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UNIT IV: Braking and Steering Systems

Multiple Choice Questions (MCQs)

1. In a mechanical drum brake system, what component directly forces the brake shoes outward against the rotating brake drum?

   a) Wheel cylinder pistons

   b) Cam or toggle linkage

   c) Master cylinder pushrod

   d) Caliper bridge bolt

2. What physical principle states that pressure applied to a confined static fluid is transmitted undiminished in all directions?

   a) Archimedes' principle

   b) Pascal's law

   c) Bernoulli's theorem

   d) Hooke's law

3. The secondary piston in a tandem master cylinder is actuated:

   a) Directly by the mechanical pushrod under all conditions

   b) Hydraulically by fluid pressure generated by the primary piston, or mechanically if primary pressure fails

   c) By an auxiliary electric motor wire

   d) Only when the handbrake lever is pulled

4. What is a critical requirement of a high-quality automotive brake fluid?

   a) Low boiling point to ensure rapid evaporation

b) High boiling point to prevent vapor locking under extreme heat

c) High chemical reactivity with rubber seals

d) High compressibility under high foot pressures

5. Which type of braking system utilizes compressed air stored in reservoirs to actuate diaphragm chambers at the wheels?

   a) Vacuum brake system

   b) Hydraulic brake system

   c) Pneumatic (Air) brake system

   d) Mechanical cable system

6. A vacuum booster (servo) assists the driver during braking by utilizing the pressure differential between:

   a) Atmospheric pressure and engine intake manifold vacuum

   b) Turbocharger boost pressure and exhaust backpressure

   c) Oil pump pressure and fuel pump pressure

   d) The battery voltage and alternator voltage

7. The angle that the steering axis makes with the vertical when viewed from the side of the vehicle is known as:

   a) Camber

   b) Castor

   c) Kingpin inclination (KPI)

   d) Toe-in

8. What steering geometry angle involves tilting the top of the wheels outward when viewed from the front to reduce steering effort?

   a) Negative camber

   b) Positive camber

   c) Toe-out

   d) Castor trail

9. What is the main purpose of configuring "Toe-in" on the front wheels of a rear-wheel-drive vehicle?

    a) To increase the turning radius of the vehicle

    b) To offset the natural tendency of the wheels to splay outward while moving forward

    c) To maximize body roll during high-speed cornering

    d) To allow the steering wheel to vibrate freely

10. Combined angle (also known as Included Angle) is the total angular measurement of:

    a) Camber angle plus Kingpin Inclination

    b) Castor angle plus Toe-in

    c) Slip angle plus steering lock angle

    d) Ackerman angle plus Davis angle

11. Center point steering is achieved when the extended centerline of the kingpin intersects the ground at:

    a) A point far outside the tire contact patch

    b) A point far inside the chassis centerline

    c) The exact center of the tire contact patch area

    d) The rear axle centerline

12. Why does the Ackerman steering mechanism utilize an asymmetrical steering linkage design?

    a) To allow both front wheels to turn at the exact same angle at all times

    b) To ensure the inner wheel turns at a sharper angle than the outer wheel during a turn

    c) To eliminate the need for a steering gear box

    d) To make the vehicle steer from the rear wheels

13. The Davis steering mechanism achieves mathematically perfect steering at all angles by utilizing which type of pairs?

    a) Turning pairs (pin joints) in a four-bar linkage

b) Sliding pairs (sliding blocks along a guide bar)

c) Cam and roller followers

d) Flexible cables and pulleys

14. Which steering gear type uses a helical gear on the steering shaft that meshes with a selector tooth sector or roller?

a) Rack and pinion

b) Worm and sector (or worm and roller)

c) Recirculating ball and nut

d) Epicyclic planetary gear

15. In a rack and pinion steering system, the pinion gear is attached to the base of the:

a) Tie rod

b) Steering column / shaft

c) Pitman arm

d) Track rod

16. The steering linkage component that converts the rotary output of a recirculating ball steering box into linear back-and-forth movement is the:

a) Kingpin

b) Pitman arm (Drop arm)

c) Tie rod end

d) Stub axle

17. A modern caliper assembly in a disc brake system houses the:

a) Brake drum and return springs

b) Brake pads and hydraulic pistons

c) Master cylinder pushrod

d) Metering valve and proportioner

18. Brake fade refers to:

a) The loss of paint on the brake calipers due to dirt

b) The temporary loss of braking effectiveness due to excessive heat generation under severe application

c) The slow leaks occurring inside a master cylinder reservoir

d) The sound made by worn brake pads

19. What component prevents the rear wheels from locking up before the front wheels during sudden, hard braking events?

    a) Vacuum booster

    b) Proportioning valve

    c) Tandem pushrod

    d) Wheel cylinder return spring

20. The Ackerman steering linkage satisfies the condition for true rolling alignment when the extensions of the steering knuckle track arms intersect at:

    a) The center point of the front axle

    b) The centerline of the rear axle housing

    c) The vehicle's center of gravity

    d) Infinity

Fill in the Blanks

1. In a disc brake, the rotating metallic disc that the brake pads squeeze against is called the _____.
2. The component that contains the primary and secondary fluid reservoirs and generates hydraulic pressure for the entire vehicle is the_____.
3. _____ provide an extra layer of safety by splitting the vehicle's brakes into two independent hydraulic circuits.
4. When moisture enters brake fluid, its boiling point drops significantly; this phenomenon is due to the fluid's_____ nature.
5. In air brake systems, a_____ valve cuts the air compressor in and out to maintain safe reservoir tank pressure limits.
6. The angle that a wheel's centerline makes with the vertical plane when viewed from the front is the _____ angle.
7. A directional stability effect that helps a steering wheel automatically snap back to the straight-ahead position after a turn is primarily provided by_____.
8. _____ is the configuration where the front edges of a pair of wheels are further apart than their trailing edges.

9. The angle formed between the steering axis (kingpin) and the vertical plane when viewed from the front is the _____.
10. The Ackerman steering mechanism uses _____ pairs, which makes it less prone to friction and wear compared to the Davis mechanism.
11. The Davis steering mechanism uses _____ pairs, which makes it slide along paths to maintain mathematically perfect steering geometry.
12. A steering gear assembly that uses tiny steel spheres rolling in matching internal tracks to minimize mechanical friction is the_____ gear box.
13. The structural bar that connects the left and right steering knuckles together to ensure synchronized tracking is the _____.
14. The short, independent axle shafts upon which the front steering wheels are physically mounted are called _____.
15. _____ systems utilize hydraulic pumps or electric motors to decrease the steering effort required by the driver.
16. The specific point on the ground where the extended steering axis line hits is called the_____.
17. In a hydraulic wheel cylinder, a pair of synthetic rubber_____ prevents high-pressure brake fluid from leaking past the pistons.
18. Air brake systems use a mechanical lever arm called a_____ to compensate for the wear of the brake linings.
19. The condition where the centerlines of all four wheels intersect at a single mutual point during a turn is called the condition for _____ alignment.
20. The_____ is defined as the ratio of the number of degrees the steering wheel turns to the number of degrees the front road wheels pivot.