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071606T4AUT**AUTOMOTIVE TECHNICIAN LEVEL 6****ENG/OS/AUT/CC/3/6/-**

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APPLY AUTOMOTIVE ENGINEERING SCIENCE PRINCIPLES

Date: 24.07.2025 11:34 AM

July/Aug 2025

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**TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION
COUNCIL (TVET CDACC)**

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WRITTEN**ASSESSMENT****TIME: 3 HOURS**

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INSTRUCTIONS TO THE CANDIDATE**1. This is of TWO sections: A and B**

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2. Attempt ALL questions in Section A and any THREE questions from Section B.

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3. You are provided with a separate answer booklet.**4. Do not write on the question paper.**

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is of FIVE (5) printed pages.

**Candidates should check the question paper to ascertain that all pages are printed as
indicated and that no questions are missing.**

Turn over

SECTION A: (40 MARKS)***Attempt ALL questions in this section***

1. Temperature and heat have many applications in engineering. Differentiate between temperature and heat. (2 Marks)

2. Equations of linear motion are very useful in solving problems involving motion. Derive the following equation of linear motion. (3 Marks)

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$$v^2 = u^2 + 2as$$

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3. The maximum speed of a train is 90 km/h. It takes 10 hours to cover a distance of 500 km. Find the ratio of its average speed to maximum speed. (4 Marks)

4. Heat can be transferred from one point to another by various means. Explain the term radiation with reference to heat transfer. (2 Marks)

5. Several factors determine the pressure of fluids. State THREE main quantities that affect the pressure of a fluid. (3 Marks)

6. The concept of friction has many applications in most engineering settings. Outline any

FOUR the friction between two moving bodies which are in contact to each other. (4 Marks)

7. State TWO differences between centrifugal force and centripetal force. (2 Marks)

8. A car travelling at speed of 108km/h suddenly applies the brake with the deceleration of 5m/s^2 . Find the stopping distance of the car. (4 Marks)

9. Different components of a motor vehicle are made of different materials. Outline FOUR factors an engineer should consider when selecting materials for a motor vehicle. (4 Marks)

10. State THREE examples of simple machines that make work easier. (3 Marks)

11. How much heat is required to raise the temperature of 20kg of iron from 10°C to 90°C . Specific heat capacity of iron is $450\text{J/kg/}^\circ\text{C}$. (3 Marks)

12. Explain why tyres of motor vehicle have treads. (2 Marks)

13. State Boyle's law. (2 Marks)

14. Outline any TWO factors that affect magnitude of pressure of fluid at any point of a

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container.
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(2 Marks)

SECTION B: (60 MARKS)

Attempt any THREE questions in this section.

15.

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- a) A wheel is rotating at 2600 rev/min and when a brake is applied, the wheel is brought to rest with uniform retardation of 800 revolutions. Find the time taken to bring the wheel to rest and the angular retardation in rad/s^2 . (6 Marks)

- b) Briefly describe the following physical properties of constructional materials in automotive industry:

- i) Elasticity (2 Marks)
- ii) Toughness (2 Marks)
- iii) Plasticity (2 Marks)

- c) A man uses the inclined plane to lift a 50kg load through a vertical height of 4m. The inclined plane makes an angle of 30° with the horizontal ground. If the efficiency of the incline plane is 72%, calculate the:

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move the load up the inclined plane at a constant velocity.

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(4 Marks)

- ii) Work done against friction in raising the load through the height of 4m. (4 Marks)
(take $g = 9.81\text{N/kg}$)

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in the cable when the driver applies a force of 150N to the handbrake.

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(4 Marks)

- ii) The strain in the cable when it is extended by 0.6mm. (2 Marks)

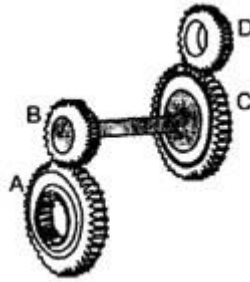
- iii) The modulus of elasticity of the cable. (2 Marks)

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- b) The figure below shows a system of gears for transmitting power. Gear A has 150 teeth and acts as the driving gear, gears B and C with 40 teeth and 100 teeth respectively are mounted on the same shaft as gear D which has 50 teeth.

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- In what direction(s) would gears C and D rotate if gear A is rotated in clockwise direction? (3 Marks)
 - Find the velocity ratio of the gear system. (5 Marks)
- c) A particle of mass 2kg is initially 3m above a table of height 1m. It is moved slowly down on to the table. Find the change in the potential energy. (4 Marks)

(take $g = 10\text{N/kg}$)

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- a) A block and tackle system is used to lift a mass of 200kg. If this machine has a velocity ratio of 5 and an efficiency of 80%;

- Sketch a possible arrangement of the pulleys, how the rope is wound.

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(3 Marks)

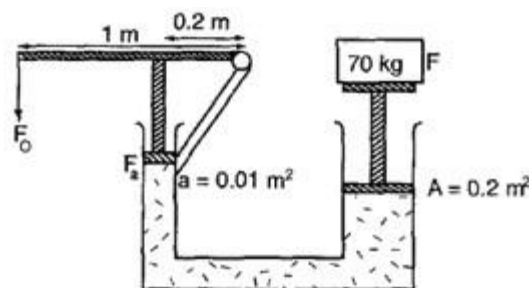
- Calculate the effort applied. (take $g = 9.81\text{N/kg}$)

(5 Marks)

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- b) The figure below shows a hydraulic press supporting a load F_0

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given (take $g = 9.81\text{N/kg}$), find:

- i) F_0 (3 Marks)
- ii) Mechanical Advantage. (2 Marks)
- iii) Efficiency. (4 Marks)

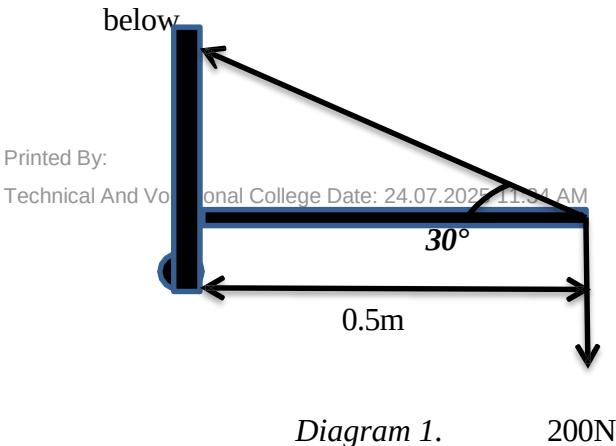
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c) A boy weighing 700 N takes 10 seconds to climb upstairs to a height of 4m. What is the average power in climbing up the height? (3 Marks)

18.

a) Determine the amount of heat energy needed to change 400 g of ice, initially at -20°C , into steam at 120°C . Assume the following: latent heat of fusion of ice is 335 kJ/kg, latent heat of vaporization of water is 2260 kJ/kg, specific heat capacity of ice is 2.14 kJ/(kg $^{\circ}\text{C}$), specific heat capacity of water is 4.2 kJ/(kg $^{\circ}\text{C}$) and specific heat capacity of steam is 2.01 kJ/(kg $^{\circ}\text{C}$). (10 Marks)

b) A rigid beam is hinged to a wall and held horizontally by a string as shown in diagram 1



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the tension in the string T in each of the following situations.

(In all calculations ignore the mass of the beam)

- i) A weight of 200N is hung from the beam as shown in diagram 1. (3 Marks)
- ii) The 200N weight is moved to the midpoint of the beam. (4 Marks)
- iii) 200N weight moved to the midpoint and another 200N at the end of the beam.

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(4 Marks)