THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATION COUNCIL OF TANZANIA

DIPLOMA IN TECHNICAL EDUCATION EXAMINATION

790 AUTOMOBILE TECHNOLOGY

Time: 3 Hour. **Monday, 10th May 2011 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) Briefly explain five general workshop safety rules that every automotive technician must observe during repair and maintenance of vehicle transmission systems.

   (b) Explain the safety precautions to be followed when working with the following:

   (i) Hydraulic jack

   (ii) Bench grinder

   (iii) Oxy-acetylene welding set

   (c) Sketch and label the following frame designs commonly used in vehicles:

   (i) Ladder frame

   (ii) Backbone frame

   (iii) Tubular frame

2. (a) (i) What is the purpose of using torque wrenches in automotive repairs?

   (ii) List four common types of torque wrenches and briefly state their unique feature.

   (iii) What is the function of a dial gauge in a vehicle workshop?

   (b) (i) Define the term "fuel knock" in internal combustion engines.

   (ii) Outline four causes of fuel knock in petrol engines.

   (c) Explain why correct steering geometry is important. Then briefly describe how each of the following angles affects steering:

   (i) Kingpin inclination

   (ii) Setback

   (iii) Included angle

3. (a) Define the term "combustion chamber" as applied in automotive engines.

   (b) Differentiate the terms compression ratio and clearance volume.

   (c) Describe three major engine block materials and give one advantage of each.

   (d) Explain the procedures of testing a battery for:

   (i) State of charge

(ii) Internal resistance

(iii) Electrolyte level

4. (a) A six-cylinder inline engine has the firing order 1-5-3-6-2-4. Complete the table to show the stroke sequence if the engine is operating under four-stroke cycle.

   Table should include columns for cylinder number and stroke type: I, C, P, E

   (b) Explain the exhaust stroke in a four-stroke diesel engine.

   (c) Identify four key differences between spark ignition and compression ignition engines.

5. (a) Highlight four major distinctions between a naturally aspirated engine and a turbocharged engine.

   (b) An engine delivers a power output of 75 kW at 3000 rpm. Calculate the torque developed at the crankshaft.

   (c) What are four desirable characteristics of a good engine lubricant?

6. (a) Explain the need for backlash adjustment in a differential gear system.

   (b) (i) What is a diaphragm spring clutch?

   (ii) Describe how torque is transmitted when the clutch is engaged.

   (iii) What happens if the clutch pedal is held partially depressed during operation?

   (iv) What is clutch drag and how is it caused?

   (c) List and explain five properties required of a clutch lining material.

   (d) (i) Where is the radiator pressure cap located in a motor vehicle cooling system?

   (ii) Describe how the radiator pressure cap contributes to engine cooling.

7. (a) Describe four functions of the rear axle in an automobile.

   (b) (i) Explain how a recirculating ball steering mechanism works.

   (ii) What are three main functions of the pressure relief valve in the lubrication system?

   (c) Compute the total cost of replacing the following parts in a 4-cylinder 3RZ-FE engine:

Engine gasket kit – Tsh. 175,000/=

Crankshaft bearing – Tsh. 27,000/= per set

Piston assembly – Tsh. 42,000/= each

Valve guide – Tsh. 7,500/= each (8 pieces)

Timing belt – Tsh. 33,000/=

Oil pump – Tsh. 88,000/=

8. (a) Explain the effect of the following defects in coil spring suspension system:

(i) Cracked coil

(ii) Sagging spring

(iii) Corroded mounting point

(iv) Broken rubber insulator

(b) (i) Mention five causes of engine overheating.

(ii) Describe how a water pump is tested for faults.

(c) Outline the steps to set ignition timing using a timing light in a petrol engine.