THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATION COUNCIL OF TANZANIA

DIPLOMA IN TECHNICAL EDUCATION EXAMINATION

790 **AUTOMOBILE TECHNOLOGY**

Time: 3 Hour. **Year: 2008 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) Describe five advanced safety precautions that must be taken when removing a vehicle's engine from the chassis using a hydraulic hoist.

   (b) Explain the safety considerations for each of the following workshop situations:

   (i) Grinding ferrous metals

   (ii) Handling high-pressure fuel lines

   (iii) Using oxy-acetylene welding equipment

   (c) Sketch and label three types of vehicle body structures, showing their load paths and stress zones.

2. (a) (i) What is a broach, and how is it used in reconditioning automotive components?

   (ii) List four types of broaches and their applications in vehicle servicing.

   (iii) Explain the purpose of a dial bore gauge and how it is zeroed before measurement.

   (b) (i) Define the term fuel starvation in automotive systems.

   (ii) Identify four likely causes of fuel starvation in a modern fuel-injected engine.

   (c) Discuss the functions and adjustment methods of the following wheel alignment parameters:

   (i) Camber

   (ii) Toe-out on turns

   (iii) Steering center point

3. (a) Explain the meaning of a rotary engine and give two of its unique advantages over reciprocating piston engines.

   (b) With examples, differentiate between naturally aspirated and turbocharged engines in terms of power output, fuel efficiency, and construction.

   (c) Describe a workshop method for determining the compression ratio of a petrol engine.

   (d) Explain how to inspect and service a diesel injection pump with reference to:

   (i) Governor control

   (ii) Plunger wear

   (iii) Injection timing

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

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

   (b) Describe the function and events during the exhaust stroke in a four-stroke engine.

   (c) Outline four disadvantages of two-stroke engines that limit their use in modern automotive technology.

5. (a) Describe four critical differences in the fuel systems of petrol and diesel engines.

   (b) An engine develops 120 Nm torque at 2000 rpm and transfers power through a 5:1 reduction gearbox with 88% efficiency. Calculate:

   (i) The torque at the output shaft

   (ii) The output shaft speed

   (c) Identify four characteristics of an effective engine oil and explain their roles in engine protection.

6. (a) Explain the importance of adjusting differential side bearing preload and the consequences of improper adjustment.

(b) (i) What is a pilot bearing in a clutch assembly, and what are its functions?

(ii) Describe how torque is transferred from the engine to the transmission during normal clutch engagement.

(iii) What are the effects of a warped pressure plate?

(iv) State two causes of clutch judder during take-off.

(c) Explain five reasons why asbestos-free materials are now preferred for clutch friction linings.

(d) (i) Where is the water temperature sensor located in a typical engine cooling system?

(ii) Explain how the sensor output affects engine management.

7. (a) Explain four functions of a live front axle in a four-wheel-drive vehicle.

(b) (i) Describe the function of a steering damper and its role in improving vehicle handling.

(ii) Explain three problems that may occur due to a faulty injection nozzle valve.

(c) A technician is estimating overhaul costs for a 4-cylinder inline petrol engine. Use the data below to compute the total cost:

Overhaul kit – 290,000/=

Main bearing set – 38,000/=

Big end bearing set – 30,000/=

Piston ring sets (4 pcs) – 72,000/= each

Valves (8 pcs) – 13,500/= each

Head gasket – 22,000/=

Oil pump – 85,000/=

8. (a) Explain how the following faults in a suspension system affect vehicle performance:

(i) Loose U-bolts

(ii) Cracked leaf spring

(iii) Weak shock absorbers

(iv) Damaged stabilizer link

(b) (i) State five common causes of weak ignition spark in a spark ignition engine.

(ii) Describe how to test a high-tension coil with a multimeter.

(c) Explain the detailed steps involved in performing ignition timing adjustment using a crankshaft timing mark and a distributor.