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.	1.1.1 Identification and use of various safety devices e.g. aprons, goggles, shield, etc.
		1.2 Types of fire extinguishers. Foam, dry powder, sand, water and wet-blanket types	1.2.1 Demonstration/use of fire extinguishers.
2	BASIC TOOLS, INSTRTUMENTS AND EQUIPMENT	2.1 Use of basic tools e.g. hand tools and power tools.2.2 Use of measuring instruments	2.1.1. Identification and use of basic tools.2.2.1 Identification and use of measuring instruments.
		2.3 Use of basic equipment e.g. jacks, hoist, air compressors, etc.	2.3.1 Identification and use of basic equipment.

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3	LAYOUT OF A MOTOR VEHICLE	3.1 Layout of a conventional motor vehicle.	3.1.1 Inspection of the layout of a motor vehicle.
		3.2. Functions of the main components.	3.2.1 Identification of the main components.
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		3.3 Drive arrangements: Front engine rear wheel drive, rear engine rear wheel drive, front engine front wheel drive, four wheel drive.	3.3.1 Inspection of the drive arrangements.

4	ENGINE (a) Main Components	4.1 Classification of engine (petrol and diesel engine) and their main parts.	4.2.1 Identification of main components.
		4.2 Arrangement and functions of the main components: Cylinder head and cover; cylinder block, crankshaft, flywheel, connecting rod, piston and rings, spark plug (petrol) fuel injection pump and injector (diesel), valve, valve springs, oil seal, cam shaft, push rod, rocker shaft/arms.	4.2.2 Decarbonization of cylinder head.
	(b) Principles of operation.(c) Types of engine	4.3 Two stroke and four stroke cycle petrol and diesel engine.4.4 Advantages and disadvantages of petrol and diesel engines.	4.3.1 Identification of two and four stroke engines.
	(d) Crank arrangement and firing order.	4.5 Single and multicylinder engines.4.6 Crank arrangement and firing orders: 2, 4 and 6	 4.5.1 Inspection and classification of engines according to cylinders. 4.5.2 Compression test. 4.5.3 Measurement of the bore and crank-journals for wear. 4.6.1 Determination of
	(e) Valve- operating mechanism	cylinder in-line engines. V-4,V-6 and 4-cylinder	firing order through valve opening. 4.6.2 Fault diagnosis.

	engines. 4.7 Fund	nlve operating ns. Drives in components, 12 – and 16 engine. Valve including	4.7.1 Identification of main components.4.7.2 Valve adjustments.4.7.3 Fault diagnosis.
5 FUEL SUPE	elements of air-fuel rate properties and diesel. 5.2 operation system-grafeed system	ref combustion; ios; types and of fuel-petrol Petrol: Layout and of petrol supply avity and force ms: ble carburetor, arburetor. filters/cleaners. and electrical ands. Advantages	 5.1.1 Checking fuel system troubles. 5.1.2 Inspection of exhaust gases for normal air-fuel ratios and excessively worn engine. 5.2.1 Inspection layout of petrol supply system:
	Merits and Electronic injection (I	sel: Layout of a diesel tem: entary treatment of pumps and	5.2.3 Dismantling, inspection and reassembling of a carburetors. 5:3:1 Identify the main components 5.4.1 Inspection of various types of injection pumps, servicing of injectors and bleeding.

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		injectors. Cold starting devices.	
6	EXHAUST SYSTEM	61 Purpose and layout of the system. Types of silencers and manifolds.	6.1.1 Inspection of exhaust system and identification of the exhaust and inlet manifolds. 6.1.2 Checking the system for leakage.

7	LUBRICATION	7.1 Engine Lubrication: Reasons for lubrication and types: boundary layer and film lubrication. Lubricated parts and components.	7.1.1 Identification of main components.72.1 Changing of oil and oil filters.
		7.2 Types of feed-splash, forced and petroil. (Wet and dry). Principle of operation of gear and rotor oil pumps. Oil filters.	7.2.2. Servicing and testing of pumps7.2.3 Fault diagnosis
		7.3 Lubricants: Applications in engines, transmission, steering, suspension system and doors: Viscosity rating, SAE numbers.	7.3.1. Identification of different types of lubricants. Comparing fresh and used oil. Use of grease gun and oil can.
8	COOLING SYSTEM	8.1 Process of heat transfer.	
		8.2 Water Cooling System: Purpose and layout of the system: functions of main components. Thermo-syphon and pump assisted systems. Elementary treatment of pressurized cooling system. Thermostats: Purpose and types. (bellows and wax pellet). 8.3 Air Cooling System: Layout and functions of the system: main	 8.2.1 Identification of main components, inspection of radiator and its construction, replacement of fan belt and hoses. 8.2.2 Flushing. 8.2.3 Fault diagnosis. 8.3.1 Fault diagnosis.
	I	I	
		components. Comparison of the air and water cooled systems.	

10	TRANSMISSION	9.1 Function and layout of	9.1.1 Identification of
10	SYSTEM	the transmission	different types of
	(a) Layout	system. Types-manual and automatic (excluding twin axles and double reduction axles) merits and demerits.	layout.
	(b) Clutch Assembly	9.2 Functions of a clutch. Types and operating principles of single plate and multiplate. Methods of actuation hydraulic and mechanical. Simple calculations. 9.3 Introduction to automatic transmission. Functions of torque converter and fluid flywheel.	9.2.1 Dismantling, identifying parts and reassembling a clutch unit (single plate). Adjusting clutch pedal clearance and bleeding clutch unit. 9.2.2 Fault diagnosis.
	(c) Gearbox	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. 9.5 Functions and types of the propeller shaft,	9.4.1 Identification of components of a gearbox.9.4.2 Inspection of gear teeth for wear.9.4.3 Fault diagnosis.
	(d) Propeller shaft and universal joint.	universal joint and sliding joint. 9.6 Purpose of rear axle. Arrangement and	9.5.1 Examination of the propeller shaft and universal joint bearings for bow and wear respectively.
	(e) Rear Axle		9.6.1 Identification of main components.

		functions of main components: final drive, differential unit, half shaft, oil seal and hub bearings. 9.7 Methods of supporting axle shafts. Advantages and disadvantages	9.6.2 Fault diagnosis.9.7.1 Identifying main components.
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 adjustment of wheel bearing clearance, removal and changing of road wheels. 10.2.1 Tyre fitting and checking tyre pressure. 10.2.2 Tube and tyre patching. 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 different types of brakes. Replacement of pads and shoes, bleeding and adjustment. "Spottesting" of brakes. 11.2.1 Fault diagnosis.

12	STEERING SYSTEM	12.1 General layout and functions of the front axle and steering systems. 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.	12.1.1 Identification of main components of different layout. 12.2.1 Front wheel alignment, inspection of tyre wear patterns.
		12.3 Steering faults	12.3.1 Fault diagnosis.
13	SUSPENSION SYSTEM	13.1 Purpose of the suspension system, layout and types, rigid beam and independent. Suspension (semi elliptic and coil springs); advantages and disadvantages, dampers (shock absorbers.)	13.1.1 Identification of differences between the rigid beam and independent suspension. 13.1.2 Fault diagnosis.

14	ELECTRICAL SYSTEMS	14.1 Basic electrical terms	14.1.1 Setting up simple
	(a) Fundamentals	and symbols. A.C and	electrical circuits, use of
		D.C sources, simple	simple electrical
		circuits, Ohm's law and	measuring instruments.
		calculations involving	
		series and parallel circuits.	
		Basic components and their	
		functions-relays,	
		resistors, lamps, fuses	
		and switches.	
		14.2 Wire gauges, colour	14.2.1 Inspection and
		coding – reasons for their	identification of various
	(b) Auto Wiring system	use. Wiring system –	components. Simple
		earth and insulated	soldering and joining of
		returns: ways of joining	cables.
		cables- jointing,	
		terminals, connectors and soldering.	
		14.3 Purpose, construction	
		and testing of lead-acid	
		battery. Electrolyte	14.3.1 Examination and
	(c) Battery	composition. Battery	testing of lead-acid
		care and maintenance.	battery. Preparation of
			electrolyte.
		14.4 Layout of the coil	3
		ignition system. Function	
		and operation of the main	14.4.1 Identification of main
		components.	components; ignition
	(d) Ignition System	Components.	timing, setting of
	(a) Ignition System		tining, setting of

	Introduction to computerized ignition system.	contact breaker points and spark plug gaps.
(e) Starting System (f) Charging System	14.5 Layout and functions of the main components. Types of starter motor. 14.6 Purpose and layout (dynamo and alternator). Main components and their operation. Comparison of d.c and a.c generators.	14.5.1 Inspection and identification of main components.14.6.1 identification of the component parts.
(g) Lighting System (h) Auxiliary Unit	14.7 Layout of the system main components and their functions. Fuses and bulbs-types and ratings. 14.8 Layout and operations of the auxiliary units. Instrument panel, horn, windscreen wiper. 14.9 Electrical faults.	14.7.1 Identification of main components, inspection and replacement of bulbs and fuses. 14.7.2 Head lamp focusing. 14.8.1 Inspection and testing of main components.
(ii) Auxiliary Oliit	14.9 Electrical faults.	14.9.1. Fault diagnosis.

15	ELECTRONICS (a) Fundamentals of Electronics.	15.1 Explanation of the tem Auto Electronics. Identification of	15.1 Identification of components.
	(b) Electronic Ignition	electronic components: diodes, transistors, resistors, capacitors, LED, transducers, coil and motors. Functions of components. Symbols in a circuit. 15.2 Operation of transistorized ignition system. Types of transistorized and electronic ignition	
	(c) Electronic Fuel Injection	system: Inductive and hall effect. Merits and demerits. 15.3 Purpose and type of systems (single-point and multi-point injections).	15.3.1 Identification of components in systems (single-point and multipoint).
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 and identification of air conditioning system and the components.
17	SAFE MOTORING	17.1 Main causes of accident, essentials of safe driving and application of highway code and safety devices.	17.1.1 Identification of faults and defective components that could cause accidents. Identification and interpretation of road signs.

RECOMMENDED READING LIST

1. Technology for Motor Mechanics Volumes 1-4 by S. C. Mudd (Edward Arnold

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