

CHASSIS SYSTEMS AND TRANSMISSION 2
7130

GENERAL CERTIFICATE OF EDUCATION BOARD

Technical and Vocational Education Examination

JUNE 2021

ADVANCED LEVEL

Specialty Name (Specialty Code)	AUTOMOBILE CONSTRUCTION AND MAINTENANCE: LIGHT VEHICLE(AM-LV)
Subject Title	CHASSIS SYSTEMS AND TRANSMISSION
Paper No.	2
Subject Code No.	7130

Duration: Three hours

INSTRUCTIONS TO CANDIDATES

The Paper has Two Sections (A and B)

Section A: Answer Three Questions

Section B: Answer Two Questions

All questions carry equal marks

Calculators are allowed





You are reminded of the necessity for good English and orderly presentation in your answers.

Turn Over

SECTION A
(Answer THREE Questions from this section)

1. TYRES

- a. Outline FOUR functions of the tyre. (4marks)
- b. What are the advantages of tubeless tyres over tubed tyres? (2marks)
- c. Name FOUR factors affecting tyre life. (2marks)
- d. Front tyres generally wear faster than those fitted to the rear of the vehicle. Justify this affirmation. (2marks)
- e. Complete the table on your answer booklet by stating the cause of abnormal tyre wear. (1×4marks)

REF	TREAD CONDITION	CAUSES
1		
2		
3		
4		

- f. Local statutory regulation specifies the classification of marking that must be shown on the side wall of a modern tyre. Give the meaning of each marking as shown P185/70 R14 88T.

(1×6marks)

2. AUTOMATIC TRANSMISSION

- a. Draw a simple neat sketch of an epicyclic gear train showing the sun gear(S), two planetary gears (P1 and P2), a planet carrier (PC) and the annulus (A). (3marks)
- b. Figure 1 below represents a longitudinally mounted four speed automatic gearbox.

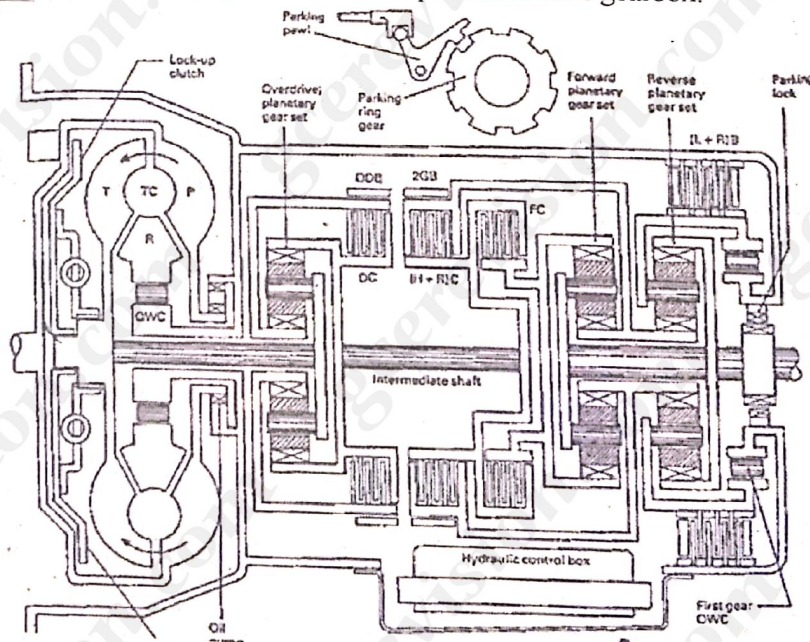


Figure 1

- i) Give the names of the parts labeled as P, T, R and OWC of the torque converter. (2marks)
- ii) What is the function of the lock-up clutch in the torque converter? (2marks)
- iii) Name the purpose of the brake bands and the clutches in the above gearbox. (2marks)
- iv) Give TWO functions of the hydraulic control box in the above gearbox. (2marks)

c. Figure 2 below is the hydraulic control box or valve body.

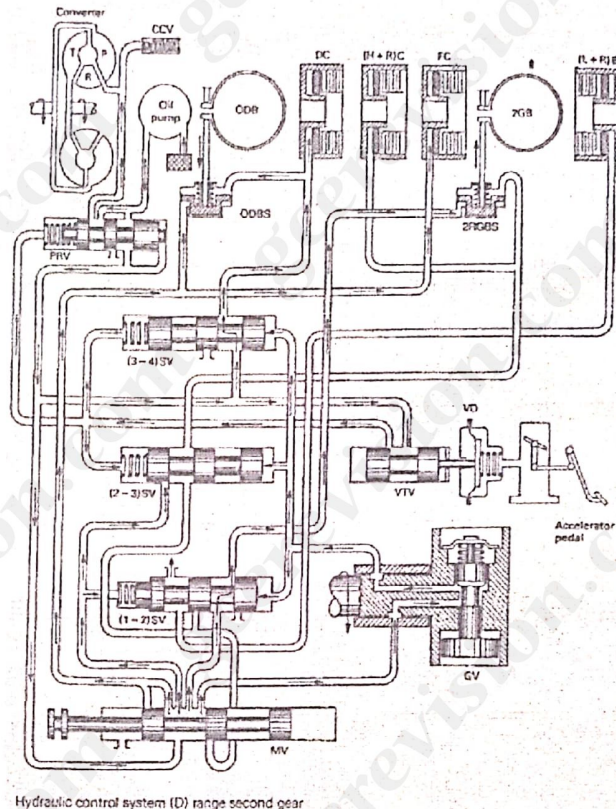


Figure 2

- i) What is the role of each of the following valves? (1×3marks)
 - Shift valve (SV).
 - Governor valve (GV).
 - Manual valve (MV).
- ii) The gear lever has a number of positions marked P R N D 2 1. (1×2marks)
 - At what position can the engine be cranked?
 - First (1st) gear impulse. What shall be the reaction of the transmission and in which driving conditions is it used?
- iii) What happens to the transmission at 'kick-down' position? (1mark)
- iv) Trouble shooting, diagnoses and maintenance. (1×3marks)
 - Give two symptoms of low oil pump pressure in the transmission.
 - Enumerate THREE things that can be regularly checked in this type of transmission during routine maintenance.
 - Propose a grade of oil that can be used to fill this gearbox.

Turn Over

3. THE SUSPENSION SYSTEM

- A suspension system has several functions. Name four of them. (2marks)
- Define with the aid of sketches the following terms in relation to the suspension system. (2marks)
 - A control arms
 - Ball joint
 - Curb height
- Pitching, drifting, spinning (yawing) raise and lower, tyre slack, body roll (tilt) and surge are the types of movements and vibrations affecting a vehicle in motion. Reproduce the vehicle axis (x,y,z) on your answer booklet and indicate the movement specified above. (2marks)

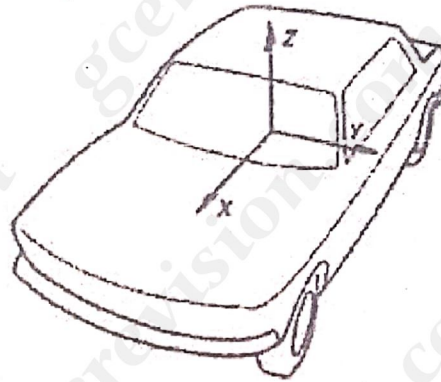


Figure 3

- Figure 4 below shows a rear suspension of the vehicle: mark OPEL OMEGA, 1999 model.

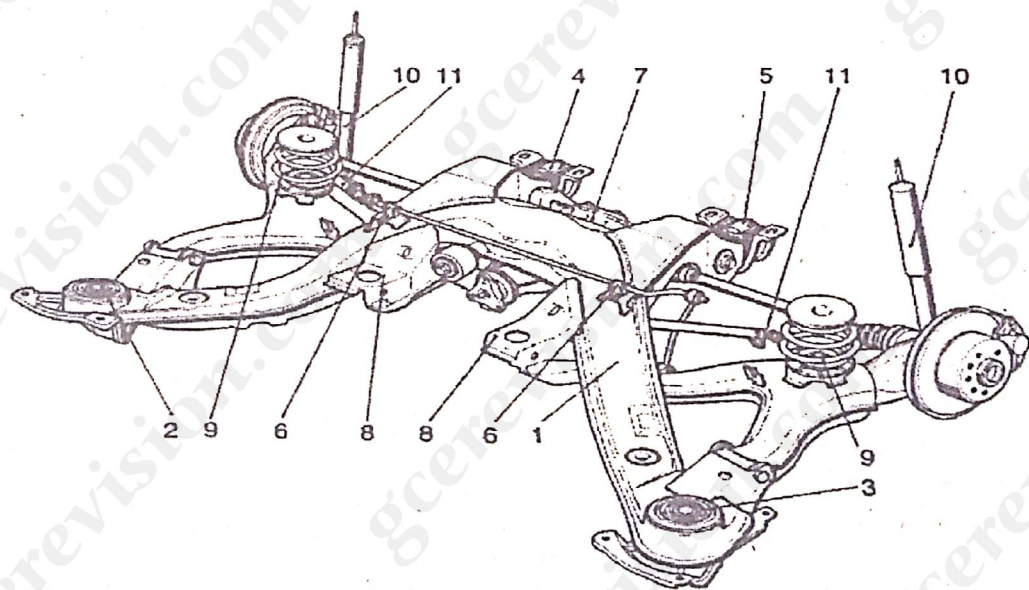


Figure 4

- Identify the parts labeled 1, (4/5), 6, 10 and 11 of the above suspension. (2marks)
- What can be the symptom for the failure of components (4 and 5) during vehicle operation? (1mark)
- When the bar supported by the component (6) is broken, what is the symptom of this as the vehicle is being exploited? (2marks)
- In not more than five lines, explain how a hydraulic shock absorber or damper limits a spring's oscillation whenever a wheel encounters a bump or enters into a pot hole. (2marks)
- How can a new shock absorber be tested before installation? (2marks)
- Enumerate the general checks that should be carried out on a vehicle's shock absorber. (2marks)

- vii) Name TWO problems that coil springs usually suffer from.
 viii) Give ONE problem that ball joints usually suffer from

(2marks)

(1mark)

4. BRAKES

- a. A hydraulic operated drum brake consists of a leading and trailing shoe.
 i) Make a simple sketch to show how the leading and trailing shoe act in the brake drums. Clearly indicate the direction of rotation of the drum as well as the direction of the frictional forces of the brake shoes acting on the drum. (2marks)
 ii) Write down the names of four other drum brake parts that have not been mentioned above. (2marks)
- b. State why the two leading shoes arrangement is preferred on the front wheels to the rear wheels. (1mark)
- c. What is the role of a proportional valve? (2marks)
- d. Give TWO reasons why the disc brake is preferred at the front wheel than on the rear wheel. (1mark)
- e. Briefly explain the procedures on how to bleed the brakes. (2marks)
- f. What is the function of a retarder? (2marks)
- g. Name FOUR types of retarders (2marks)
- h. Explain the principle of operation of the Exhaust brake in not more than FOUR lines. (2marks)
- i. What is ABS and why is it necessary? (2marks)
- j. Give TWO causes each of the following defects in the braking system
 i) Excessive brake pedal travel (1mark)
 ii) Spongy brake pedal (1mark)

5. AIR CONDITIONING SYSTEM

Figure 5 below is an automobile air conditioning system.

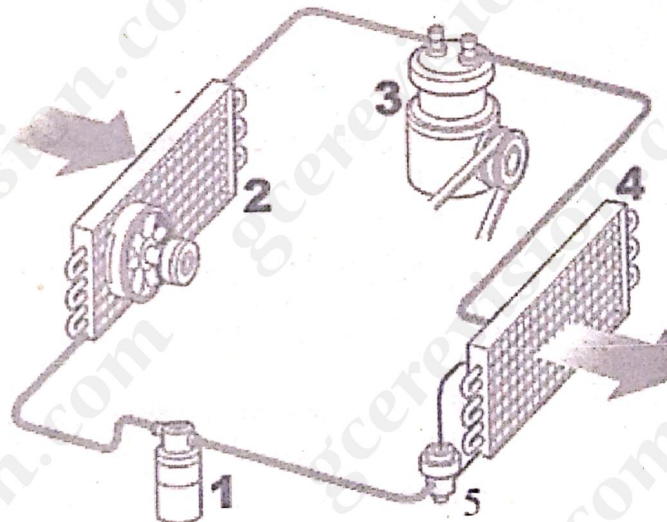


Figure 5

- a. Give the names of the numbered parts 1,2,3,4 and 5 from figure 4 above. (5marks)
 b. What are the functions of the following parts 1,2,3,4 and 5? (5marks)

Turn Over

- c. Name the scientific terms used to describe how heat is transferred through solid, liquid, gases and vacuum. (2marks)
- d. What does R12 and R134a stands for? Why is R134a preferred today? (2marks)
- e. State the main characteristic of the Refrigerant. (1mark)
- f. Name TWO factors on which the compressor depends for maximum performance. (2marks)
- g. The car interior does not receive cold air. Give THREE probable causes of this fault. (3marks)

SECTION B

(Answer Two Questions from this section)

6. THE ACKERMAN PRINCIPLE OF STEERING AND STEERING GEOMETRY

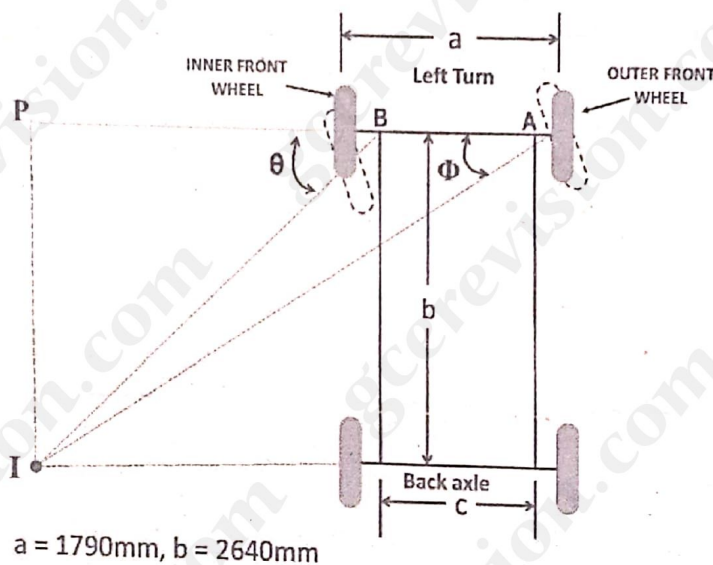


Figure 6

Figure 6 above illustrates the Ackerman principle.

- What will be the effect on the tyres if the wheels do not turn about the instantaneous centre of rotation (I)? (3marks)
- What does the distances (a) and (b) represent? (2marks)
- Given that $IP=b=2640\text{mm}$, $BP=2940$ and $PA=3640\text{mm}$; determine the cornering angles (θ) and (Φ) of the inner and outer front steered wheels at the position shown. (4marks)
- Calculate the cornering radii $IB=R_{in}$ and $IA=R_{out}$ of the inner and outer front steered wheels respectively at the bend. (2marks)
- Define wheel alignment and give THREE important things that are usually checked during a wheel alignment exercise. (2marks)
- Six fundamental angles or specifications are needed for proper wheel alignment. Name FOUR of these angles. (3marks)
- Define toe-out on turns. (2marks)
- Name TWO instruments that can be used to carry out wheel alignment. (2marks)

7. TRANSMISSION

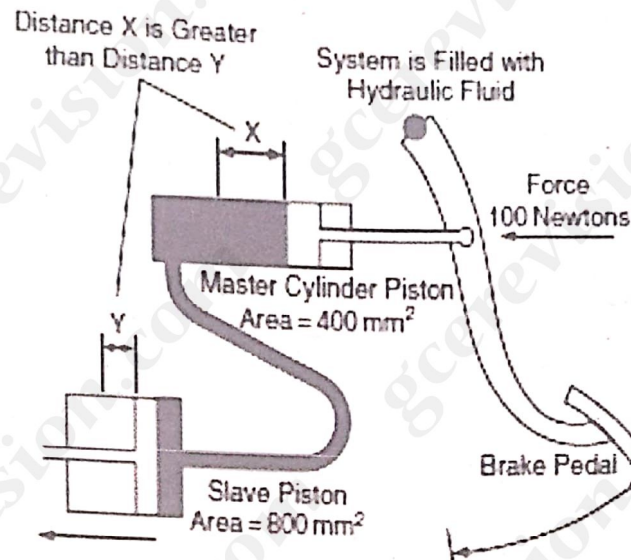


Figure 7

- If a single plate clutch rotates at a speed of 3600 rev/min to the angular velocity of the crankshaft. Convert this value to radians per second. (2marks)
- Figure 7 above shows the basic structure of a hydraulically operated clutch mechanism. If the driver applies a force of 100 N on the master cylinder piston during clutching, what will be the;
 - Pressure of the master cylinder? (3marks)
 - Force at the slave cylinder? (3marks)
- Give ONE example in each case of the clutch components that are subjected to the following.
 - Shear stress (2marks)
 - Tensile stress (2marks)
 - Compressive stress (2marks)
 - Calculate the tensile force on a bolt 15mm in diameter when tighten torque produces a tensile stress of 56 N/mm^2 . (3marks)
- A vehicle has a gearbox whose low-gear ratio is 5:1 and the rear axle whose ratio is 6.5:1. Calculate the overall gear ratio. (3marks)

Turn Over