THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

093 MOTOR VEHICLE MECHANICS

Time: 3 Hours **ANSWERS** **Year: 2018**

Instructions

1. This paper consists of section A, B and C.

2. Answer all questions in section A and B and three questions from section C.

1. (i) What are the two basic carburetor designs?
A Zenith and "U" tube
B Piston type and cylinder type
C Choke type and throttle type
D Constant and variable venturi
E Downdraft and vertical type

Answer: D – The two basic carburetor designs are constant venturi and variable venturi types, based on air-fuel mixing behavior.

(ii) The only type of valve used in motor vehicle engine is
A Sleeve valve
B Poppet valve
C Slive valve
D Ball valve
E Rotary

Answer: B – The poppet valve is the standard type used in internal combustion engines for controlling intake and exhaust flow.

(iii) The following are temporary fasteners except
A Keys
B Cotters
C Rivets
D Pins
E Bolts and nuts

Answer: C – Rivets are permanent fasteners; others are removable and classified as temporary fasteners.

(iv) Which of the following are the parts of the motor vehicle tyre?
A Tread part, rim and bead area
B Rim, side wall and tread part
C Tread part, side wall and bead area
D Side wall, tread part and rim
E Bead area, axle and tread part

Answer: C – A tyre consists of the tread part (contact area), side wall (lateral area), and bead area (seating to rim).

(v) The length of hotchkiss drive shaft can be increased or decreased by a joint known as
A Butt joint
B Rotary joint

C Universal joint
D Ball joint
E Sliding joint

Answer: E – A sliding joint allows longitudinal movement in the drive shaft to accommodate suspension motion.

(vi) Why is the motor vehicle equipped with an exhaust muffler?
A To optimize exhaust efficiency
B To reduce burnt oxygen gases
C To reduce carbon oxide gases
D To reduce exhaust gas volume
E To reduce exhaust noise

Answer: E – The primary function of an exhaust muffler is to reduce engine exhaust noise.

(vii) Which of the following activities demand the use of a thread gauge?
A Measuring diameter of threaded part
B Measuring lead of thread
C Measuring crest of thread
D Measuring root of thread
E Measuring pitch of thread

Answer: E – A thread gauge is used to measure the pitch, or the distance between threads.

(viii) A headless fastening device threaded at both end is called
A Stud
B Bolt
C Pin
D Nut
E Screw

Answer: A – A stud is a headless fastener threaded on both ends to join parts with nuts.

(ix) Apart from increasing the performance of the engine 'oil cooler' is used to
A Control the oiliness
B Prevent loosing of oil viscosity
C Control formation of foam in oil
D Reduce the need of oil detergents
E Increase the need of oil inhibitors

Answer: B – Oil coolers prevent overheating of engine oil, helping retain its viscosity and lubricating efficiency.

(x) What is the modern method of mixing petrol with air as it enters the engine?
A Electronic carburetors
B Venturi method
C Variable venturi
D Petrol injection
E Fixed venturi

Answer: D – Petrol injection is the modern method of delivering fuel to engines, offering better fuel economy and combustion control.

2. Briefly explain the difference between chassis and integral body construction.
Chassis construction separates the frame and body; all parts are mounted on a strong frame.
Integral body (monocoque) combines the body and frame into a single structure, reducing weight and improving rigidity.

3. List three qualities of steering system.
– Ease of operation
– Minimum backlash
– Good self-centering action

4. (a) What is the size of free play of the clutch adjustment/movement of clutch pedal of a motor vehicle?
Typically between 20 mm to 30 mm.

(b) Why is the 'clutch pedal' facilitated with free play from clutch adjustment?
To ensure that the release bearing is not constantly in contact with the pressure plate, preventing wear and ensuring full clutch engagement.

5. Name three functions of the engine cam.
– To open and close the engine valves
– To control valve timing
– To operate fuel injectors in some engines

6. (a)(i) What is transmission brakes?
Brakes that act on the drivetrain instead of wheel drums, used in some heavy vehicles.

(ii) State where the transmission brake fitted?
It is fitted on the propeller shaft or gearbox output shaft.

(b) How does a transmission brake operate?

It uses a brake drum and shoe mechanism to stop the shaft's rotation, typically manually or hydraulically operated.

7. (a) Why is a workshop layout important?
Proper layout enhances workflow efficiency, safety, accessibility, and space utilization in a workshop.

(b) If the building hall is to be designed for a motor vehicle workshop; what are the four important equipment to be considered when 'workshop laying out' is carried out?
– Vehicle hoist or lift
– Workbenches and tool storage
– Compressed air and lighting system
– Drainage and ventilation systems

8. Name the components in chronological order through which the effort applied to the steering wheel is transferred to the front wheels.
– Steering wheel ---> Steering shaft ---> Steering gear box ---> Drag link ---> Tie rod ---> Steering knuckle ---> Front wheels

9. (a) Briefly explain the term "fasteners".
Fasteners are mechanical components used to join or affix two or more parts together securely.

(b) Mention two groups of fasteners. Provide one example for each group.
– Temporary fasteners: Bolts and nuts
– Permanent fasteners: Rivets

10. Briefly explain how does the following cooling system works in an engine?

(a) Parallel cooling system
Coolant flows through various engine parts in parallel branches, allowing uniform temperature control and efficient cooling.

11. Name three components which facilitate the connections of a vehicle hand brake.
– Handbrake lever
– Brake cable
– Equalizer or adjuster mechanism

12. (a) Differentiate between the diagonal-ply from radial-ply in the tyre construction.
Diagonal-ply: Cord plies run diagonally across the tyre at angles; stiff but less flexible.
Radial-ply: Cords run perpendicular to the bead with steel belts under the tread; more flexible, better grip, longer life.

(b) Briefly explain three operational conditions for selecting tread patterns of a tyre.

– Road condition (wet, dry, off-road)
– Load carrying requirements
– Driving speed and performance demands

(c) Describe four tyre markings which are marked on the sidewall of the tyre.
– Tyre size (e.g. 185/70R14)
– Load index and speed rating
– Manufacturing date
– Tread wear, traction, and temperature ratings

13. (a) Briefly explain how the water pump in Figure 1 works.
The water pump circulates coolant through the engine and radiator using an impeller powered by a pulley/belt system. It draws coolant from the radiator and forces it through the engine block and back to the radiator.

(b) Name the parts labeled A, B, C, D, E and F and give their functions.
A – Pulley: Drives the pump via belt
B – Bearing: Supports rotating shaft
C – Shaft: Transfers motion from pulley to impeller
D – Seal: Prevents leakage of coolant
E – Impeller: Circulates coolant
F – Pump housing: Encloses the impeller and guides coolant flow

(c) What happens if the seal in the water pump is malfunctioning?
Coolant will leak, reducing system pressure and leading to engine overheating or water pump failure.

(d) If the water is not circulating in the engine, briefly explain four possible causes.
– Faulty water pump
– Blocked radiator or coolant passages
– Broken fan belt
– Stuck thermostat

14. (a) What are the three functional requirements of a good suspension system?
– Load support and vehicle stability
– Shock absorption
– Maintaining wheel contact with road

(b) Differentiate between sprung weight and unsprung weight as applied to suspension systems.
Sprung weight: Weight supported by suspension (body, engine, passengers).
Unsprung weight: Parts not supported by suspension (axle, wheels, tyres).

(c)(i) What will happen if the vehicle is not equipped with sway bar or stabilizer?
Increased body roll during cornering, reduced stability, and higher risk of rollover.

(ii) How does panhard rod work in independent coil spring?
Panhard rod restricts lateral movement of the axle in coil spring suspensions, maintaining axle alignment.

(d)(i) Which type of the suspension system is employed with regard to Figure 2?
Coil spring independent suspension.

(ii) Label the parts indicated by A, B, C and D in Figure 2.
A – Axle housing
B – Coil spring
C – Shock absorber
D – Panhard rod

(iii) How will you know that component A in Figure 2 is not working?
Unusual axle movement, vibration, or noise from rear axle area.

(iv) What symptoms will make you judge that component B and D in Figure 2 are not working?
Component B (Coil spring): Rough ride, sagging suspension.
Component D (Panhard rod): Axle misalignment, swaying during cornering.

15. (a)(i) Describe oil pressure switch.
A sensor that monitors oil pressure and signals low pressure by warning light on the dashboard.

(ii) Explain the purpose of oil seals in lubrication system parts.
Oil seals prevent leakage and contamination by sealing rotating shafts in the system.

(iii) Why is an oil cooler important in lubrication system?
Prevents overheating of oil, maintains viscosity, and protects engine components.

(b) Explain the following as applied to automobile lubrication system:
(i) Dry sump lubrication – Oil is stored in a separate tank and pumped to the engine, used in performance vehicles.
(ii) Wet sump lubrication – Oil is stored in the sump (oil pan) and circulated by oil pump, common in most vehicles.

(c)(i) What are the two symptoms of low oil level in gearbox and differential?
– Gear grinding or noise
– Difficulty in gear shifting

(ii) Differentiate between oil filler and oil strainer.
Oil filler: Point where oil is poured into engine.
Oil strainer: Filters large particles before oil enters the pump.

16. (a)(i) Briefly explain how does a drum brake works?
Brake shoes press against the inner surface of a rotating drum when brake pedal is pressed, creating friction and stopping the wheel.

(ii) How does a 'cam operated internal expanding brakes' work?
A cam inside the drum pushes brake shoes outward against drum surface when it rotates.

(iii) Explain the action of leading shoe and trailing shoes in drum brake.
Leading shoe: Moves in same direction as drum, has self-servo effect.
Trailing shoe: Moves against drum rotation, less braking force.

(c) Compare the effects of brake fade in drum brake with that of disc brake.
Drum brake: More prone to fade due to heat buildup.
Disc brake: Better cooling, less affected by fade under heavy braking.