TECHNICAL REPORT ON

STUDENT INDUSTRIAL WORK EXPERIENCE SCHEME

(S.I.W.E.S)

UNDERTAKING AT

TITILOPE TECHNICAL ENGINEERING SERVICE TAKI SEKONI AREA OGBOMOSHO OYO STATE

BY

SOLOMON IFEOLUWA ISAIAH

ND/23/MEC/PT/0107

DEPARTMENT OF MECHANICAL ENGINEERING INSTITUTE OF TECHNOLOGY

KWARA STATE POLYTECHNIC

SUBMITTED IN PARTIAL FULFILMENT OF THE AWARD OF
NATIONAL DIPLOMA (ND)

IN MECHANICAL ENGINEERING

MARCH 2025

ACKNOWLEDGEMENTS

My appreciation goes to God almighty, through the help of the Holy Spirit made me to choose mechanical engineering as my discipline.

To paraphrase an actor who just won an Emmy, “there are so many people to thank”. However, I will like to thank the Industrial Training Fund for their foresight in putting this program to place and also to the Mechanical Engineering department, Kwara State Polytechnic, for providing the platform on which was engaged in the training.

I want to say a big thank you to my industrial based Supervisor, Eng. Titilope John who helped with solutions to my numerous questions. I am grateful to Titilope Technical Engineering service for providing with the opportunity to be exposed to engineering services to the automobile industry.

I also want to thank my parent, brother and sister for their encouragement all through my Industrial Training period and also appreciate my uncle for their effort to ensure I get a placement, also for their moral and financial support.

CHAPTER ONE

INTRODUCTION TO TRAINING PROGRAM

1.0: PURPOSE OF TRAINING

The Student Industrial Work Experience Scheme (SIWES) was initiated in 1973 by the Industrial Training Fund (ITF). This was to update practical knowledge of students in the Universities, Polytechnics and Colleges of Technology. It was aimed at bridging the gap between the theoretical knowledge acquired in classes and the technical knowledge acquired in the industry by providing students with the opportunities to apply their educational knowledge in real working situations.

Over the years, SIWES has contributed immensely to building the common pool of the technical and allied skills available in the Nigeria economy which are needed for the national's industrial development.

Furthermore, the place and relevance of SIWES is underscored by the fact that the scheme contributes to improving the quality of technical skills generally available in the pool from which employer's source technical manpower. Its gives student the opportunity to blend the theoretical knowledge acquired in the classroom and with practical hands on the application of knowledge required to perform work in the industry. Also it prepares students for employment and makes the transition from school to the world of work easier after graduation.

I undertook my Siwes at Titilope Technical Engineering service which is located at Taki Sekoni area Ogbomosho Oyo state

1.1: ESTABLISHMENT'S PROFILE

The establishment was founded in 2009 by the current Chairman/CEO Eng. Awire Seun it has staff strength of approximately. Titilope Technical Engineering service located at Taki Sekoni area Ogbomosho Oyo state

. It is an indigenous establishment that deals with Mercedes Benz vehicles such as, salon car, station wagon, jeep, bus and pickups. Though not equipped with the latest technology available in developed parts of the world, however with its equipment and tools it had been carrying out proper servicing and maintenance of customer's vehicle. Titilope Mechanic Workshop is made up of four (4) major Departments which are Sales department, Service and Maintenance department, Body and Paint department and Spare parts department.

1.2: ESTABLISMENT'S CORPORATE GOAL

Titilope Technical Engineering service goal to our clients is to fix your vehicle to the proper working condition in a clean and professional environment, so that you are happy and satisfied with the service that was performed. We also want you to have the trust and confidence in us that you are being treated honestly and fairly.

Also to have the freedom to approaches us at any time with any questions or concerns with the service that you are receiving.

The goal to my employees is to provide them with the best working conditions possible with the proper tools and equipment to repair our client's vehicles. This in turn gives them the privilege to associate, satisfied and dedicated to clients. Also, for the employees to have the freedom to prove the personal ability to the employer.

CHAPTER TWO

THE TRAINING PROGRAM

2.0: DESCRIPTION OF WORKDONE

During my stay in Titilope Technical Engineering service, I was assigned to the service and maintenance department as a Diagnosis and Mechanical Technician. Job duties in the department includes keep equipment available for use, inspecting and testing vehicles, completing preventive maintenance such as engine tune-ups, oil changes, replacing filters and wheel balancing.

Maintain vehicle functional condition by listening to operator complaints; conducting inspections, repairing engine failures, repairing mechanical systems malfunctions; replacing parts and components.

Verifies vehicle serviceability by conducting, test drives; adjusting controls and systems.

2.1: AUTOMOTIVE MECHANICAL SYSTEMS

2.1.0: ENGINE

Internal combustion engines run on a mixture of fuel and air, the core of the engine is the cylinder, with the piston moving up and down inside the cylinder and this takes place in a four stroke process, which are intake, compression, Power and Exhaust.

The piston moves down on the intake stroke, the intake valve is open and the fuel air mixture is admitted into the cylinder, and the piston moves up during the compression with stroke both valves are closed, compresses the trapped fuel air mixture that was brought during the intake stroke, thereafter the spark plug fires, igniting the compressed air fuel mixture which produces a powerful expansion of the vapor which is used to drive the crankshaft and this is the power stroke. Finally, during the exhaust stroke, where the piston is at the bottom of the cylinder the exhaust valve opens to allow the burned gas to be expelled to the exhaust system.

2.1.0.1: ENGINE TYPES

The majority of engines in motor vehicles today are four stroke, spark ignition internal combustion engines.

There are several engine types which are identified by the number of cylinders and the way the cylinders are laid. Straight line cylinders have their cylinders in row while the “V” arrangement uses two banks of cylinders side-by-side and it’s commonly used in V-6.

2.1.0.2: PART OF ENGINE

Some automobile engine parts include; spark plug, valves, piston, piston ring, connecting rod, crankshaft, sump, camshaft, carburetor, timing belt, crankshaft pulley.

2.1.0.2.0: SPARK PLUG

The spark plug supplies the spark that ignites the air and fuel mixture so that combustion can occur. The spark must happen at just the right moment for this to work properly. **2.1.0.2.1: VALVES**

The intake and exhaust valves open at the proper time to let in air and fuel and to let out exhaust. A valve is a device that regulates direct or controls the flow of a fluid (or gas) by opening, closing, or partially obstructing various passageways.

2.1.0.2.2: PISTON

Piston is a cylindrical piece of metal that moves up and down inside the cylinder. The piston is an essential part of the internal combustion engine which converts the fuel which you use to fill up your car into energy to drive the car forward. It is a moving component which is used to transfer the force from the gas which expands in the cylinders to the crankshaft to turn the wheel.

2.1.0.2.3: PISTON RINGS

Piston rings provide a sliding seal between the outer edge of the piston and the inner edge of the cylinder. The rings serve two purposes.

* They prevent the fuel and air mixture and the exhaust in the chamber from leaking into the sump during compression and combustion.

* They keep oil in the sump from leaking into the combustion area where it would be burn and lost.

2.1.0.2.4: CONNECTING ROD

The connecting rod connects the piston to the crankshaft, it rotates at both ends so that its angle can change as the piston moves and the crankshaft rotates. A connecting rod is an engine component that transfers motion from the piston to the crankshaft and functions as a lower arm. Connecting rods are commonly made from cast aluminum alloy and are designed to withstand dynamic stresses from combustion and piston movement.

2.1.0.2.5: CRANKSHAFT

The crankshaft turns the piston's reciprocating motion in the cylinder into circular motion. The crankshaft rotates within the engine block through use of main bearings, and the crankpins rotate within the connecting rod bearings.

2.1.0.2.6: SUMP (OIL PAN)

The sump surrounds the crankshaft. It contains some amount of oil, which collects in the bottom of the sump. The oil pan or sump is a metal dish which covers the bottom of the engine block and holds the engine oil when it is not circulating around the engine. The oil pump has a pickup tube that dangles into the sump and sucks up oil, once used, the engine oil drops back into the sump.

2.1.0.2.7: CAMSHAFT

The camshaft in an internal combustion engine makes it possible for the engine's valve to open and close, the asymmetrical lobes of the camshaft correspond to the engine valves.

2.1.1: LUBRICATING SYTREM

Oil is the life-blood of the engine. An engine running without oil will last about as long as human without blood. Oil is pumped to all the moving parts of the engine by and oil pump. The oil pump is mounted at the bottom of the engine in the oil pan and is connected by a gear to either the crankshaft or camshaft. This way, when the engine is running the pump is pumping simultaneously. There is usually an oil pressure sensor near the oil pump that monitors pressure and sends this information to a warning light on the dash board (this features is found in modern cars as it might be in your car), when the ignition key is turned on, but before the car is started the oil light should light, indicating that there is no oil pressure yet, but also letting you know that the warning system is working.

2.1.2: COOLING SYSTEM

A car engine produces enormous amount of heat when it is running, and must be cooled continuously to avoid engine damage, generally this is done by circulating coolant liquid usually water mixed with an antifreeze solution through special passages.

2.1.1.0: HOW THE COOLING SYSTEM WORK

Actually there are two types of cooling system found on motor vehicles: liquid cooled and air cooled. Air cooled engines are found on a few older cars, but for most part, automobiles and trucks

use liquid cooling systems and that is what this write up will concentrate on subsequently. The cooling system is made up of the passages inside the engine block and heads, water pump to circulate the coolant, a thermostat to control the temperature of the coolant, a radiator cap to control the pressure inside the system, and a plumbing consisting of interconnecting hoses to transfer the coolant from the engine to the radiator and also to the car's system where hot coolant is used to warm up the vehicle's interior on a cold day. A cooling system works by sending a liquid coolant through passages in the engine block and heads.

As the coolant flows through these passages, it picks up the heated fluid then makes its way through a rubber hose to the radiator in the front of the car. As it flows through the thin tubes in the radiator, the hot liquid is cooled by the air stream entering the engine compartment from the grill in front of the car.

Once the fluid is cooled, it returns to the engine to absorb, core heat. The water pump has the job of keeping the fluid moving through this system of plumbing and hidden passages. In order to prevent the coolant from boiling, the cooling system is designed to be pressurized, under pressure the boiling point of coolant is raised considerably. However, too much pressure will cause hose and other parts to burst, so a system is needed to relieve pressure if it exceeds a certain point and this is job of radiator cap.

2.1.3: TRANSMISSION SYSTEM

A car transmission is simply the assembly of parts, including the gears and the propeller shaft that transmit the power from the engine to the axle. There are two kinds of transmission: Automatic and Manual Transmission

AUTOMATIC TRANSMISSION:

It is a type of motor vehicle transmission that automatically changes the gear ratio as the vehicle moves, meaning that the driver does not have to shift the gears manually. Like other transmission systems on vehicle, it allows an internal combustion engine best suited to run at a relatively high rotational speed to provide a range of speed and torque outputs necessary for vehicle travel. Automatic transmissions are commonly used instead of manual transmissions; common types of automatic transmissions are the hydraulic automatic transmission, automated manual transmission, dual-clutch transmission and the continuously variable transmission (CVT). The number of forward gear ratios is often expressed for automatic transmissions as well.

MANUAL TRANSMISSION:

A manual transmission, also known as a manual gearbox, a standard transmission, stick shift, or simply stick, or gearbox, is a type of transmission used in motor vehicle applications. It uses a driver-operated clutch, usually engaged and disengaged by a foot pedal or hand lever, for regulating torque transfer from the engine to the transmission; and a gear selector that can be operated by hand.

A conventional 5 or 6 speed manual transmission is often the standard equipment in a modern base model vehicle, with 5 speed being common on lower end vehicles and commercial vehicles. Higher end vehicles, such as sports cars and luxury cars are often usually equipped with a 6 speed transmission for the base model.

MANUAL Vs AUTOMATIC TRANSMISSION: Manual transmissions typically run longer and are cheaper to fix and repair when compared to automatic transmissions. Nonetheless, many people still prefer automatic transmission because of their ease of use. Manual transmissions are more affordable and more traditional as well. We'll dive into the various factors with the cost of repairing or replacing a transmission later, as well as many problems that can result, which will require you to repair or replace them. After all, transmissions are not everlasting and like any part of the car, they need fixing on time or another and it's better to do it when you know approximately what is required and how much it will cost you.

2.1.3.0: MAIN COMPONENTS OF A TRANSMISSION

2.1.3.0.1: TRANSMISSION CONTROL MODULES

One of the main parts of a transmission is transmission control modules; it controls the automatic transmissions, but is nonexistent in manual transmissions.

2.1.3.0.2: TRANSMISSION FILTERS

Another important component of transmissions is filters. Transmission depend on transmission fluid, s coolant that allows the clutch to engage and disengage, gears to change, valves to open and close, and so on. The filters ensure that any outside particles or substances are not mixed in with the fluid.

2.1.3.0.3: TRANSMISSION SHAFTS

Transmissions are also connected to the engine crankshaft by means of a flywheel, since the combustion engine inside the transmission cannot go below a particular speed. Therefore, the output of the transmission is done via the driveshaft, hence the name drive wheels of a car.

2.1.4: BRAKING SYSTEM

The automotive braking system is a group of mechanical, electronic and hydraulic activated components which use friction/heat to stop a moving vehicle. A braking system is designed to slow and halt the motion of vehicle.

To do this, various components within the braking system must convert vehicle's moving energy into heat. This is done by using friction. Friction is the resistance to movement.

2.1.4.0: HOW THE AUTOMOTIVE BRAKING SYSTEM WORK

The brake pedal is depressed the pressure on the brake pedal moves a piston in the master cylinder, forcing the brake fluid from the master cylinder through the brake lines and flexible hoses to the calipers and wheel cylinders. The force applied to the brake pedal produces a proportional force on each of the pistons. The calipers and wheel cylinders contain pistons, which are connected to a disc brake pad or brake shoe. Each output piston pushes the attached friction material against the surface of the rotor or wall of the brake drum, thus slowing down the rotation of the wheel. When the pressure on the pedal is released, the pads and shoes return to their release positions. This action forces the brake fluid back through the flexible hose and tubing to the master cylinder.

2.1.4.1: COMPONENTS OF AUTOMOTIVE BRAKING SYSTEM

2.1.4.1.0: BRAKE DISC

Brake disc are comprised of a disc or rotor, a caliper assembly, disc brake pads and the wheel bearings and hardware necessary to mount the components on the here it is created through hydraulic lines to the vehicle. The caliper is connected to the master cylinder through tubes, hoses and valves that conduct brake fluid through the system.

2.1.4.1.1: BRAKE DRUM

Brake drums are comprised of a drum and backing plate, a hub or axle assembly, brake shoes, wheel cylinder, wheel bearings and hardware necessary to mount these components on the vehicle. The wheel cylinder is connected to the master cylinder through tubes, hoses and valves that conduct brake fluid through the system.

2.1.4.1.2: BRAKE FLUID

Brake fluid is a type of hydraulic fluid used in brake applications for automobiles and light trucks. It is used to transfer force under pressure from where it is created through hydraulic lines to the

braking mechanism near the wheels. Braking applications produce a lot of heat so brake fluid must have a high boiling point to remain effective and must not freeze under operating conditions.

2.1.5: FUEL SYSTEM

The fuel system is critical in storing and delivering the gasoline or diesel fuel your engine needs to run. Think of it as your vascular system, with a heart (fuel pump), veins (fuel lines) and kidneys (filter). A failure in any of these fuel system components has the same devastating effects as in your body.

2.1.5.0: COMPONENTS OF THE FUEL SYSTEM

2.1.5.0.1: FUEL TANK

Basically a holding tank for your fuel. When you fill up at a gas station the gas travels down the filter tube and into the tank. In the tank there is a sending unit which tells the gas gauge how much gas is in the tank. Some fuel thank houses the fuel pump and has more emissions controls to prevent vapors leaking into the gas

2.1.5.0.2: FUEL PUMP

On newer cars the fuel pump is usually installed in the fuel tank. Older cars have the fuel pump attached to the engine or on the frame rail between the tank and the engine. If the pump is in the tank or the frame rail then it is electric and is driven by your car battery. Fuel pumps mounted to the engine use the motion of the engine to pump the fuel, most often being driven by the camshaft, but sometimes the crankshaft.

2.1.5.0.3: FUEL FILTER

Clean fuel is critical to engine life and performance. Fuel injectors and carburetors have tiny openings which clog easily so filtering the fuel is a necessity. Filters can be before or after the fuel pump. They are most often made from a paper element, but can be stainless steel or synthetic material and are designed to be disposable in most cases. Some performance fuel filters will have washable mesh, which eliminated the need for replacement

2.1.6: SUSPENSION SYSTEM

Suspension is the term given to the system of shock absorbers and linkages that connect a car to its wheels. The suspension system has two basic functions:

1) To keep the car’s wheels in firm contact with the road to provide the traction

2) To provide a comfortable ride for the passengers and isolate them from road noise, bumps and vibrations.

2.1.6.0: COMPONENT OF THE SUSPENSION SYSTEM

The basic components of a suspension system are as follows:

- Control Arms and Bushing: Holds the steering knuckle, bearing system, or axle housing in position, as the wheel moves up and down. The outer end of the control arm has a ball joint and inner end has bushings. Vehicles, having control arm on the rear suspensions may have bushings at both ends. The control arm bushing act as bearings, which allows the control arm to move up and down the shaft bolted to the frame or suspension unit.
- Shock Absorbers and Struts: Shock absorbers are necessary because springs do not settle down fast enough. After the spring has been compressed and released. It continues to shorten and lengthen for a time; such spring action on a vehicle would produce a very bumpy and uncomfortable ride. It would also be dangerous because a bouncing wheel makes the vehicle difficult to control; therefore a dampening device is needed to control the spring.
- Ball Joints: The ball joints are connections that allow limited rotation in every direction and support the weight of the vehicle. They are used at the outer ends of the control arm where arms attach to the steering knuckle. In operation, the swiveling action of the ball joints allows the wheel and steering knuckle to be turned left or right and to move up and down with changes in road surface.
- Strut Rods: The strut road fastens to the outer end of the lower control arm and to the frame. This prevents the control arm form swinging toward the rear or front of the vehicle. The front of the strut rod has rubber bushings that soften the action of the strut rod. These bushings allow a controlled amount of lower control arm movement while allowing suspension to travel.
- Spring bar limits the body roll of the vehicle during cornering
- Spring supports the weight of the vehicle, permits the control ram and wheel to move up and down. It also helps in isolation of vibration.

2.1.7: STEERING SYSTEM

The direction of motion of a vehicle is controlled to a desired direction. When the driver turns the steering wheel, a shaft from the steering column turns a steering gear. The steering gear moves tie rods that connect to the front wheels. The tie rods move the front wheels of the vehicle to right or left. Steering system, steering wheel, gears linkages and other components used to control the direction of a vehicle motion, because of friction between the front tires and the road,

especially in parking, effort is required, and the wheel is connected through a system of gears to components that position the front tires.

2.1.7.0: TYPES OF STEERING SYSTEMS

1) Standard mechanical (reciprocating ball) steering can be either power-assisted or non-power. The steering wheel is connected to the steering box through the steering column. The steering box turns the rotation of the steering wheel 90o and, in the case of power steering, uses high-pressure fluid to help actuate the steering. The steering box has an arm attached to the output shaft called the pitman arm. This connects the steering to the steering gear.

The pitman arm is connected to one end of the center link (drag link). On the other end of the center link is an idler arm. Between the idler and pitman arms, the drag link is supported in the proper position to keep the left and right wheels working together.

The inner tie rod ends are attached to each end of the center link and provide points for the steering gear. From there it goes to the outer tie rod ends through an adjustment sleeve. This sleeve joins the inner and outer tie rod ends together and allows for adjustment when the front wheels are aligned. The outer tie rods ends are connected to the steering knuckle that actually turns the front wheels. The steering knuckle has an upper and lower ball joint on which it pivots and creates the geometry of the steering axis.

2) Rack and Pinion Steering is almost always power assisted, although there are cases where it is not. Rack and pinion steering, on the other hand, basically combines the steering box and drag link into one unit. The steering wheel, through the steering column, is directly connected to the rack. Inside the steering rack is a pinion assembly that moves a toothed piston which in turn moves the steering gear. One end of the inner tie rod ends is connected to each of this piston and the other end is connected directly to the outer tie rod end. The inner tie rod end is actually threaded into the outer tie rod end and can be rotated to make adjustments during a wheel alignment.

The advantage of rack and pinion steering is that it’s more precise than mechanical system. By reducing the number of parts and pivot points, it can more accurately control wheel direction, making the steering move responsive. The disadvantage of a rack and pinion steering system is that it’s prone to leakage, requiring replacement of the steering rack assembly.

2.1.7.1: COMPONENTS OF STEERING SYSTEM

- Power Steering fluid reservoir
- Power Steering Pump

- Rack and Pinion steering gear
- Steering Wheel
- Pitman Arm
- Steering Box
- Tie rod and Track rod
- Steering Column and Knuckle
- Drag Link
- Steering Shaft

CHAPTER THREE

3.0: REPAIR AND MAINTENANCE PROCESS

Mechanical systems in automobiles are a little complex and some problems, may need to be serviced at the repaired shop.

3.1: SAFETY INFORMATION

Most accidents in servicing and mechanical repair involve slips, trips and falls or poor manual handling. Other causes of incidents sometimes resulting in serious injury or death include working under inadequately supported vehicles, incidents involving petrol and vehicle movement. Keeping work areas free of clutter is an important, but often overlooked, step in running a safe and productive workshop. Requiring appropriate protective gear minimizes eye and finger lacerations, which are common auto body shop injuries. Shops should purchase appropriate eyewear and make protective gloves available to prevent cuts from glass, sheet metal or other jagged objects.

3.2: TOOLS REQUIRED

1. Screwdrivers

One of the basic tools is a quality set of screwdrivers. Having multiple sizes of screwdrivers can help you get into tight spaces, and can also prevent you from stripping delicate screw heads. There are shapes galore although the most common are: Flat, Phillips, Allen, and Torx.

2. Pliers

Pliers are very universal tools. You can adjust metal parts with them, cut wires and grab objects in tight areas. There are many types of pliers, and you can get them in sets at a low price. A decent set of three-to-six pliers usually include expandable combination pliers, needle nose pliers, and wire cutters.

3. Mechanic Tool Set

Every car owner must have a toolset. Basic tool set needs to have 6mm to 19mm socket, extensions, ratchet, Allen keys. If you don't have a socket set, we highly recommend you invest in a good set as it will pay off in the long run. Once you have a toolset, you'll be able to remove all the nuts and bolts easily. Many modern vehicles also require Allen, or "hex," wrenches. These are L-shaped steel wrenches that range in length from two to six inches.

4. Wrenches

Wrenches are used on the same types of bolts as ratchets. Having both tools in correct sizes is essential. They can also be used to hold a nut while you use a ratchet to loosen the adjoining bolt. If you have to decide between metric and standard wrenches, go for metric. In metric, they start from 6mm and having them up to 21-24mm is fine.

5. Power Tools

A cordless drill or impact wrench isn't essential, but both can significantly save time. The wrench can spin off nuts that would defeat a ratchet and socket, and the drill is ideal for brushing and buffing.

6. Oil filter wrench

Changing oil is one of the simplest operations and a true money-saver. Oil filters tend to get really stiff and it is usually borderline impossible to remove them by hand. Often, when the car is worked on by professionals, the oil filter is screwed in too tight, which makes it exceedingly difficult to loosen it.

7. Oil drain and oil caddy

Changing oil and transmission liquid requires an oil caddy with enough capacity to contain the largest fluid volume anticipated. As your services expand and you're working with vehicles on lifts, a standing oil caddy that can reach the raised car will make the job easier and quicker.

8. Air compressor

An air compressor is one of the most required tools for the dyers. It serves not only to power tools like a nail gun, die grinder, paint sprayer, or impact wrench, but it is also helpful for inflating tires of all sorts (automotive, bicycle, and wheelbarrows) or even as a way to blow the dust off of your projects.

9. Jack with stands

Car jacks are very important when working under your car. The jack lifts your vehicle off the ground, and the jack stands support your vehicle while you work underneath it. If you have a large truck or SUV, you may need a heavy-duty set that can support the full weight of your vehicle to ensure your safety. That's why you should always purchase high-quality jack and stands!

10. On Board Code Reader

If you see on your dashboard some certain lights are on, then an On-Board Diagnostics reader can help you identify the issue. They are easy to use, that's why every DIYer can figure out the problem with a code reader without visiting a mechanic.

11. Vacuum Pump, Bleeder, Pressure-Testing Kit

The vacuum pump is used to test your vacuum-controlled sensors and motors or find a leaking vacuum line by plugging each one and applying a vacuum. If it holds, it's good. If you want to bleed your brakes yourself, then attach the fluid transfer bottle and vinyl tubing to the pump. Next, use the refill adapters to keep the master cylinder filled while you suck brake fluid out of the bleeder screws. Keep pumping until you see fresh fluid. You can also use the pump to flush powersteering fluids.

12. Battery charger and jumper

Very often we are faced with a problem of dead batteries or charging problems. That's why it is recommended to have a good battery charger and jumper to handle these services.

13. Tire Gauge

The tire gauge is used to indicate if your tires are over-inflated or under-inflated. Benefits of properly inflated tires include:

Prevents excessive wear

Lowers risk of a blowout

Creates a smoother ride Increases

fuel efficiency

Increases traction.

14. Flashlight

Having good visibility for DIY jobs is necessary. Sometimes you have to work in the darkness, and sometimes you need to find your way around when the power is out. In cases like these, you need a flashlight to see what you're doing.

15. Hammer set

It is recommended to get a hammer in two different sizes, a small one and a big one. The big one is to remove drum brakes, ball joints and tie rods or something that needs a little more power. The small one for other jobs where a hammer is required.

16. Creeper

The creepers were designed to save your back and keep it comfortable because of the padded surface. The six rotating caster wheels maximize mobility as you move around the floor.

17. Safety glasses

Eye protection is a necessary part of any project you take on. Safety glasses are particularly important when doing tasks that can create debris, like sawing, drilling, spraying paint or using a sealant.

18. Mechanic Gloves (Disposable and Non-disposable)

It's always good to have disposable nitrile gloves for quick in-and-out operations or when working on car interiors where old mechanic gloves can leave some grease traces. Don't get latex as they are less resistant against chemicals. That's why it is always recommended to get some better quality gloves which will protect your hands.

19. Hand cleaner

When you work on cars, your hands get dirty. Even if you are wearing gloves, your hands get sweaty, and the gloves get ripped up quick. The hand cleaner gets 90% of the nasty stuff off within seconds.

20. Service manual

You should get a service and repair manual for your car make and model. They include everything, from pictures and diagrams on how to work on the engine, ignition, cooling system, fuel system, transmission, rear axle, brakes, electrical and body, as well as maintenance periods, troubleshooting, and specifications.

3.3: TROUBLESHOOTING ENGINES

Troubleshooting is simply a process of diagnosis, or determining the exact cause of a particular problem. It is very difficult to properly repair a vehicle without a proper diagnosis. The skill to properly troubleshoot an automobile (or truck or heavy equipment) is what separates a skilled professional from a parts changer.

3.3.0: BELTS AND HOSES

Belts and hoses are essential to the cooling, air conditioning and charging systems and the engine. Don’t take these routine replacement intervals for granted because they can break down and leave you stranded.
The timing belt keeps the crankshaft and camshaft mechanically synchronized to maintain engine timing. Whether serpentine, V-belt or fan belt (the belts on the outside of the engine), they all transmit power from the front of the engine to accessories that need to be driven, such as the air conditioning, the charging system and fans. Radiator and heater hoses carry coolant to and from the engine, radiator and heater core.

3.3.0.1: ITEMS AFFECTING BELTS AND HOSES:

- Vehicle age
- Oil contamination
- Belt tension
- Failed hose clamps

3.3.0.2: SYMPTOMS

- Squeaking noise from under the hood during start-up or operation
- Coolant leaks
- Dashboard light will illuminate
- A/C System may fail
- Engine overheating
- Smell of burnt rubber

3.3.1: EMISSION SYSTEM

Car emission system keeps the engine running cleanly and efficiently in all sorts of operating conditions. A steady or flashing warning light on your vehicle dashboard indicates a problem that is currently happening and may require immediate attention. Failure to do so can reduce your gas mileage or cause your vehicle to pollute.

Emission system controls the emissions, exhaust and pollutants (including gasoline vapors escaping from the fuel tank), using an array of sensors, computerized engine controls and the exhaust components. The emission system substantially reduces harmful gases such as carbon monoxide (CO), unburned hydrocarbons (HC) and oxides of nitrogen (NOx) and by law must be maintained in operating condition.

3.3.1.0: FACTORS AFFECTING THE EMISSION SYSTEM INCLUDE:

- Driving and atmospheric conditions
- Mileage
- Vehicle age
- Type of spark plug electrode material
- Poor vehicle maintenance
- Poor quality fuel
- Damaged or worn sensors
- Dry-rotted or cracked vacuum hoses

3.3.2: ENGINE COOLING SYSTEM

The engine cooling system affects your car's overall dependability engine longevity. Cooling systems have advanced over the years with new coolant formulations and new radiator designs and materials. If you suspect a problem with your cooling system, you should check it immediately. The key parts of the cooling system remove heat from the engine and automatic transmission and dissipate heat to the air outside. The water pump circulates coolant through the engine. The coolant absorbs heat and returns it to the radiator where heat is dissipated. The thermostat regulates the coolant temperature to keep it consistent for efficient engine operation.

3.3.2.0: FACTORS AFFECTING THE COOLING SYSTEM:

- Driving habits
- Operating conditions
- Type of vehicle
- Type of coolant
- Frequency of regular maintenance such as coolant changes

3.3.2.1: SYMPTOMS

 Overheating

- Sweet smell
- Leaks
- Repeatedly need to add flud

3.3.3: EXHAUST SYSTEM

Exhaust system has come a long way from the old days of exhaust pipes and mufflers. Today, the exhaust system is safety and emissions control rolled into one. Have your car's exhaust system inspected regularly and check it immediately if you suspect any problems.

The exhaust system routes dangerous exhaust gas from the engine out and away from the car to keep from affecting the occupants. Next, the exhaust system reduces exhaust noise from the engine. The catalytic converter reduces the level of harmful pollutants in the exhaust. The oxygen sensors mounted in the exhaust system monitor the level of oxygen in the exhaust gases to maintain efficient engine operation and to monitor the converter's operation.

3.3.3.0: FACTORS AFFECTING EXHAUST SYSTEM:

1. Driving habits (short trips take their toll on exhaust system life).
2. Road conditions (salt, road spray, bumps).
3. Vehicle type
4. Age of exhaust system parts

3.3.3.1: SYMPTOMS

1. Loud noise
2. Rattling noise when starting, accelerating or braking
3. Drowsiness while driving
4. Rotten eggs smell

3.3.4: FILTERS AND FLUIDS

Filters are important to the longevity of your car and interior comfort. Maximize your car investment by replacing filters regularly.

The oil filter traps contaminants, allowing the oil to flow through the engine unrestricted. The fuel filter separates harmful contaminants that may cause problems with carburetors or intricate fuel injectors. The air filter traps dirt particles, which can cause damage to engine cylinders, walls, pistons and piston rings. The air filter also plays a role in keeping contaminants off the airflow sensor (in fuel-injected cars). The cabin filter helps trap pollen, bacteria and dust that may find their way into a car's ventilation system.

3.3.5: BRAKE PROBLEMS

Brake problems usually indicate the need for certain repairs or replacement parts, so here is a quick review of some common fixes:

3.3.5.0: LOW BRAKE FLUID

This may be the result of worn disc brake pads, or it may indicate a leak in the brake system. If the BRAKE WARNING LIGHT is also on, most likely the problem is a leak though the Brake warning light may also come on if the master cylinder reservoir has a fluid level sensor.

Leaks are dangerous because they can cause brake failure. The brake calipers, wheel cylinders, brake hoses and lines, and master cylinder all need to be inspected. If a leak is found, the defective component must be replaced. Your vehicle should NOT be driven until the leak can be repaired

3.3.5.1: LOW BRAKE PEDAL

The brake pedal may be low if the shoe adjusters on rear drum brakes are rusted or sticking and not compensating for normal lining wear. Adjusting the rear drum brakes may restore a full pedal.

But unless the adjusters are cleaned or replaced the problem will return as the linings continue to wear. Other causes include worn brake linings or a fluid leak.

3.3.5.2: SPONGY OR SOFT BRAKE PEDAL

This is usually caused by air in the brake system, either as a result of improper bleeding, fluid loss or a very low fluid level. The cure is to bleed all of the brake lines using the sequence recommended for your vehicle. Another possible cause is a rubber brake hose that is "ballooning" when the brakes are applied.

3.3.5.2: EXCESSIVE BRAKE PEDAL TRAVEL

Possible causes include worn brake linings front or rear (or both), misadjusted drum brakes, or air in the brake lines. This can be dangerous because the brake pedal may run out of travel before the brakes are fully applied. Pumping the pedal when you apply the brakes usually helps, but you need to diagnose and fix the problem.

3.3.5.3: BRAKE PEDAL SINKS TO FLOOR

This may occur while holding your foot on the brake pedal at a stop light. If the pedal goes slowly down, it means the master cylinder is not holding pressure. This is also a potentially dangerous condition because a worn master cylinder or a leak in the hydraulic system may cause the brakes to fail.

3.3.5.4: BRAKE PEDAL PULSATION

Indicates a warped brake rotor (one that is worn unevenly). The rotor needs to be resurfaced or replaced. The faces of a rotor must be parallel (within 0.0005 inch on most cars) and flat (no more than 0.003 inches of run out as a general rule on most cars and trucks, but some cars cannot tolerate any more than 0.0015 inches of run out). Excessive run out can be corrected by resurfacing the rotors in place with an on-car brake lathe, or by installed special tapered shims between the rotors and hub to correct the run out.

3.3.5.5: SCRAPING NOISE FROM BRAKES

Usually indicates metal-to-metal contact due to worn out disc brake pads (or shoes on rear drum brakes). Your vehicle needs a brake job now! In fact, it is overdue for a brake job.

Your vehicle is also dangerous to drive in this condition because it may take longer to stop. The rotors or drums will likely have to be resurface or replaced because you waited too long to replace the pads and shoes.

3.3.5.6: BRAKE SQUEAL

It can be caused by vibrations between the disc brake pads and caliper, or the pads and rotor. Harder semi-metallic brake pads tend to be noisier than non asbestos (NOA) or ceramic brake pads. The noise can usually be eliminated by replacing the old pads with new ones (ceramic pads are usually the quietest, but may not be available for some applications because the vehicle requires semi-metallic pads), and resurfacing or replacing the rotors. Installing noise dampening shims behind the pads, spraying the rotors with some type of aerosol brake noise control compound or applying a small amount of high temperature brake grease (never ordinary grease) to the backs of the pads can also help suppress noise. Also, if any pad mounting hardware such as shims or antirattle clips is missing, these should be replaced

3.3.5.7: BRAKE CHATTER

It can be caused by warped rotors or rotors that have been improperly finished. Brakes Oil, grease or brake fluid on the brake pads will cause them to slip and grab.
This may create a jerky sensation when braking. The cure is to inspect the pads for contamination, replace them if they have oil, grease or brake fluid on them, and eliminate the cause of the contamination (such as replacing a leaky brake caliper or curing a nearby oil or grease leak). Badly scored drums or rotors can also cause uneven or grabby braking. Resurfacing may be needed.

3.3.5.8: DRAGGING BRAKES

This can cause a steering pull or increased fuel consumption. The constant drag will also accelerate brake wear and cause the brakes to run hot (which can increase pedal effort and the risk of brake fade if the brakes get too hot).

Dragging brakes can be caused by weak or broken retracting springs on drum brakes, a jammed or corroded disc brake caliper piston, a floating caliper with badly corroded mounting pins or bushings (uneven pad wear between the inner and outer pads is a clue here), overextended drum brake self-adjusters or a sticky or frozen emergency brake cable.

3.3.5.9: BRAKES PULL TO ONE SIDE

If your vehicle suddenly swerved to one side when you apply the brakes, there is uneven braking side-to-side. This usually means one front brake is not working properly. The pull will be toward the side with the good brake (because it is doing all the work).

Brake pull can be caused by brake fluid, oil or grease on the brake pads, a stuck caliper, a blockage in the brake line to one of the front calipers, or sometimes loose wheel bearings. A brake pull can also be caused by different types/brands of brake pads side-to-side on the front brakes.

Different friction materials have different friction characteristics, so the brakes will pull toward the side that generates the most friction.

3.3.5.10: HARD BRAKE PEDAL

Lack of power assist may be due to low engine vacuum, a leaky vacuum hose to the brake booster, or a defective brake booster. The booster is located between the master brake cylinder and firewall in the engine compartment. Sometimes a faulty check valve will allow vacuum to bleed out of the booster causing a hard pedal when the brakes are applied. This condition can be diagnosed by starting the engine (to build vacuum), shutting it off, waiting four or five minutes, then trying the brakes to see if there is power assist. No assist means a new check valve is needed.

3.3.6: SUSPENSION ISSUES

Suspension components, including springs, shock absorbers (or struts on some vehicles), anti-roll bars, control arms and other parts, are like combat troops serving on the front lines: They take a pounding daily from pock-marked streets, railroad tracks, rain, snow, road salt, gravel, all manner of dirt and grime, and the occasional piece of scrap metal or other debris that drivers see too late to avoid.

Under those conditions, just about any suspension component can be damaged or worn out from years of abuse, resulting in a number of symptoms and/or noises that should be your wakeup call to see a car doctor. Here are some common issues vehicle owners are likely to encounter:

- Poor wheel alignment: The wheels have to be pointed in the right direction (literally) and aligned for toe-in, camber and caster. If they aren’t, your steering won’t be centered when you’re going straight and tire wear will increase. Wheels get knocked out of alignment by potholes and curbs, but getting the wheels aligned won’t fix damaged springs, controls arms or other parts that affect alignment. When you buy new tires, it’s a good idea to have the alignment checked so suspension issues don’t shorten tread life.

- Shock absorbers: They really should be called “dampers,” and when they wear out you should notice more bouncing after a bump and a whole lot of shaking going on over rough roads because they can’t keep the tires planted on the pavement. Shocks contain fluid that dampens the bouncing, and once they start to leak, performance will deteriorate.
- Springs: These are what hold the weight of the car, and as they wear they can sag or break. If your car is on level ground but one corner is lower than the others, that’s a sign of a damaged spring. You can measure the height of the corners to confirm your visual cue. You might also hear clunking noises over bumps, and the car may not corner with confidence because a damaged spring can’t control the weight it’s supporting.
- Ball joints: These are pivot points that attach the suspension to the wheels, and they absorb some of the shock from up-down movement and rotate as the steering angle changes. You’ll know they need replacing when you can hear them squeaking and creaking, especially when turning. You’ll know you waited too long if a ball joint breaks and suspension parts are dragging on the pavement. A mechanic can tell if they need replacing by the amount of wheel movement they can force by hand or, in some cases, by wear indicators on the ball joints.
- Control arms: These are hinges that hold the wheels to the frame and connect the steering to the wheels, so when you turn one the other responds. Lower control arm bushings are more prone to wear out on front-wheel-drive cars than on rear-wheel-drive cars. Bushings are rubber and/or metal parts that help absorb shock, and when they wear they can cause ride and handling problems and accelerate tire wear. So can a bent control arm. Signs of wear include clunks or rattles because the wheels move back and forth in acceleration and braking and loose, imprecise steering.

3.7: TRANSMISSION PROBLEMS

Steps 1 - Clear all the diagnostic trouble code (DTC) with an engine scan tool.

Step 2 - Start the engine and observe the MIL, if it does not illuminate continue to next step (service engine soon or check engine light.)

Step 3 - Drive the vehicle while trying to maintain a constant throttle position as it accelerates up through all four gears. If the transmission is shifting properly, it should be in 4th gear by the time you reach 45 to 50 mph on level ground. Repeat this procedure from a standing start 3 to 5 times. Rescan the power train control module (PCM) for trouble codes, if none appear the problem could have been a onetime occurrence. If a trouble code has returned repair as needed and recheck system.

PROBLEM GUIDE

1) Will not go into gear:

•Broken gear selector cable.

•Brake lock solenoid or brake light switch has failed not allowing the gear selector to move out of "Park.

•Excessively low transmission fluid (Note: If transmission is operated for an extended amount of time with a low fluid level the transmission might fail prematurely.)

•Shorted electrical component not allowing the power train control module (PCM) to control the transmission. Example: shorted fuse or vehicle speed sensor (VSS).

•Flex plate (flywheel) is broken completely not transferring engine power to the transmission.

2) Goes into gear but fades out of gear or is slipping while driving:

•Transmission fluid is low.

•Transmission clutch discs or bands are worn out or burned.

•Faulty transmission shift solenoid.

3) Goes into gear but does not shift out of first gear:

•Blown fuse to the power train control module (PCM) controller

•Faulty vehicle speed sensor (VSS)

•Shorted second gear control solenoid

•Faulty transmission controller power train control module (PCM)

TIPS AND FIXES

•When the vehicle is cold or going around corners the transmission fades in and out of gear: In most cases this means the transmission fluid is low. The transmission will lose hydraulic pressure causing the transmission to drift in and out of gear. Check your transmission fluid when the car is on flat ground with the engine idling in park, Some Chrysler products must be checked in neutral.

•Transmission is shifting too late or not at all. On most cars the transmission is controlled by the power train control module (PCM) if the vehicle speed sensor fails the power train control module (PCM) has no input so the computer will not shift the transmission properly. The best way to check the sensor is to make sure the speedometer is operating correctly, if not replace the vehicle speed sensor (VSS) and recheck.

•The transmission skips second gear, shifts from first gear to third gear and the "service engine soon" or "service engine soon" MIL is illuminated. Scan the computer to help locate the transmission control solenoid that is malfunctioning.

•Fluid Level and Leaks

•A common complaint with automatic transmissions is them leaking fluid. Leaks can occur from the output shaft seal, input shaft seal, pan gasket, fluid cooler or lines. When adding transmission fluid, do not overfill, doing so could cause the fluid to become aerated which will affect transmission operation.

•If the fluid level is low with no visible leaks, check the radiator for fluid in the coolant. The cooler inside the radiator may be leaking and cross-contaminating the radiator coolant (the coolant will be milky pink.) Also check the condition of the fluid, some discoloration and darkening is normal as the fluid ages, but if the fluid is brown or has a burnt smell it's badly overused and a transmission service is needed.

•Most transmission problems can be prevented by changing the fluid and filter (if applicable) according to manufacturer specifications. In extreme conditions installing an aftermarket auxiliary cooler parallel can be installed furthering the cooling effect. This prevents fluid overheating on vehicles used for towing or performance applications.

• Excessively low transmission fluid (Note: If transmission is operated for an extended amount of time with a low fluid level the transmission might fail prematurely.)

•Shorted electrical component not allowing the power train control module (PCM) to control the transmission. Example: shorted fuse or vehicle speed sensor (VSS)

•Flex plate (flywheel) is broken completely not transferring engine power to the transmission.

3.8: SIX STEP APPROACH

At this stage it is important to emphasize the need to be methodical. A simple but effective approach is diagnostic work know as six step approach. This six-step approach maybe, recognized as an organized approach to problem solving in general. As quoted here it may be seen that certain steps are recursive. The six steps are:

1. Collect evidence;
2. Analyze evidence;
3. Locate the fault;
4. Find the cause of the fault and remedy it;
5. Rectify the fault (if different from 4)

6. Test the system to verify that repair is correct.

CHAPTER FOUR

4.0: OBSERVATIONS AND CONTRIBUTIONS

4.0.1: OBSERVATIONS

As a student my first observation was the cognition of the difference between the school environment and the labor market, as it is a different ball game entirely.

I also observed that safety was paramount and it could easy be seen as the primary goal of every staff of the company and not only the technicians. As safety equipment and instructions were always put in place or made available at strategic locations within the company workshop to the service desks to the customer care centers to the offices to the receptions.

Neatness was also a key attribute as even though the job is usually seen as a dirty job, technicians were always admonished to be as neat as possible in their dressing and in carrying out their duties. This was further encouraged by rewarding technicians that could fully adhere to this;

The hospitality shown to customers was of another level as customers were treated with so much care and respect. From provision of free breakfast and lunch, to a brief internal training, to free medical checkup the customers were always made to feel at ease.

Communication played a vital role in the successful execution of jobs, from among personnel in a section to departments communicating with other departments present in the company and also customers with company's personnel. Good flow of information was required and as a result most jobs that were returned or problematic, come about as a result of poor communication between parties.

4.0.2: CONTRIBUTIONS

My contributions were shown in my work done and services given as a Diagnosing / Mechanical technician in the establishment, which was basically diagnosing and repair of mechanical components of automobiles. I was able to maximize the job efficiency and work output in my section, because after a couple of months my section supervisor gave me the access to work directly with the spare parts and material store department, thereby speeding up the job completion process, as he wasn't always around to attend due to official reasons. I was also able to revive the job registration process as it was slightly overlooked prior to my attachment because of the magnitude of work in the section, but after successfully reviving it, it became useful in double-checking the vehicles that came into the section and technicians that worked on them

CHAPTER FIVE

5.0: CONCLUSION AND RECOMMENDATION

5.1: CONCLUSION

My Four months industrial attachment as a junior technician at special gift technical services was a huge success and a great time of acquisition of knowledge and skills. Through my training I was able to appreciate my chosen course of study even more, because I had the opportunity to blend the theoretical knowledge acquired from school with the practical hands on application of knowledge gained here to perform very important tasks that contributed in a way to my productivity in the company. My training here has given me a broader view to the importance and relevance of Mechanical Engineers in the immediate society and the world as a whole, as I now look forward to impacting it positively after graduation. I have also been able to improve my communication and presentation skills and thereby developed good relationship with my fellow colleagues at work. I have also been able to appreciate the connection between my course of study and other disciplines in producing a successful result.

5.2: RECOMMENDATION

I use this means to make the following recommendations concerning the training of students in Industrial Attachments;

I would like to recommend that the Engineering curriculum in the Kwara State Polytechnic be adjusted such as would provide going on industrial attachments for a longer period of time as opposed to 4 months or making the program to occur twice throughout an engineering degree program.

LIST OF FIGURES


Makita
Makita
Makita