SOUTH WEST REGIONAL MOCK EXAMINATION
TECHNICAL EDUCATION

THE TEACHERS' RESOURCE UNIT (TRU)
Cellule d'appui à l'action Pédagogique

IN COLLABORATION WITH
En collaboration avec

THE REGIONAL INSPECTORATES OF PEDAGOGY AND

THE SUBJECT TEACHERS' ASSOCIATIONS (STA)

TUESDAY, 18/03/24 ADVANCED LEVEL

Subject Title	**Chassis Systems and Transmission**
Paper Number	**Paper 2**
Subject Code Number	**7130**

Two hours, 30 min

INSTRUCTIONS TO CANDIDATES:

This paper is made up of eight (8) questions; answer any five, choosing three (3) from section A and two (2) from section B. All questions carry equal marks.

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

SECTION A

TECHNOLOGY

Answer any THREE (03) questions in this section

1. POWER ASSISTED STEERING SYSTEM

Figure 1 below shows a typical power assisted steering system equipped in TOYOTA Corolla car.

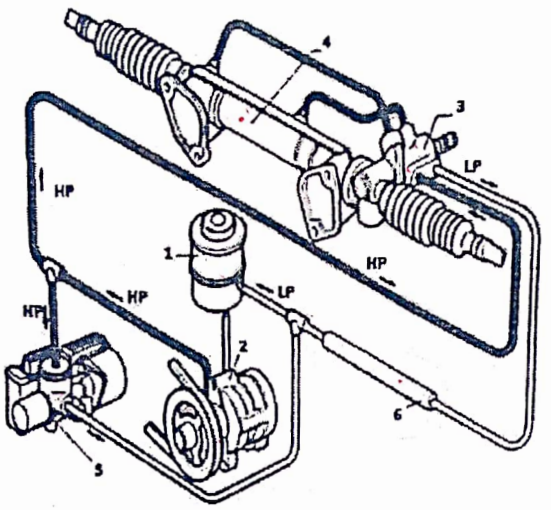

Figure 1

a) Give the name and functions of the numbered parts 1, 2, 3, 4, and 5. **(7.5 marks)**

b) Give FIVE areas in the power assisted steering that need regular preventive maintenance. **(5 marks)**

c) Describe the functioning of the power assisted steering. **(5 marks)**

d) How does the system behave when part 1 is empty? **(2.5 marks)**

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2. DIFFERENTIAL

Figure 2a and 2b below shows a full diagram of the final drive differential system.

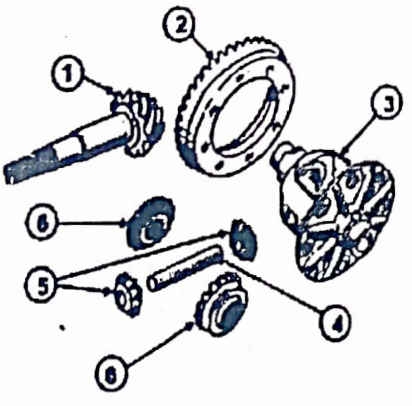

Figure 2a

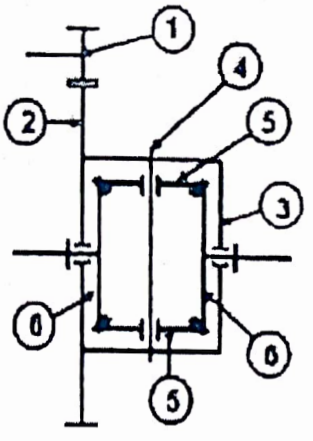

Figure 2b

a) Give the names and functions of parts 1 and 2. **(4 marks)**

b) Explain the functioning of the differential in straight ahead and when taking a turn. **(6 marks)**

c) State THREE causes of axle vibration and three sources of axle leakages. **(6 marks)**

d) What is differential lock? **(2 marks)**

e) When does the differential lock come into action? **(2 marks)**

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3. BRAKING SYSTEM

Figure 3 below shows the exploded views of the components of the braking system.

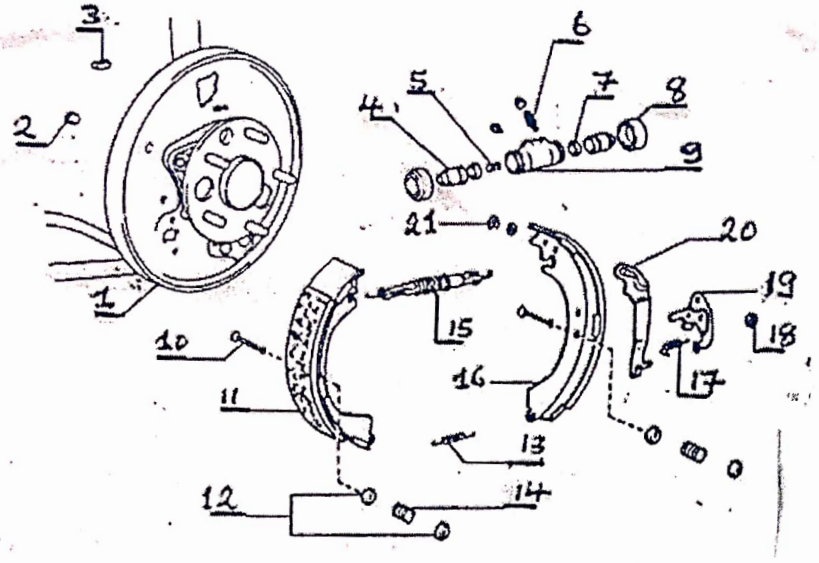

Figure 3 Explosion of Disc Brakes

a) What are the functions of a brake booster and a master cylinder in the braking system of this? **(3 marks)**

b) By referring to figure 3 above, give the names of the following parts of the rear brake drum assembly : **(4 marks)**

Ref.	Name (0.5mark x 4)	Ref.	Name (0.5mark x 4)
4		11	
6		12	
8		13	
9		15	

c) What is the material that is used for the manufacturing of the part <u>11</u>? **(1 mark)**

d) What is the symptom of a failed brake booster during brake application? **(1 mark)**

e) What does a spongy brake pedal behavior signify during brake application? **(1 mark)**

f) This braking system suffers from the following problems:

- Very little braking is felt when the service brakes are applied
- The car pulls to one side when braking with the vehicle in motion.

Use the table below to give two (02) likely causes of these faults and their proposed remedies. **(6marks)**

Problem	Causes (1mark x 4)	Remedies (0.5mark x 4)
Very little braking is felt when braking		
Car pulls to one side when braking		

g) Briefly explain how you will bleed air from the above braking system in your garage if there was air in its hydraulic circuit. **(4marks)**

4. SUSPENSION, ROAD WHEEL AND TYRES

Figure 4 below shows a layout of a vehicle suspension system.

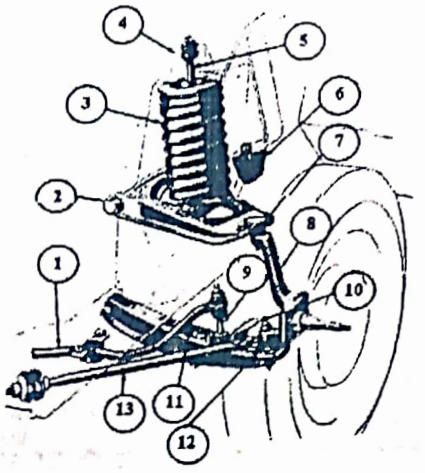

Figure 4

a) Identify the type of suspension layout. **(1 mark)**

b) Complete the table below by giving the names of the organs and their respective roles. **(5 marks)**

Ref	Name (0.5x5 marks)	Function (0.5x5 marks)
1		
3		
4		
5		
13		

c) What are suspension bushings? **(1 mark)**

d) State TWO problems caused by worn suspension bushings. **(2 marks)**

e) Briefly explain how the element 1 operates during movement of the suspension system. **(2 marks)**

f) Suspension problems increase tyre wear and may require an interchanging of tyres. Why is this done? **(2 marks)**

g) Figure 5 below is a pictorial view of a vehicle tyre. Given the tyre characteristics with the corresponding numbers on the figure, fill the table below in your booklet. **(7 marks)**

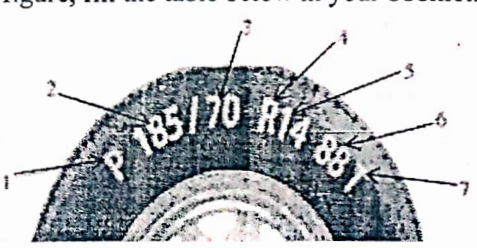

Figure 5

Ref	Designation
1	
2	
3	
4	
5	
6	
7	

5. AUTOMATIC TRANSMISSION

a) Give the function of a torque converter **(2 marks)**

b) Name the three main components of a torque converter **(3 marks)**

c) Which are the three functions performed by the torque converter? **(3 marks)**

The figure 6 below is that of a planet gear set.

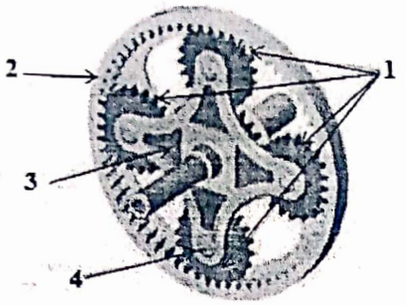

Figure 6

d) Name the numbered parts 1, 2, 3, and 4. **(2 marks)**

e) What happens when there is; **(4 marks)**

i. Reverse

ii. Over drive

f) What are the two methods of operating automatic gearbox? **(4 marks)**

g) What precautions should be used when towing a vehicle with an automatic gearbox? **(2 marks)**

SECTION A

CALCULATION AND SCIENCE

Answer any TWO (02) questions in this section

6. GEARBOX

Figure 7 below is that of a 5-speed manual shift synchromesh gearbox of a certain front-engine, front-wheel drive vehicle.

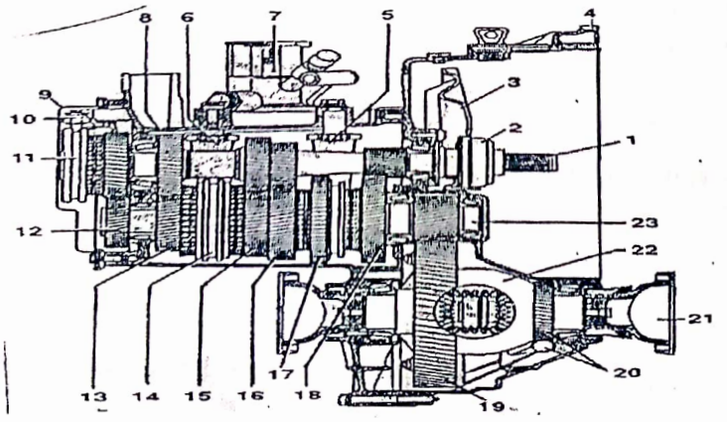

Figure 7

a) Give any two (02) functions of the gear box in a motor vehicle's transmission system. **(2 marks)**

b) Identify the parts 1, 5, 6, 11, 14, 17, 19, 20, 22, and 13 of the above gearbox. **(5 marks)**

c) Knowing that Z_1= **16 teeth**, Z_2= **18 teeth**, Z_3= **21 teeth**, Z_4= **25 teeth**, Z_5= **31 teeth**, are the number of teeth on the 1st, 2nd, 3rd, 4th and 5th speed gear wheels mounted on the primary shaft, and that Z_{12}= **29 teeth**, Z_{13}= **31 teeth**, Z_{15}= **34 teeth**, Z_{16}= **37 teeth**, Z_{18}= **48 teeth**, are the number of teeth on

their corresponding gear wheels mounted on the main shaft, calculate the 1st, 4th and 5th speed gear ratios when these speeds have been selected **(5.5 marks)**

d) Calculate the corresponding speeds ($\omega_{1output}$, $\omega_{4output}$ and $\omega_{5\ output}$) of the shaft (23) when the 1st, 4th and 5th gears have been selected, if the engine's speed is **3500 rev/min.** **(4.5 marks)**

e) Calculate the torque output ($T_{1\ output}$) from the gearbox when the 1st speed have been selected knowing that the power output from the gearbox corresponding to this speed is $P_{1output}$ = 1.25KW corresponding **(3 marks)**

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7. HYDRAULICS

Figure 8 below is a hydraulic layout of the braking system. The master cylinder piston diameter is 23mm, front wheel piston diameter is 58mm, rear wheel piston diameter is 33mm, A is 220mm, B is 60mm and the driver effort exerted on the pedal is 30N.

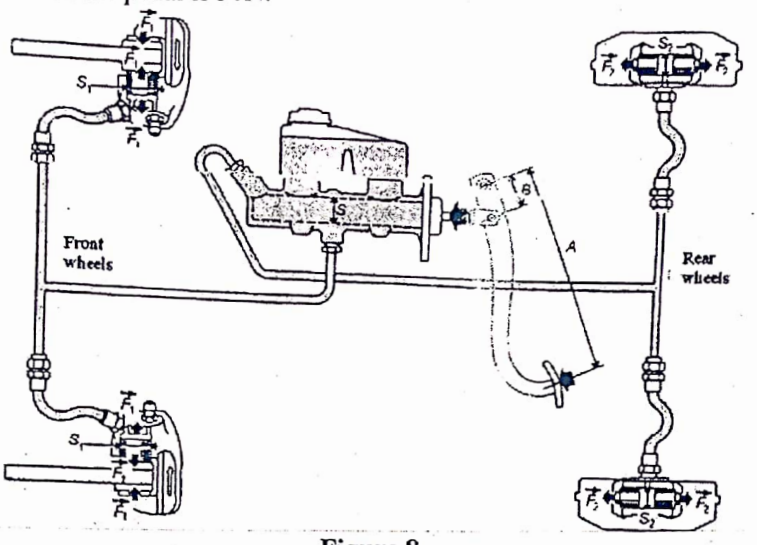

Figure 8

a) State;

h) The principle of moment. **(2 marks)**

ii) Pascal law. **(2 marks)**

b) Calculate the force applied on the master cylinder piston. **(2.5 marks)**

c) Calculate the sectional areas; S, S_1 and S_2. **(1.5x3 marks)**

d) Calculate the circuit pressure. **(3 marks)**

e) Calculate the force F_1 applied on the front disc. **(1.5 marks)**

f) Calculate the force F_2 applied on the rear drum. **(1.5 marks)**

g) Deduce the pedal and hydraulic ratios. **(1.5x2 marks)**

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8. ANTI-LOCK BRAKE SYSTEM ANALYSIS

a) A car of mass 80kg is travelling at 36km/h, calculate the following;

i. The kinetic energy it possesses **(2 marks)**

ii. • The average braking force to bring it to rest in 20 meters **(2 marks)**

b) Calculate the stopping distance of a vehicle travelling at 60km/h **(2 marks)**

c) Briefly make a projection on the behavior of an ABS **(2 marks)**

d) Give three consequences of a vehicle's wheels locking up during braking **(3 marks)**

e) Copy the table below in your answer booklet and give a brief examination of the operation of an Anti-lock Brake System by analyzing the following requirements;

Requirements	Analysis **(3x3marks)**
1. Fail safe	
2. Maneuverability	
3. Availability of immediate response	
