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|-----|-----|--|---|---|---------------|---|----|
| Q.6 | i. | What is the concept of a dual brake system? Explain how it enhances safety in vehicles. | 3 | 2 | $\frac{1}{6}$ | 5 | 12 |
| | ii. | Explain the constructional details of drum brakes, including their components. How they function. | 7 | 2 | $\frac{1}{6}$ | 5 | 12 |
| | OR | iii. What is the Anti-lock Braking System (ABS)? Explain its components and how it improves vehicle safety during braking. | 7 | 2 | $\frac{1}{6}$ | 5 | 12 |

Total No. of Questions: 6

Total No. of Printed Pages: 4

Enrollment No.....



Faculty of Engineering

End Sem Examination Dec 2024

AU3CO51 Introduction to Automotive Systems

Programme: B.Tech.

Branch/Specialisation: AU

Maximum Marks: 60**Duration: 3 Hrs.**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

| | | Marks | BL | PO | CO | PSO |
|-----|------|--|----|----|---------------|-----|
| Q.1 | i. | Which of the following is NOT a type of chassis layout? | 1 | 1 | $\frac{1}{6}$ | 12 |
| | | (a) Front-engine, front-wheel drive (FF) | | | | |
| | | (b) Rear-engine, rear-wheel drive (RR) | | | | |
| | | (c) Front-engine, rear-wheel drive (FR) | | | | |
| | | (d) Side-engine, all-wheel drive (SAWD) | | | | |
| | ii. | Which of the following is a type of vehicle frame used primarily in heavy-duty trucks? | 1 | 1 | $\frac{1}{6}$ | 12 |
| | | (a) Monocoque frame | | | | |
| | | (b) Backbone frame | | | | |
| | | (c) Ladder frame | | | | |
| | | (d) Perimeter frame | | | | |
| | iii. | The condition for true rolling motion of wheels during steering includes: | 1 | 1 | $\frac{1}{6}$ | 12 |
| | | (a) No slip between the tyres and the road | | | | |
| | | (b) Tires must be inflated | | | | |
| | | (c) Wheels must be of the same size | | | | |
| | | (d) All of these | | | | |
| | iv. | What is the purpose of the kingpin inclination (KPI) in steering geometry? | 1 | 1 | $\frac{1}{6}$ | 12 |
| | | (a) To adjust wheel alignment | | | | |
| | | (b) To maintain tyre contact with the road | | | | |
| | | (c) To help in turning the vehicle | | | | |
| | | (d) To reduce tyre wear | | | | |

| | [2] | | [3] |
|-------|---|--|--|
| v. | Which type of differential is designed to allow one wheel to spin faster than the other during turns without losing power? (a) Non-slip differential (b) Locking differential (c) Limited-slip differential (d) Open differential | 1 1 1 3 6 3 1 2 | Q.2 i. Define the term "chassis" and explain its importance in vehicle design. ii. Explain the process of vehicle frame testing, particularly focusing on torsional rigidity tests. OR iii. Discuss the different materials used for vehicle frame construction, highlighting their advantages and disadvantages. |
| vi. | In a fully floating rear axle, which component supports the vehicle weight? (a) Axle shaft (b) Wheel hub (c) Differential case (d) Leaf spring | 1 1 1 3 6 3 1 2 | Q.3 i. Define the term "Front axle" and discuss its importance in vehicle dynamics. ii. What are the key aspects of front wheel geometry? Discuss the importance of caster, camber, kingpin inclination, and toe-in. OR iii. Compare and contrast the Ackermann and Davis steering systems in terms of their design and functionality. |
| vii. | What is the purpose of a shock absorber in a suspension system? (a) To support the weight of the vehicle (b) To control the oscillation of the springs (c) To increase ground clearance (d) To improve fuel efficiency | 1 1 1 3 6 4 1 2 | Q.4 i. Define driving thrust and torque reactions. How do they affect vehicle dynamics? ii. Explain the construction and operation of the Hotchkiss drive system. What are its advantages and disadvantages? OR iii. Differentiate between fully floating, three-quarter floating, and semi-floating rear axles. |
| viii. | Which type of spring is commonly used in heavy-duty vehicles due to its ability to carry large loads? (a) Torsion bar spring (b) Leaf spring (c) Coil spring (d) Air spring | 1 1 1 3 6 4 1 2 | Q.5 i. What are coil springs? How do they differ from leaf springs in terms of design and function? ii. Describe the construction and characteristics of leaf springs, including their advantages and disadvantages. OR iii. Describe independent suspension systems, including their benefits compared to dependent suspension systems. |
| ix. | What is a significant advantage of disc brakes over drum brakes? (a) Better heat dissipation (b) Lower cost (c) Simpler design (d) More components | 1 1 1 3 6 5 1 2 | |
| x. | Air brake systems are primarily used in which type of vehicle? (a) Passenger cars (b) Motorcycles (c) Heavy-duty trucks and buses (d) Electric vehicles | 1 1 1 3 6 5 1 2 | |

Marking Scheme

AU3CO51 Introduction to Automotive Systems

| | | | | |
|-----|---|----------|--|--------------------------|
| Q.1 | i) (d) Side-engine, all-wheel drive (SAWD) | 1 | Camber | 1 mark |
| | ii) (c) Ladder frame | 1 | kingpin inclination | 1 mark |
| | iii) (a) No slip between the tyres and the road | 1 | toe-in | 1 mark |
| | iv) (c) To help in turning the vehicle | 1 | OR iii. Compare and Contrast the Ackermann steering systems | 7 |
| | v) (d) Open differential | 1 | | 3.5 marks |
| | vi) (b) Wheel hub | 1 | Davis steering systems | 3.5 marks |
| | vii) (b) To control the oscillation of the springs | 1 | | |
| | viii) (b) Leaf spring | 1 | | |
| | ix) (a) Better heat dissipation | 1 | Q.4 i. Define driving thrust and torque reactions. | 2 mark |
| | x) (c) Heavy-duty trucks and buses | 1 | How do they affect vehicle dynamics? | 1 mark |
| Q.2 | i. Define the term "chassis" | 1.5 mark | ii. Explain the construction and operation of the Hotchkiss drive system. | 7 |
| | explain its importance in vehicle design. | 1.5 mark | advantages | 4 marks |
| | ii. Explain the process of vehicle frame testing particularly focusing on torsional rigidity tests. | 4 mark | disadvantages? | 1.5 mark |
| OR | | 3 mark | OR iii. Differentiate between fully floating, three-quarter floating and (Definition) floating, semi-floating rear axles. | 7 difference 1 mark each |
| | iii. Discuss the different materials used for vehicle frame construction | 4 mark | | |
| | highlighting their advantages and disadvantages. | 3 mark | | |
| Q.3 | i. Define the term "Front axle" | 1.5 mark | Q.5 i. What are coil springs | 3 |
| | Discuss its importance in vehicle dynamics. | 1.5 mark | How do they differ from leaf springs in terms of design and function | 1.5 marks |
| | | | ii. Describe the construction characteristics of leaf springs | 2 marks |
| | | | including their advantages | 2 marks |
| | | | disadvantages. | 1.5 marks |
| | | | | 1.5 marks |

Q.6 i. What is the concept of a dual brake system. 1.5 mark 3
Explain how it enhances safety in vehicles. 1.5 mark

ii. Explain the constructional details of drum brakes 7
1.5 mark
including their components. How they function.
5.5 mark

iii. What is the Anti-lock Braking System (ABS)? Explain 7
its components and how it improves vehicle safety
during braking.

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