THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATION COUNCIL OF TANZANIA

DIPLOMA IN TECHNICAL EDUCATION EXAMINATION

790 **AUTOMOBILE TECHNOLOGY**

Time: 3 Hour. **Year: 2007 p.m.**

Instructions

1. This paper consists of **eight (8)** questions.
2. Answer any **five (5)** questions
3. Each question carries **twenty (20)** marks.
4. Programmable calculators, cellular phones and other unauthorized materials are **not** allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet(s).

1. (a) Safety in automotive service workshops involves knowledge of risk anticipation. Explain five detailed safety precautions a technician must follow when dismantling a hydraulic braking system in a vehicle fitted with ABS (Anti-lock Braking System).

   (b) Explain the safety measures to be observed when using each of the following precision tools in the workshop:

   (i) Micrometer screw gauge

   (ii) Dial indicator

   (iii) Torque wrench

   (c) With the aid of sketches, show three types of chassis frame constructions and label their structural components.

2. (a) (i) Explain the principle of operation of a taper reamer and its importance in engine overhauling.

   (ii) Describe four differences between hand reamers and machine reamers in terms of use and structure.

   (iii) State two advantages of using a telescopic gauge and explain how it is used alongside a micrometer.

   (b) (i) Define the term vapor lock as used in fuel systems.

   (ii) Mention four possible conditions that may result in vapor lock during vehicle operation.

   (c) Explain the effects of incorrect wheel alignment and describe how the following are inspected and corrected:

   (i) Set-back

   (ii) Thrust angle

   (iii) Steering axis inclination (SAI)

3. (a) Define the term "multi-fuel engine" and explain two advantages of its use in modern vehicles.

   (b) Differentiate between air-cooled and liquid-cooled engines by giving three specific technical differences and two applications of each.

   (c) Outline the step-by-step procedure for determining the swept volume and clearance volume of an engine cylinder in the workshop.

   (d) Describe the procedures involved in servicing and calibrating a common rail diesel injector with

reference to:

(i) Nozzle opening pressure

(ii) Fuel return flow

(iii) Injector response time

4. (a) An inline four-cylinder engine has a firing order of 1-3-4-2. Complete the table below to show the strokes for each cylinder, assuming pistons move in pairs.

Use strokes: P – power, C – compression, E – exhaust, I – induction

(b) Explain the operation of the compression stroke in a four-stroke compression ignition engine.

(c) Analyze four key operational and structural differences between two-stroke engines and four-stroke engines, and discuss their implications on efficiency and emissions.

5. (a) Explain four major performance and design-based differences between petrol and diesel engines used in commercial vehicles.

(b) A diesel engine produces a brake power of 50 kW at 1800 rev/min. The torque is transmitted through a gearbox with a ratio of 4.5:1 and final drive efficiency of 85%. Calculate:

(i) Torque at the wheels

(ii) Rotational speed of the wheels

(c) Mention four essential characteristics of a good anti-freeze coolant and explain how each helps maintain engine performance.

6. (a) Explain the reasons for adjusting backlash and gear contact pattern between the crown wheel and pinion in a final drive unit.

(b) (i) Define the term “clutch drag” and explain how it affects vehicle performance.

(ii) Describe the process through which the clutch disengages torque from the engine to the transmission.

(iii) State two causes and effects of a worn release bearing.

(iv) Explain what happens when the clutch plate has oil contamination.

(c) List and explain five desirable properties of friction materials used in clutch plates.

(d) (i) Where is the thermostat located in a typical inline water-cooled engine?

(ii) Describe a step-by-step procedure for testing a thermostat using hot water and a thermometer.

7. (a) Explain four mechanical functions performed by the front axle assembly in a rigid frame vehicle.

(b) (i) Describe the rack and pinion steering mechanism with the help of a labeled diagram.

(ii) Explain three functional roles of the delivery valve in a diesel injection pump.

(c) The following are spare parts and costs for overhauling a 6-cylinder diesel engine:

Engine overhaul kit – 370,000/=

Main bearing (3 sets) – 35,000/= per set

Piston rings (6 sets) – 78,000/= per set

Valve guides (12 pcs) – 8,000/= each

Camshaft bearings (4 pcs) – 18,000/= each

Connecting rod bearings (6 sets) – 29,000/= per set

Cylinder sleeves (6 pcs) – 59,500/= each

Compute the total estimated cost of these components.

8. (a) Describe the mechanical effect on vehicle handling and performance when each of the following faults occur in a leaf spring suspension:

(i) Fatigued spring leaves

(ii) Worn-out eye bushings

(iii) Misaligned centre bolt

(iv) Deformed shackle plate

(b) (i) Explain five possible causes of engine knocking under load conditions.

(ii) Explain a standard method used to test a condenser using an analogue multimeter.

(c) Describe the complete ignition timing procedure for a petrol engine vehicle using a timing light and manufacturer's specifications.