TEVETA

Technical Education, Vocational and Entrepreneurship Training Authority

DIPLOMA IN AUTOMOTIVE ENGINEERING

LEVEL 6 YEAR I EXAMINATIONS

FINAL INTEGRATED SUMMATIVE EXAMINATIONS

SITTING: NOVEMBER/DECEMBER 2025

SUBJECT: BRAKING SYSTEMS

TIME: THREE (3) HOURS **TOTAL MARKS: 100**

PASS MARK 50

INSTRUCTIONS TO CANDIDATE

1. Write your Examination number and National Registration Card (NRC) number on the answer booklet provided. Ensure you append your signature in the space provided on the answer booklet.
2. Write the ANSWER SCRIPT SERIAL NUMBER on the examination register and on the entry slip provided.
3. This paper consists of EIGHT (8) questions.
4. Answer FIVE (5) questions. Question ONE (1) is compulsory and any other FOUR (4) questions.
5. All questions carry equal marks.
6. Cell phones and programmable calculators are not allowed in the examination room.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

QUESTION 1 - COMPULSORY

A. You are a junior mechanic at "AutoSafe Brake & Clutch Specialists." Your senior technician has asked you to help train a new apprentice by explaining some fundamental brake system concepts. To ensure the apprentice understands the core principles, explain the following five (5) key terms in the context of brake system operation:

i) Friction (2 Marks)

ii) Brake fade (2 Marks)

iii) Brake ratio (2 Marks)

iv) Self-adjustment (2 Marks)

v) Self-Servo Action (2 Marks)

B. A customer with a small commercial van used for local deliveries is complaining about poor braking performance, especially when the vehicle is fully loaded. The senior technician has decided that upgrading the rear brakes to a Two Leading Shoe (2LS) configuration would be the best solution. To justify this decision to the workshop manager, state five (5) performance advantages that a 2LS brake assembly would provide for this specific vehicle and its usage. (10 Marks)

Total Marks (20 Marks)

QUESTION 2

A. A customer has brought their vehicle into the workshop for a brake inspection. They are curious about the difference between drum and disc brakes and how the components inside their wheels work. To help the customer understand the disc brake system on their vehicle, produce a neat, labelled sketch that clearly shows its main components and describe how it is constructed. (10 Marks)

B. During a routine service on a vehicle with drum brakes, the apprentice mechanic is unfamiliar with the component that pushes the brake shoes apart. Explain to the apprentice how a double-acting wheel cylinder functions in the following situations:

i) When the brake pedal is pressed (brakes applied). (5 Marks)

ii) When the brake pedal is released (brakes released). (5 Marks)

Total Marks (20 Marks)

QUESTION 3

A. During a routine vehicle safety inspection, you find a vehicle with a cracked, brittle, and worn-out master cylinder reservoir cap. Explain two (2) critical problems or risks that this worn-out cap could cause to the brake system. (4 Marks)

B. An apprentice is struggling to understand why a Two Leading Shoe (2LS) drum brake is more powerful than a simpler design. Explain the mechanical principle of how a 2LS brake assembly uses the rotation of the drum to create a "self-servo" or "self-energizing" action, which increases its braking force. (5 Marks)

C. A customer is deciding between two used cars, one fitted with disc brakes on all four wheels and another with drum brakes at the rear. They ask you why the all-disc model might be better. List four (4) key performance advantages of disc brakes over drum brakes that you would explain to the customer. (8 Marks)

D. Explain the primary safety advantage provided by a tandem master cylinder in the event of a hydraulic brake failure (3 Marks)

Total Marks (20 Marks)

QUESTION 4

A. You are cleaning up an old workshop and find a set of vintage brake shoes lined with asbestos. An apprentice asks why this material was ever used, given its known dangers today. From a historical perspective, state two (2) functional properties that made asbestos a desirable frictional material for brake shoes in the past. (6 Marks)

B. State two (2) common, safer materials used in modern non-asbestos organic (NAO) or semi-metallic brake linings. (4 Marks)

C. During a brake refurbishment, the friction material on a shoe has worn out and needs to be replaced. Describe three (3) common methods used to securely attach new friction lining material to a brake shoe (6 Marks)

D. State two (2) functional disadvantages of drum brakes when compared to modern disc brakes (4 Marks)

Total Marks (20 Marks)

QUESTION 5

A. A customer is considering buying a new car and is unsure if the Anti-lock Braking System (ABS) is worth the extra cost. Explain three (3) key safety benefits of having an ABS to help the customer understand its value. (6 Marks)

B. The same customer's vehicle is also equipped with a Traction Control System (TCS). They want to know how it works without being too technical. Explain how the TCS operates in the following two situations:

   i) When it actively uses the brakes to control wheelspin. (4 Marks)

   ii) After the situation is controlled and the brakes are released. (4 Marks)

C. The customer notices that the ABS and TCS warning lights are next to each other on the dashboard and asks if these systems are related. Explain the fundamental relationship between the Anti-lock Braking System (ABS) and the Traction Control System (TCS). (6 Marks)

Total Marks (20 Marks)

QUESTION 6

A. As a technician, state two (2) possible faults in the braking system that could cause this "stiff" or "hard" brake pedal. (4 Marks)

B. State two (2) common issues within the hydraulic system that would lead to this spongy brake pedal feel. (4 Marks)

C. A fleet manager for heavy-duty trucks wants to understand the benefits of installing an engine brake (Jacobs brake).

   i) State two (2) key positive effects of using a Jacobs engine brake on a commercial vehicle (4 Marks)

   ii) Describe how a Jacobs compression release engine brake operates from the moment it is engaged by the driver until it slows the vehicle. (8 Marks)

Total Marks (20 Marks)

QUESTION 7

A. You are a mechanic at a workshop that services both light vehicles and heavy commercial vehicles. A new apprentice has joined and needs to understand the different braking systems they will encounter. In the context of drum brake design, state the meaning of the abbreviation TLS (4 Marks)

B. A fleet manager for a trucking company is deciding on a new vehicle specification. Give three (3) key advantages of using pneumatic (air) brakes over hydraulic brakes for heavy-duty applications. (6 Marks)

C. Explain the general operation of a brake chamber in a pneumatic brake system. (10 Marks)

Total Marks (20 Marks)

QUESTION 8

A. You are training a new apprentice in the brake shop. Their first task is to understand the central role of the master cylinder. Explain to the apprentice four (4) key functions that the brake master cylinder performs in the hydraulic brake system. (8 Marks)

B. Sketch a neat and clear diagram of a tandem (dual) brake master cylinder. Label all its major components to show how it is constructed. (8 Marks)

C. A customer complains that their brake pedal is extremely hard to press and the car takes longer to stop. You have diagnosed a faulty brake booster. Explain why a failed brake booster causes these specific symptoms of a hard brake pedal and reduced braking power. (4 Marks)

Total Marks (20 Marks)