PRACTICE EXAM 3: T3 SIMULATION (40 QUESTIONS)

DOMAIN A — CLUTCH (Questions 1–11)

1. The pilot bearing on a heavy-duty truck drivetrain is most directly responsible for:

A. Disengaging the input shaft from the flywheel during shifts

B. Supporting the front of the transmission input shaft inside the flywheel

C. Reducing wear on the clutch release bearing assembly

D. Preventing oil migration from the engine to the clutch housing

2. The clutch brake material is typically located on the:

A. Outer face of the pressure plate against the flywheel surface

B. Inner surface of the clutch housing during operation

C. Friction face of the driven disc during normal operation

D. Input shaft splines between the release bearing and transmission

3. Heavy-duty pull-type clutch internal adjustment is performed at the:

A. Pressure plate adjusting ring inside the clutch cover assembly

B. Master cylinder pushrod at the clutch pedal linkage

C. External linkage at the cross shaft and release fork

D. Driven disc hub against the input shaft splines

4. The deep reduction (low) gear in a heavy-duty transmission is most commonly used for:

A. High-speed highway operation when fuel economy is critical

B. Climbing steep grades while maintaining engine RPM

C. Starting a fully loaded vehicle from a stop on a grade

D. Engine braking during long downhill descents

5. The proper sequence for diagnosing clutch-related complaints is:

A. Verify customer concern, inspect external components, then disassemble if needed

B. Disassemble the clutch as the first step in every diagnostic procedure

C. Apply battery voltage to clutch components for diagnostic verification

D. Replace the clutch assembly as preventive maintenance during diagnosis

6. Heavy-duty clutch pressure plate spring force is typically:

A. 100 to 300 pounds of clamping force on the driven disc

B. 500 to 700 pounds of clamping force on the driven disc

C. 1,000 to 1,200 pounds of clamping force on the driven disc

D. 2,000 to 3,500 pounds of clamping force on the driven disc

7. The most accurate description of clutch disc marcel is:

A. The friction surface treatment that increases coefficient of friction

B. The wave-shaped spring between the friction facings for cushioning

C. The rivet pattern that holds friction facings to the clutch disc hub

D. The torsional damper springs in the clutch hub for engagement smoothing

8. The proper sequence for installing a clutch assembly to a heavy-duty truck flywheel is:

A. Bolt the pressure plate first, then install the disc with alignment tool

B. Install all components without alignment, then torque pressure plate bolts

C. Insert disc with alignment tool, install pressure plate, torque bolts in stages

D. Apply battery voltage to verify clutch components before installation

9. The flywheel ring gear on a heavy-duty diesel engine is engaged by the:

A. Starter motor pinion gear during cranking operation

B. Transmission input shaft during normal forward operation

C. Engine timing gear during the four-stroke cycle process

D. Clutch release bearing during pedal application sequence

10. Heavy-duty clutch facing material has typically transitioned from organic asbestos compounds to:

A. Sintered metal compounds bonded to ceramic substrate exclusively

B. Ceramic and organic non-asbestos formulations for safety reasons

C. Pure copper alloy facings for maximum heat dissipation capacity

D. Magnesium-based compounds for reduced rotational inertia

11. The release bearing on a heavy-duty pull-type clutch is positioned:

A. Outside the clutch cover and pulled forward by the release fork

B. Behind the pressure plate against the flywheel surface during operation

C. On the input shaft inside the transmission case during normal use

D. Inside the clutch cover and pulled rearward during disengagement

DOMAIN B — TRANSMISSION (Questions 12–24)

12. The Eaton Fuller 18-speed transmission contains:

A. A 5-speed main section with high/low range and splitter ratios

B. A 6-speed main section with high/low range and splitter ratios

C. A 4-speed main section with high/low range and splitter ratios

D. An 18-speed direct-drive system without range or splitter sections

13. Synchronizer rings are typically NOT used in heavy-duty manual truck transmissions because:

A. They cannot operate at the rotational speeds required for trucks

B. The lubricant requirements differ between truck and automobile applications

C. They cannot reliably handle the torque levels of medium and heavy trucks

D. They produce excessive noise during normal operating conditions

14. The proper transmission lubricant level on a heavy-duty manual transmission is verified by:

A. Reading the dipstick markings during cold engine conditions

B. Removing the fill plug and observing lubricant at the plug threshold

C. Listening for fluid movement with a stethoscope during operation

D. Applying battery voltage to the level sensor for diagnostic testing

15. The shift inhibitor function on an air-shift transmission prevents:

A. Range shifts from completing during normal forward operation

B. Splitter shifts during partial-throttle operation conditions

C. Reverse engagement during all forward gear selections only

D. Range shifts unless the main case is in the neutral position

16. The lubrication system in most heavy-duty manual transmissions uses:

A. Splash distribution from gear rotation through the lubricant pool

B. Pressurized circulation from an internal gear-driven oil pump

C. Engine oil supplied from the main oil gallery through external lines

D. Gravity feed from a reservoir mounted above the transmission case

17. AMT clutch actuators on most heavy-duty applications are powered by:

A. Hydraulic fluid from a dedicated electric pump system

B. Engine oil pressure from the main oil gallery during operation

C. Compressed air from the truck's pneumatic supply system

D. Vacuum from the intake manifold during normal operation

18. The transmission countershaft transmits power between the:

A. Output shaft and the drive yoke during normal operation

B. Input shaft and the main shaft through the gear sets

C. Auxiliary section and the main case during shift events

D. Range cylinder and the splitter cylinder during shifts

19. The electronic control of an AMT receives input from all of the following sensors EXCEPT:

A. Input shaft speed sensor on the transmission case

B. Output shaft speed sensor for vehicle speed determination

C. Shift rail position sensor for gear engagement verification

D. Coolant temperature sensor for engine fuel mixture control

20. The recommended service interval for heavy-duty manual transmission lubricant on most fleet applications is approximately:

A. Every 25,000 miles regardless of operating conditions

B. Every 50,000 to 100,000 miles for normal applications

C. Every 250,000 to 500,000 miles for synthetic lubricants

D. Lifetime fill — no service required during normal operation

21. The proper torque value for heavy-duty transmission case bolts is determined by:

A. Visual estimation based on bolt size and condition during service

B. Standard automotive torque specifications for similar bolt diameters

C. Manufacturer service information specific to the transmission model

D. Maximum torque the bolt can sustain without thread failure

22. The pneumatic shift system on a heavy-duty manual transmission requires minimum air pressure of approximately:

A. 60 to 70 PSI for proper range and splitter shift completion

B. 20 to 30 PSI for proper range and splitter shift completion

C. 100 to 120 PSI for proper range and splitter shift completion

D. 150 to 200 PSI for proper range and splitter shift completion

23. AMT software calibration updates are typically performed using:

A. Engine ECM scan tool during routine service operations

B. Battery voltage applied to specific TCM terminals for reset

C. Replacement of the TCM with a pre-programmed unit only

D. Manufacturer-specific service tool with current calibration files

24. The most accurate description of an automatic transmission's torque converter function is:

A. Mechanical gear coupling between engine and transmission

B. Hydraulic coupling that multiplies torque during initial vehicle launch

C. Electronic coupling controlled by the transmission ECM

D. Pneumatic coupling powered by the truck's air supply system

DOMAIN C — DRIVESHAFT AND U-JOINTS (Questions 25–31)

25. The slip joint on a heavy-duty truck driveshaft accommodates:

A. Length changes during normal suspension travel cycling

B. Angle changes during cornering and turning operations

C. Rotational differences between front and rear axles during turns

D. Torque variations during throttle changes during normal operation

26. The maximum allowable U-joint operating angle on most highway applications is approximately:

A. 0.5 degrees during normal highway speed operation

B. 1.5 degrees during normal highway speed operation

C. 3 degrees during normal highway speed operation

D. 7 degrees during normal highway speed operation

27. Heavy-duty truck driveshaft balancing is typically performed:

A. After every U-joint replacement during routine service

B. During driveshaft manufacturing using a balance machine

C. Annually as part of preventive maintenance procedures

D. Only when vibration symptoms appear during operation

28. The U-joint cross is mounted to the driveshaft yoke through:

A. Threaded studs that screw directly into the yoke ears for retention

B. Welded connections that permanently bond the cross to the yoke

C. Press-fit pins that secure the cross to the yoke during assembly

D. Bearing caps held by retaining straps, U-bolts, or snap rings

29. The lubrication interval for a heavy-duty truck driveshaft U-joint with a grease fitting is typically:

A. Every 100,000 miles during normal highway operation

B. Once every two years regardless of mileage accumulated

C. Every 25,000 to 50,000 miles depending on application

D. Lifetime sealed — no lubrication required during operation

30. Driveshaft tube damage that requires replacement typically includes:

A. Dents, twists, or cracks anywhere on the tube wall surface

B. Light surface scratches less than 0.020 inches in depth

C. Paint damage exposing bare metal during normal service

D. Minor surface rust that can be cleaned and refinished

31. The center support bearing on a multi-piece driveshaft typically uses:

A. A sealed ball bearing in a rubber-isolated housing mounted to the frame

B. A roller bearing requiring periodic lubrication during service intervals

C. A plain bushing with continuous oil lubrication from the engine

D. A magnetic bearing system controlled by the engine ECM during operation

DOMAIN D — DRIVE AXLE (Questions 32–40)

32. Heavy-duty drive axle ring gear and pinion mesh patterns are evaluated using:

A. Battery voltage applied to the gear surfaces for diagnostic testing

B. Stethoscope listening during slow rotation of the gear set

C. Marking compound on the ring gear teeth and observed contact pattern

D. Visual inspection of the gears under bright shop lighting only

33. The crown of a drive axle ring gear refers to:

A. The outer rim of the ring gear that mounts to the differential carrier

B. The convex contact surface of each tooth that meshes with the pinion

C. The mounting flange where the pinion attaches to the driveshaft yoke

D. The gear oil reservoir cast into the axle housing for lubrication

34. The primary purpose of differential carrier preload on a drive axle is to:

A. Increase the gear oil capacity of the differential housing assembly

B. Allow easier gear meshing during cold-weather operating conditions

C. Reduce internal friction between the spider and side gears in operation

D. Establish proper bearing seating for accurate ring gear position

35. The thrust block on some heavy-duty differential designs serves to:

A. Reduce ring gear deflection under heavy torque loading conditions

B. Apply braking force to the differential during downshift operations

C. Prevent the ring gear from rotating during the assembly process

D. Increase oil flow to the differential bearings during operation

36. The most accurate description of a no-spin differential is:

A. A locked differential that prevents any speed difference between wheels

B. A differential that allows differential action during turns but provides positive lock-up under load

C. A standard open differential with all conventional spider and side gears

D. A clutch-type differential controlled by the engine ECM during operation

37. The proper procedure for setting drive axle pinion depth is to:

A. Apply battery voltage to the pinion shaft during installation

B. Listen for proper engagement with a stethoscope during rotation

C. Reuse existing shims regardless of bearing replacement during service

D. Use shims behind the pinion bearing race per service specifications

38. Heavy-duty drive axle wheel bearings are typically:

A. Sealed ball bearings requiring no service during axle life

B. Permanently lubricated with grease in a sealed assembly

C. Tapered roller bearings requiring periodic lubrication and adjustment

D. Plain bushings with engine oil supplied through the axle housing

39. The proper procedure when servicing drive axle wheel bearings includes:

A. Cleaning, inspection, lubrication with proper grease, and torque adjustment

B. Replacement as preventive maintenance regardless of inspection findings

C. Visual inspection only without any removal from the axle assembly

D. Application of battery voltage for diagnostic testing during service

40. The primary function of the differential side gears is to:

A. Drive the spider gears during all operating conditions

B. Transmit torque from the spider gears to the axle shafts

C. Mount the ring gear to the differential carrier assembly

D. Carry the pinion bearing preload during normal operation

ANSWER KEY AND EXPLANATIONS

DOMAIN A — CLUTCH

1. B — The pilot bearing supports the front end of the transmission input shaft inside the flywheel center, maintaining alignment between the input shaft and the engine crankshaft. Without this support, the input shaft would deflect during operation, damaging the clutch disc hub and front transmission bearings.

2. D — The clutch brake is a friction component installed on the input shaft splines between the release bearing and the transmission case. When the pedal is pushed fully to the floor, the release bearing contacts the clutch brake to stop input shaft rotation, allowing engagement of starting gears from a stop.

3. A — Heavy-duty pull-type clutches use an internal adjusting ring inside the clutch cover assembly. The technician rotates the ring to adjust the position of the pressure plate fingers relative to the release bearing, restoring proper free travel as the clutch facings wear over time.

4. C — Deep reduction provides the highest mechanical advantage for moving heavy loads from a complete stop, particularly on grades where additional starting torque is needed. It is not used for sustained climbing, highway operation, or engine braking — those tasks use higher gears or specialized braking systems.

5. A — The proper diagnostic sequence begins with customer concern verification, then progresses through external inspection (pedal travel, linkage condition) before any disassembly. This sequence prevents unnecessary teardown by identifying problems that can be confirmed without major labor investment.

6. D — Heavy-duty clutch pressure plate spring forces typically range from 2,000 to 3,500 pounds depending on design and torque capacity. This high clamping force allows the clutch to transmit the high engine torque produced by medium and heavy duty diesel engines without slipping under load.

7. B — Marcel refers to the wave-shaped spring steel between the two friction facings on a clutch disc. This spring cushions the engagement, reducing shock loading on the drivetrain when the clutch is released. Worn or collapsed marcel produces harsh engagement and accelerated drivetrain wear.

8. C — Proper clutch installation begins with positioning the disc using an alignment tool, followed by the pressure plate, with bolts torqued in stages in a star pattern. This sequence ensures the disc remains centered on the pilot bearing for transmission installation and even clamping force across the assembly.

9. A — The flywheel ring gear is engaged by the starter motor pinion gear during cranking. The starter advances its pinion into mesh with the ring gear, then drives the engine through the cranking RPM range. Once the engine starts, the pinion retracts away from the ring gear.

10. B — Heavy-duty clutch facing materials transitioned from organic asbestos compounds to ceramic and organic non-asbestos formulations to address asbestos-related health hazards. Modern formulations provide equivalent or better friction performance and heat resistance without the safety concerns of asbestos materials.

11. D — Pull-type clutch release bearings are positioned inside the clutch cover and pulled rearward (away from the flywheel) by the release fork during disengagement. This is the opposite of push-type designs where the release bearing is pushed forward toward the flywheel for disengagement.

DOMAIN B — TRANSMISSION

12. A — The Eaton Fuller 18-speed transmission uses a 5-speed main section combined with high/low range and splitter ratios. The combination produces 18 forward gears: 5 main case ratios × high/low range × splitter, providing fine ratio steps for matching engine power to load conditions.

13. C — Heavy-duty manual truck transmissions transmit torque levels far beyond what passenger car-style synchronizers can handle reliably. Synchronizers in this class of equipment would wear out rapidly under the torque loads, so non-synchronized designs requiring double-clutching are used instead.

14. B — Manual transmission lubricant level is verified by removing the fill plug on the side of the case and observing whether lubricant is at the plug threshold. The fill plug is positioned at the proper level mark; if lubricant flows out, level is correct, if not, lubricant is added until it reaches the threshold.

15. D — The shift inhibitor (slave valve) prevents range shifts unless the main case is in the neutral position. This protection prevents range shift attempts under load, which would damage the auxiliary planetary gears that cannot complete the shift while transmitting torque.

16. A — Most heavy-duty manual transmissions use splash lubrication where rotating gears throw oil from the lubricant pool throughout the case interior, distributing it to bearings, gears, and shift components. Some designs add internal pumps for specific high-stress components, but splash distribution is the primary lubrication mechanism.

17. C — AMT clutch actuators on most heavy-duty applications use compressed air from the truck's pneumatic supply system. The pneumatic actuator extends and retracts to control clutch engagement during shifts, with the TCM controlling pneumatic valves that direct air to the actuator.

18. B — The countershaft transmits power between the input shaft and the main shaft through gear meshes. Engine torque enters via the input shaft, transfers to the countershaft through a constant-

mesh gear set, then transfers to the main shaft through whichever gear pair is engaged for the selected ratio.

19. D — The ECT sensor provides input for engine fuel mixture control to the engine ECM, not the AMT TCM. The TCM uses input shaft speed, output shaft speed, shift rail position, and clutch position sensors to manage shift operation. Engine and transmission ECMs share information across the data bus but use different sensor inputs for their respective functions.

20. C — Synthetic lubricants in modern heavy-duty manual transmissions allow extended drain intervals of 250,000 to 500,000 miles for normal applications. Earlier designs with conventional lubricants required more frequent service. Severe-duty applications use shorter intervals to manage contamination from extreme operating conditions.

21. C — Manufacturer service information specifies torque values for transmission case bolts based on bolt grade, thread pitch, and case material. Standard automotive specifications and visual estimation are inadequate for heavy-duty equipment because incorrect torque can cause case distortion, leakage, or bolt failure.

22. A — The pneumatic shift system requires minimum air pressure of approximately 60 to 70 PSI for proper range and splitter shift completion. Below this pressure, the cylinders cannot generate enough force to complete shifts, producing shift problems that manifest as failure to engage the selected range or splitter position.

23. D — AMT software calibration updates require manufacturer-specific service tools with current calibration files. The TCM contains complex logic that requires specialized programming equipment, not standard scan tools. The service tool flashes the TCM with updated calibration that addresses recent issues or improves performance.

24. B — A torque converter is a hydraulic coupling that multiplies torque during initial vehicle launch. The converter contains a pump (driven by the engine), a turbine (driving the transmission), and a stator that redirects fluid flow. The fluid coupling allows engine torque to multiply during launch, improving startability under heavy loads.

DOMAIN C — DRIVESHAFT AND U-JOINTS

25. A — The slip joint accommodates length changes during normal suspension travel as the rear axle moves up and down relative to the transmission. As the suspension cycles, the distance between the transmission output and the axle pinion changes, with the slip joint allowing the driveshaft length to adjust accordingly.

26. C — The maximum allowable U-joint operating angle on most highway applications is approximately 3 degrees during normal highway speed operation. Angles beyond this specification cause excessive U-joint wear, vibration, and reduced component life. The specific allowable angle decreases as RPM increases.

27. B — Driveshaft balancing is typically performed during manufacturing on a balance machine, with weights welded to the tube to correct any imbalance. Field rebalancing is sometimes required after major service, but most driveshafts maintain factory balance throughout their service life if components are serviced properly.

28. D — U-joint crosses are mounted to the driveshaft yokes through bearing caps held in place by retaining straps, U-bolts, or snap rings depending on the design. The bearing caps fit into the yoke ears, with the cross trunnions inserted into needle bearings inside each cap. Retainers prevent the caps from working loose during operation.

29. C — Greaseable U-joints typically require lubrication every 25,000 to 50,000 miles depending on the application. Severe-duty applications may require shorter intervals. Sealed (non-greaseable) U-joints provide longer life but cannot be re-lubricated when symptoms appear, requiring replacement instead.

30. A — Driveshaft tube damage requiring replacement includes dents, twists, or cracks anywhere on the tube wall surface. These conditions affect balance, structural integrity, or both. Light surface scratches and minor surface rust do not require replacement; only damage that affects the tube's structural integrity or balance condition requires service.

31. A — Center support bearings typically use a sealed ball bearing in a rubber-isolated housing mounted to the frame crossmember. The rubber isolation reduces vibration transmission to the chassis while supporting the driveshaft. The sealed bearing requires no service during normal operation.

DOMAIN D — DRIVE AXLE

32. C — Ring gear and pinion mesh patterns are evaluated by applying marking compound (typically a colored gear marking compound) to the ring gear teeth and rotating the gear set to observe the contact pattern that develops. The pattern indicates whether mesh is correct or whether shim adjustments are needed to correct the contact position.

33. B — The crown of a ring gear tooth is the convex contact surface of the tooth that meshes with the pinion. Proper crown geometry is essential for distributing load across the tooth face during mesh, preventing concentrated stresses that would lead to early gear failure.

34. D — Differential carrier preload establishes proper bearing seating that maintains accurate ring gear position relative to the pinion. The preload prevents bearing movement under load that would change ring gear position and disrupt the mesh pattern, producing noise and accelerated wear.

35. A — The thrust block on some heavy-duty differential designs reduces ring gear deflection under heavy torque loading. Without the thrust block, the ring gear can deflect away from the pinion under load, producing improper mesh and accelerated wear. The thrust block contacts the back of the ring gear under heavy load, limiting deflection.

36. B — A no-spin differential allows differential action during turns (when load on one wheel is light) but provides positive lock-up under load, sending power to both wheels. This design provides better traction than an open differential without the highway-speed problems of a fully locked differential.

37. D — Pinion depth is set using shims behind the pinion bearing race per service specifications. The shim thickness positions the pinion at the correct depth relative to the ring gear for proper tooth contact. Incorrect depth produces poor mesh patterns and gear noise that worsen progressively with operation.

38. C — Heavy-duty drive axle wheel bearings are typically tapered roller bearings requiring periodic lubrication and adjustment. The tapered design handles both radial and thrust loads, supporting the weight of the loaded axle and the axial forces during cornering. Lubrication and adjustment per TMC RP 618 maintain proper bearing life.

39. A — Drive axle wheel bearing service includes cleaning to remove old grease and contamination, inspection for wear or damage, lubrication with proper grease for the application, and torque adjustment to specification per TMC RP 618. Each step is essential to ensure proper bearing function and service life.

40. B — Differential side gears transmit torque from the spider gears to the axle shafts. The spider gears provide differential action by allowing the side gears to rotate at different speeds during turns, while the side gears couple to the axle shaft splines to deliver power to each wheel.