	61 Purpose and layout of the system. Types of silencers and manifolds.	<p>6.1.1 Inspection of ex identification of inlet manifolds.</p> <p>6.1.2 Checking the sy leakage.</p>
7	LUBRICATION	<p>7.1 Engine Lubrication: Reasons for lubrication and types: boundary layer and film lubrication. Lubricated parts and components.</p> <p>7.2 Types of feed-splash, forced and petrol. (Wet and dry). Principle of operation of gear and rotor oil pumps. Oil filters.</p> <p>7.3 Lubricants: Applications in engines, transmission, steering, suspension system and doors: Viscosity rating, SAE numbers.</p>	<p>7.1.1 Identification of components.</p> <p>7.2.1 Changing of oil</p> <p>7.2.2. Servicing and t</p> <p>7.2.3 Fault diagnosis</p> <p>7.3.1. Identification of lubricants. Com used oil. Use o oil can.</p>
8	COOLING SYSTEM	8.1 Process of heat transfer.	

		<p>8.2 Water Cooling System: Purpose and layout of main components. Thermo-syphon and pump assisted systems. Elementary treatment of pressurized cooling system.</p> <p>Thermostats: Purpose and types. (bellows and wax pellet).</p> <p>8.3 Air Cooling System: Layout and functions of the system: main components. Comparison of the air and water cooled systems.</p>	<p>8.2.1 Identification of components, inspection of its construction fan belt and hoses.</p> <p>8.2.2 Flushing.</p> <p>8.2.3 Fault diagnosis.</p> <p>8.3.1 Fault diagnosis.</p>
10	<p>TRANSMISSION SYSTEM</p> <p>(a) Layout</p> <p>(b) Clutch Assembly</p> <p>(c) Gearbox</p>	<p>9.1 Function and layout of the transmission system. Types-manual and twin axles and double reduction axles) merits and demerits.</p> <p>9.2 Functions of a clutch. Types and operating principles of single plate and multiplate. Methods of actuation-hydraulic and mechanical. Simple calculations.</p> <p>9.3 Introduction to automatic transmission. Functions of torque converter and fluid flywheel.</p> <p>9.4 Types, layout and operating principles of sliding-mesh, constant mesh and synchromesh gearboxes; main components and their functions. Gear selector mechanism; simple calculations of gear ratios.</p> <p>9.5 Functions and types of the propeller shaft, universal joint and sliding joint.</p> <p>9.6 Purpose of rear axle. Arrangement and functions of main components: final drive, differential unit, half - shaft, oil seal and hub bearings.</p> <p>9.7 Methods of supporting axle shafts. Advantages</p>	<p>9.1.1 Identification of layout.</p> <p>9.2.1 Dismantling, identifying parts, assembling a clutch. Adjusting clutch clearance and bleeding clutch.</p> <p>9.2.2 Fault diagnosis.</p> <p>9.4.1 Identification of gearbox.</p> <p>9.4.2 Inspection of gear.</p> <p>9.4.3 Fault diagnosis.</p>

	(d) Propeller shaft and universal joint. (e) Rear Axle	and disadvantages	9.5.1 Examination of t shaft and unive for bow and we 9.6.1 Identification of components. 9.6.2 Fault diagnosis. 9.7.1 Identifying main
10	WHEELS AND TYRES	10.1 Types of wheel rims: pressed steel, disc and wire spoke wheels. Hub attachments. Wheel balancing. Tyre sizes and markings. 10.2 Tyres: tubed and tubeless types: Advantages and disadvantages. 10.3 Wheel balancing, tyre sizes, markings.	10.1.1 Checking and wheel bearing c removal and ch wheels. 10.2.1 Tyre fitting and pressure. 10.2.2 Tube and tyre 10.3.1 Wheel balancing
11	BRAKING SYSTEM	11.1 Layout, functions and operation of braking system, drum and disc, mechanical and hydraulic. Brake lining materials and methods of attachment. Importance of servo- assisted brake. Advantages and disadvantage of disc and drum brakes. 11.2 Brake fault.	11.1.1 Inspection of d brakes. Replac and shoes, ble adjustment. "S" 11.2.1 Fault diagnosis

12	STEERING SYSTEM	<p>12.1 General layout and functions of the front axle and steering systems.</p> <p>12.2 Steering geometry. Ackerman linkage, castor, camber, king pin inclination, toe-in and toe-out. Types of steering gearboxes-rack and pinion, recalculating balls only.</p> <p>12.3 Steering faults</p>	<p>12.1.1 Identification of components of</p> <p>12.2.1 Front wheel alignment inspection of tyre patterns.</p> <p>12.3.1 Fault diagnosis</p>
13	SUSPENSION SYSTEM	<p>13.1 Purpose of the suspension system, layout and types, rigid beam and independent.</p> <p>Suspension (semi-elliptic and coil springs); advantages and disadvantages, dampers (shock absorbers.)</p>	<p>13.1.1 Identification between the rigid and independent</p> <p>13.1.2 Fault diagnosis</p>
14	<p>ELECTRICAL SYSTEMS</p> <p>(a) Fundamentals</p> <p>(b) Auto Wiring system</p> <p>(c) Battery</p> <p>(d) Ignition System</p>	<p>14.1 Basic electrical terms and symbols. A.C and D.C sources, simple circuits, Ohm's law and calculations involving series and parallel circuits. Basic components and their functions-relays, resistors, lamps, fuses and switches.</p> <p>14.2 Wire gauges, colour coding – reasons for their use. Wiring system – earth and insulated returns: ways of joining cables-jointing, terminals, connectors and soldering.</p> <p>14.3 Purpose, construction and testing of lead-acid battery. Electrolyte composition. Battery care and maintenance.</p> <p>14.4 Layout of the coil ignition system. Function and operation of the main components. Introduction to computerized ignition system.</p> <p>14.5 Layout and functions of the main components. Types of starter motor.</p> <p>14.6 Purpose and layout (dynamo and alternator). Main components and their operation. Comparison of d.c and a.c generators.</p> <p>14.7 Layout of the system main components and their functions. Fuses and bulbs-types and ratings.</p>	<p>14.1.1 Setting up simple circuits, use of measuring</p> <p>14.2.1 Inspection and of various components soldering and cables.</p> <p>14.3.1 Examination of lead-acid battery electrolyte.</p> <p>14.4.1 Identification of components; i setting of con and spark plu</p>

	<p>(e) Starting System</p> <p>(f) Charging System</p> <p>(g) Lighting System</p> <p>(h) Auxiliary Unit</p>	<p>14.8 Layout and operations of the auxiliary units. Instrument panel, horn, windscreen wiper.</p> <p>14.9 Electrical faults.</p>	<p>14.5.1 Inspection and identification of main components.</p> <p>14.6.1 Identification of component parts.</p> <p>14.7.1 Identification of components, replacement of fuses.</p> <p>14.7.2 Head lamp focus.</p> <p>14.8.1 Inspection and identification of components.</p> <p>14.9.1. Fault diagnosis.</p>
15	<p>ELECTRONICS</p> <p>(a) Fundamentals of Electronics.</p> <p>(b) Electronic Ignition</p>	<p>15.1 Explanation of the term Auto Electronics. Identification of electronic components: diodes, transistors, resistors, capacitors, LED, transducers, coil and motors. Functions of components. Symbols in a circuit.</p> <p>15.2 Operation of transistorized ignition system. Types of transistorized and electronic ignition system: Inductive and hall effect. Merits and demerits.</p> <p>15.3 Purpose and type of systems (single-point and multi-point injections).</p>	<p>15.1 Identification of components.</p>

	(c) Electronic Fuel Injection		15.3.1 Identification of components in s point and multi-
16	AUTO AIR-CONDITIONING	16.1 Purpose, layout and identification of major components (compressor, condenser, evaporator and dryer). Principles of operation.	16.1.1 Inspection an of air- condition and the comp
17	SAFE MOTORING	17.1 Main causes of safe driving and code and safety accident, essentials of application of highway devices.	17.1.1 Identification defective com cause accident Identification interpretation

RECOMMENDED READING LIST

1. Technology for Motor Mechanics Volumes 1 – 4 by S. C. Mudd (Edward Arnold Publishers).
2. Vehicle and Engine Technology by Heinz Heister
3. Motor Vehicle Technology and Practical Work by J. A. Dolan
4. Fundamentals of Motor Vehicle Technology by Hillier and Pittuck (4th Edition)
5. Automobile Engine and Vehicle Technology by Ian Chisholm
6. Motor Vehicle Technology (Books I and II) by R. W. Bent
7. Motor Vehicle Mechanic's Textbook by E. K. Sulley (New Edition)
8. Highway Code
9. Motor Vehicle Technology for Mechanics by P. P. J Read and V. C. Reid.

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