RTB | RWANDA TVET BOARD

RQF LEVEL 3

AUTLS301

AUTOMOBILE TECHNOLOGY

Engine Lubricating System Repairing

TRAINER'S MANUAL

December 2023

ENGINE LUBRICATING SYSTEM REPAIRING

2023

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KIGALI-RWANDA

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LIST OF ABBREVIATIONS AND ACRONYMS

% : Percentages

AC : Air Conditioning

BSL : British Sign Language

CBET : Competency-Based Education and Training

CO : Carbon Monoxide

COVID-19 : Corona Virus Deseases-19

Km/h **:** Kilometer per hour

Mph : Miles per hour

PPE : Personal Protective Equipment

RQF : Rwanda Qualification Framework

RTB : Rwanda TVET Board

TVET **:** Technical and Vocational Education and Training

CO_2 : Carbon Dioxide

INTRODUCTION

This trainer manual encompasses all methodologies necessary to guide you to properly deliver the module titled Engine Lubricating System Repairing. Students undertaking this module shall be exposed with practical activities that will develop and nurture their competencies. The writing process of this training manual embraced competency-based education and training (CBET) philosophy by providing practical opportunities reflecting real life situations.

The trainer manual is subdivided into learning outcomes; each learning outcome has got various topics. Trainer will start guiding a self-assessment exercise to help students rate themselves on their level of skills, knowledge and attitudes about the learning outcome or unit in their trainee manual.

The trainer manual will give trainer the information about the objectives, learning hours, didactic materials, proposed methodologies and crosscutting issues.

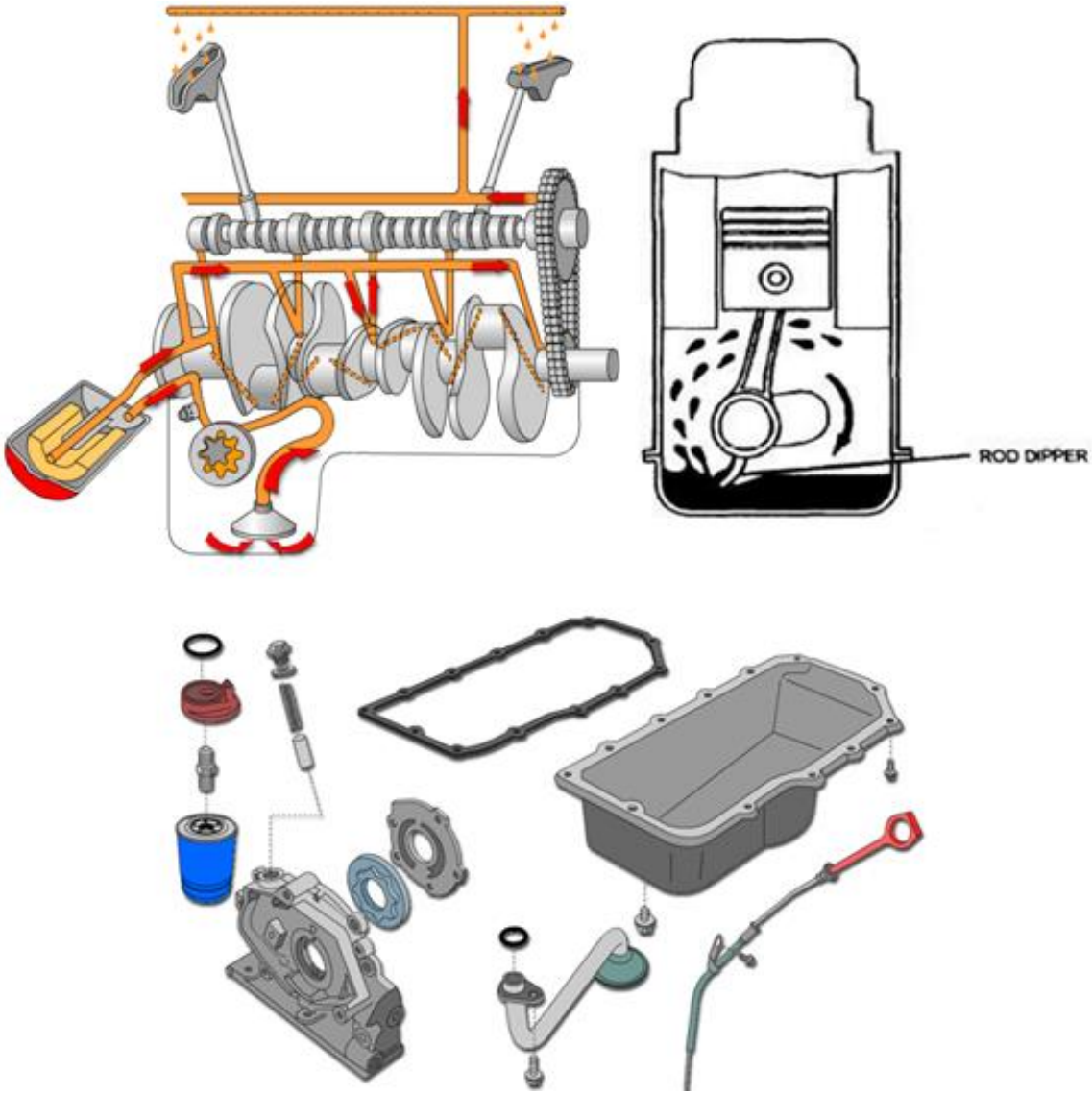
A discovery activity is followed to help students discover what they already know about the unit.

This manual will give trainer tips, methodologies and techniques about how to facilitate students to undertake different activities as proposed in their trainee manuals. The activities in this training manual are prepared such that they give opportunities to students to work individually and in groups.

After going through all activities, trainer shall help students to undertake progressive assessments known as formative and finally facilitate them to do their self-reflection to identify strengths, weaknesses and areas for improvements.

Trainer remind trainees to read the point to remember section which provides the overall key points and takeaways of the unit.

Learning outcomes	Learning Hours	Topics
Learning outcome 1: Describe engine lubricating system	5	1.1 Classification of engine lubricating system
		1.2 Description of engine lubricating system components
Learning outcome 2: Prepare the workplace and apply safety	20	2.1 Safety precautions at workplace
		2.2 Selection of PPE
		2.3 Arrangement of the workplace
Learning outcome 3: Repair engine lubricating system components	35	3.1 Selection of tools, materials and equipment
		3.2 Diagnosis and repair of engine lubricating system
		3.3 Perform engine oil change



Learning outcome 1: Self-Assessment

1. Ask trainees to look at the unit Illustration in their Trainee Manuals and together discuss:
    a. What does the illustration show?
    b. What is the structure called?
    c. What activities are performed in the illustration above?
    d. What topics do you think will be covered under this unit based on the illustration?

2. After the discussion, inform students that this unit is intended to provide them with the knowledge, skills and attitudes to identify engine lubricating systems. They will cover classification of engine lubrication system and description of engine lubrication system components.
3. Ask trainees to fill out the self-assessment at the beginning of the unit in their Trainee Manuals. Explain that:
    a. The purpose of the self-assessment is to become familiar with the topics in the unit and for them to see what they know or do not know at the beginning.
    b. There is no right or wrong way to answer this assessment. It is for their own reference and self-reflection on the knowledge, skills and attitudes acquisition during the learning process.
    c. They should think about themselves: do they think they have the knowledge, skills or attitudes to do this? How well?
    d. They read the statements across the top and put a check in column that best represents their level of knowledge, skills or attitudes.
    e. At the end of the unit, they will do a self-reflection, which includes re-taking the self-assessment and identifying their strengths, areas of improvement and actions to be taken.

Key Competencies:

Knowledge	Skills	Attitudes
1. Explain engine lubricating system	1. Classify engine lubricating system	1. Comply with safety precautions at the workplace
2. Identify types of engine lubrication system	2. Describe engine lubricating system components	2. Pay attention to details while dealing with engine lubricating components

Knowledge	Skills	Attitudes
3. Identify types of engine lubricating system component	3. Describe splash Lubrication method	3. Demonstrate team spirit while working with others
	4. Describe pressurized Lubrication method	4. Comply with national and international standards related to workplace organization
	5. Describe Engine lubricating system components	

Steps:

Discovery Activity

Task 1

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze illustrations provided under task 1 in their trainee manuals and answers the questions that follow.

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers with the class. Encourage all students to give their views.

   Make sure instructions are understood, all the students are actively participating and necessary materials/tools are given.

3. After the presentations/sharing session, inform students that this activity was not intended for them to give the right answers but to give them a picture of what they will cover in the unit.

4. Introduce Topic 1.1: Classification of engine lubricating systems

Topic 1.1: Classification of Engine Lubricating Systems

 **Objectives: By the end of the topic, trainees will be able to:** a) Describe splash engine system method b) Describe pressurized engine system method c) Differentiate engine lubrication systems
 **Time Required: 5 hours**
 **Learning Methodology:** Group discussion, Trainer guided, short questions, Open ended questions, Site visit
 **Materials, tools and equipment Needed:** ✓ **Materials:** Projector, chalk, pen, oil, teaching manual, Engine oil, Oil filter, shop rags, white board, Marker pen and Chalks, Black board., ✓ **Tools:** Oil funnel, Complete tool box, Pliers, Spanners, Filter oil wrench, Allen key, Filler gauge ✓ **Equipment:** Drain pan, A car, car engine lubricating system components
 **Preparation:** ❑ Preparation of workshop with vehicles and motorcycles engines ❑ Availability of tools and equipment to be used ❑ Contact garage manager for field visit.

Cross Cutting Issues:

- ✓ Ensure gender balance while forming groups, allocating tasks and during presentations
- ✓ Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all
- ✓ Promote financial education by emphasizing the need/importance of taking care of tools and equipment
- ✓ Ensure environment and sustainability regulations are followed while dealing with engine cooling systems.

Prerequisites:

- ❑ Physics,
- ❑ Bench work
- ❑ Technical drawing

Activity 1: Problem Solving

Task 2

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, ask trainees to visit the school automotive workshop and check the engines of a Toyota RAV4 and a Honda Motorcycle. Ask them to answer the questions provided under task 2 in their trainee manuals.

   Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used.

2. After the sharing session, refer students to Key facts 1.1, and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 2: Guided Practice

Task 3

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, ask trainees to visit the school workshop and answer the questions provided under task 3 in their trainee manuals.
2. During the task, students should be given degree of independence to apply the knowledge and skills acquired in activity 1. Your role is to guide them by using probing questions such as Why? What? How? to enable them come to informed responses.
3. During the task, use this opportunity to discuss or address any cross-cutting issues that may arise such as gender, inclusivity, financial education, environment and sustainability among others. Also attitudes and behavior changes should be handled during this activity.
4. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers with the class. Write their responses for reference. Encourage all students to give their views.

   Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used
5. After the sharing session, refer students to Key Facts 1.1, and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 3: Application

Task 4

1. Using an appropriate methodology such as individual work, pairs, or small groups, ask trainees to visit the nearest garage and make a report of the description of the vehicle

and motorcycle engines lubrication systems that they will need to analyze and focus on the following:

a. Splash engine method description
b. Pressured engine method description
c. Differences between the two method
d. The function of the lubrication system in the engine

Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used.

This activity requires students to work independently with limited support from the trainer. During the task, students should be given a high degree of independence to apply the knowledge, skills and attitudes acquired to real life situations. Your role is to set clear instructions, methodology and timeframe for submitting the report.

Topic 1.2: Description of Engine Lubricating System Components

	**Objectives: By the end of the topic, trainees will be able to identify:** a) Identify engine lubricating system components b) Differentiate engine lubricating system components. c) Describe of the function of engine lubricating system components
	**Time Required:** 15 hours
	**Learning Methodology:** Group discussion, Trainer guided, short questions, Open ended questions, site visit
	**Materials, tools and equipment needed:** ✓ **Materials:** Projector, chalk, pen, oil, teaching manual, Engine oil, Oil filter, shop rags, white board, Marker pen and Chalks, Black board.

- ✓ **Tools:** Oil funnel, Complete tool box, Pliers, Spanners, Filter oil wrench, Allen key, Filler gauge.
- ✓ **Equipment:** Drain pan, A car, car engine lubricating system components.

Preparation:

- Preparation of workshop with vehicles and motorcycles engines
- Availability of tools and equipment to be used
- Contact garage manager for field visit.

Cross Cutting Issues:

- ✓ Ensure gender balance while forming groups, allocating tasks and during presentations
- ✓ Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all
- ✓ Promote financial education by emphasizing the need/importance of taking care of tools and equipment
- ✓ Ensure environment and sustainability regulations are followed while dealing with lubricants.

Prerequisites:

- ❑ Physics
- ❑ Bench work
- ❑ Technical drawing

Activity 1: Problem-Solving

Task 5

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the illustration about the engine lubrication system components and answer the questions provided under task 5 in their trainee manuals.

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers with the class. Write their responses for reference. Encourage all students to give their views.

   Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used

3. After the sharing session, refer students to Key facts 1.2, and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 2: Guided Practice

Task 6

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario about describing the components of Toyota lush engine lubricating system components and to answer the questions provided under task 6 in their trainee manuals.

2. During the task, students should be given degree of independence to apply the knowledge and skills acquired in activity 1. Your role is to guide them by using probing questions such as Why? What? How? to enable them come to informed responses.

3. During the task, use this opportunity to discuss or address any cross-cutting issues that may arise such as gender, inclusivity, and financial education among others. Also, attitudes and behavior changes should be handled during this activity.

4. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers with the class. Write their responses for reference. Encourage all students to give their views.

   Make sure instructions are understood, all the students are actively participating and necessary materials/tools and equipment are provided and being used

5. After the sharing session, refer students to Key Facts 1.2, and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 3: Application

Task 7

Using an appropriate methodology such as individual work, pairs, or small groups, ask trainees to read the scenario under task 7 in their trainee manual and to make a report of components of the lubrication system for the vehicle including:

a. The classification of the system
b. The components of the system

Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used

This activity requires students to work independently with limited support from the trainer. During the task, students should be given a high degree of independence to apply the knowledge, skills and attitudes acquired to real-life situations. Your role is to set clear instructions, methodology and timeframe for submitting the report.

Formative Assessment

1. Which part of the engine lubricating removes unwanted impurities?

   Answer: *The oil filter is the component of the engine lubricating system responsible for removing unwanted impurities, such as dirt, metal particles, and other contaminants, from the engine oil. It plays a crucial role in maintaining the cleanliness and effectiveness of the lubricating oil.*

2. Name the engine lubricating system that stores engine oil.

   Answer: *The engine lubrication system that stores engine oil is commonly associated with the oil pan or sump.*

3. What do you use to measure the level of oil in the oil pan?

   Answer: *A dipstick is used to measure the level of oil in the oil pan.*

4. Describe the following components of an engine lubricating system.

   Answer:

   a. ***Oil Pump:*** *The oil pump is responsible for circulating the engine oil through the lubrication system. It draws oil from the oil pan and delivers it to various engine components that require lubrication.*

   b. ***Oil Filter:*** *As mentioned earlier, the oil filter removes impurities from the engine oil, ensuring that only clean oil reaches critical engine parts.*

   c. ***Oil Pan (Sump):*** *The oil pan is a reservoir that stores the engine oil when it is not in use. It also serves as a collection point for oil before it is drawn into the oil pump.*

   d. ***Oil Cooler:*** *In some engines, especially those operating under heavy loads or in high-temperature environments, an oil cooler is used to regulate the temperature of the engine oil. It helps prevent overheating and maintains the oil's viscosity.*

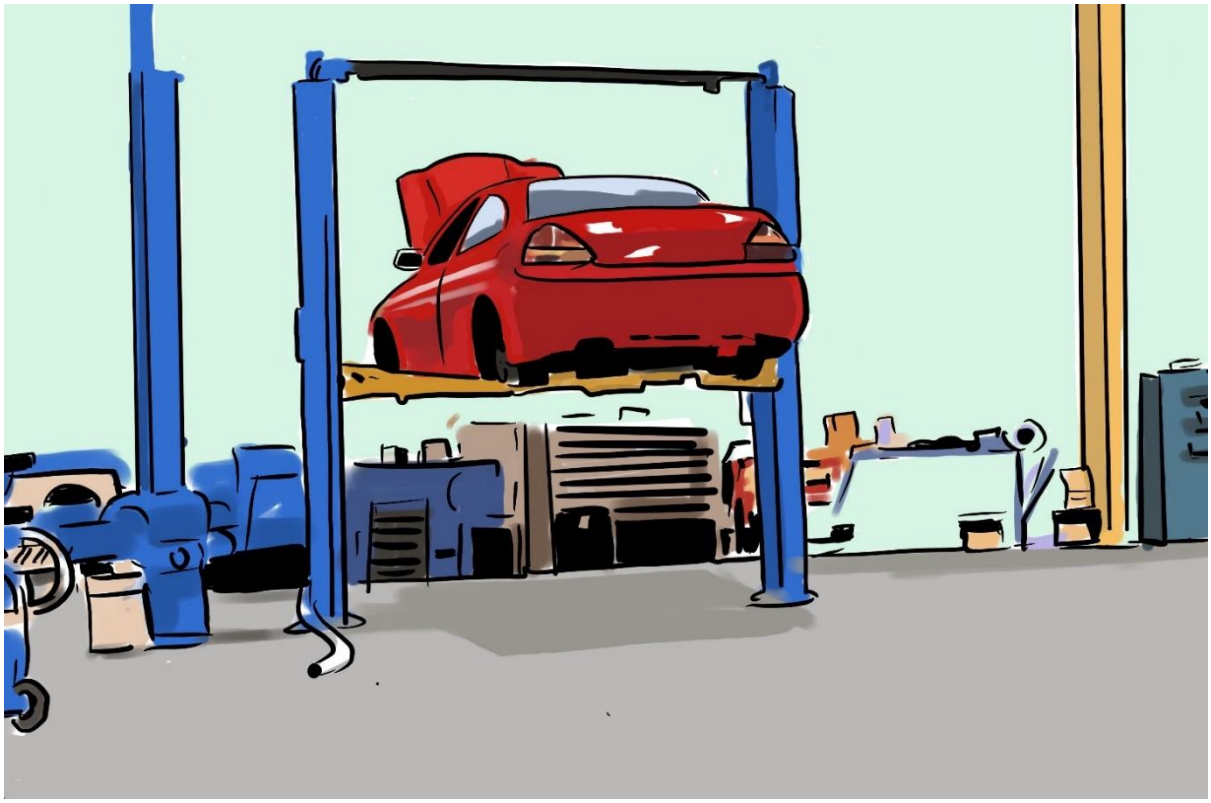
   e. Oil Pressure Relief Valve: *This valve is designed to prevent excessive pressure within the lubrication system. It opens to allow oil to return to the oil pan when the pressure surpasses a safe limit, preventing damage to engine components and ensuring proper lubrication.*

Points to Remember

- Engine lubricating system plays a vital role in automobiles as they comprise two or more robing, moving parts; these parts produce friction and generate heat which causes excessive wear and tear of the parts. When two moving parts experience a film of lubrication, they are separate from each other.
- Engine lubricating systems are classified into splash and pressurized systems.
- Engine lubricating system has various components to enable the system to function:
  - ✓ Oil sump
  - ✓ Engine oil filter
  - ✓ Piston cooling nozzles
  - ✓ The oil galleries
  - ✓ Oil cooler
  - ✓ The oil pressure indicator/light

Self-Reflection

1. Ask learners to re-take the self-assessment at the beginning of the unit. They should then fill in the table in the Trainee's Manual to identify their areas of strength, areas for improvement and actions to take to improve.
2. Discuss trainees' results with them. Identify any areas that are giving many trainees difficulties and plan to give additional support as needed (ex. use class time before you begin the next learning outcome to go through commonly identified difficult concepts).



Learning outcome 2: Self-Assessment

1. Ask trainees to look at the unit Illustration in their Trainee Manuals and together discuss:
    a. What does the illustration show?
    b. What topics do you think will be covered under this unit based on the illustration?
2. After the discussion, inform students that this unit is intended to provide them with the knowledge, skills and attitudes to prepare workplace. They will cover the identification of Safety precautions at workplace, Selection of personal protective equipment (PPE), Cleaning and arrangement of the workplace.
3. Ask trainees to fill out the self-assessment at the beginning of the unit in their Trainee Manuals. Explain that:
    a) The purpose of the self-assessment is to become familiar with the topics in the unit and for them to see what they know or do not know at the beginning.

b) There are no right or wrong ways to answer this assessment. It is for their own reference and self-reflection on the knowledge, skills and attitudes acquisition during the learning process.

c) They should think about themselves: do they think they have the knowledge, skills or attitudes to do this? How well?

d) They read the statements across the top and put a check in column that best represents their level of knowledge, skills or attitudes.

e) At the end of the unit, they will do a self-reflection, which includes re-taking the self-assessment and identifying their strengths, areas of improvement and actions to be taken.

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify the personal Safety precautions at workplace	1. Describe the Safety precautions at workplace	1. Pay attention to details while describing the procedures for cleaning the workplace, tools and equipment
2. Classify personal protective equipment (PPE)	2. Use of personal protective equipment (PPE)	2. Demonstrate team spirit while working with others
3. Identify types of cleaning method at workplace	3. Describe the procedures for cleaning the workplace, tools and equipment	3. Pay attention to details while usage of personal protective equipment (PPE)

Discovery Activity

Task 8

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the illustration about application of Safety precautions at workplace and answer questions provided under task 8 in their trainee manuals and answer the questions that follow.

   Make sure instructions are understood, all the students are actively participating and necessary materials/tools are given.

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Encourage all students to give their views.

3. After the presentations/sharing session, inform students that this activity was not intended for them to give the right answers but to give them a picture of what they will cover in the unit.

4. Introduce Topic 2.1: Application of safety precautions at workplace.

Topic 2.1: Application of Safety precautions at workplace.

Objectives: By the end of the topic, trainees will be able to: a) Describe the personal safety b) Describe work area safety c) Describe tools and equipment safety d) Follow safety precautions at workplace
Time Required: 1 *hours*
Learning Methodology: Group discussion, Trainer guided, short questions, Open ended questions, Site visit
Materials, Tools and Equipment Needed: • **Materials:** Soap solution, Solvent, Clothes rugs, white board, spray bottle, soft brushes, scrubber sponge, Broom, Mops.

- **Tools:** Electric blower, cleaning drill brush, cleaners' corner & edge brush
- **Equipment:** PPE's (Boots, masks, helmets, gloves, overcoats), dust pan and Air compressor.

Preparation:

- Preparation of workshop with vehicles
- Availability of tools, materials and equipment to be used
- Contact garage manager for field visit.

Cross Cutting Issues:

- ❑ Ensure gender balance while forming groups, allocating tasks and during presentations
- ❑ Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all
- ❑ Promote financial education by emphasizing the need/importance of taking care of tools and equipment
- ❑ Ensure environment and sustainability regulations are followed while dealing with engine exhaust systems.

Prerequisites:

N/A

Activity 1: Problem-Solving

Task 9

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the illustrations about safety precautions at workplaceand answer the questions provided under task 9 in their trainee manuals.

   Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*

3. After the sharing session, refer students to **Key facts 2.1 a & b** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 2: Guided Practice

Task 10

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, ask trainees to read the scenario and answer the questions provided under task 10 in their trainee manuals.

   Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used

2. During the task, students should be given degree of independence to apply the knowledge and skills acquired in activity 1. Your role is to guide them by using probing questions such as W*hy? What? How?* to enable them come to informed responses.

3. During the task, use this opportunity to discuss or address any cross-cutting issues that may arise such as gender, inclusivity, financial education, environment and sustainability among others. Also attitudes and behavior changes should be handled during this activity.

4. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*

5. After the sharing session, refer students to **Key Facts 2.1.a & b** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 3: Application

Task 11

Using an appropriate methodology such as individual work, pairs, or small groups , ask trainees to visit the nearest garage, then participate in the application of safety precautions at the workplace and make a report as asked under the task 11 in their trainee manuals.

Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used.

This activity requires students to work independently with limited support from the trainer. During the task, students should be given a high degree of independence to apply the knowledge, skills and attitudes acquired to real life situations. Your role is to set clear instructions, methodology and timeframe for submitting the report.

Topic 2.2: Selection of personal protective equipment (PPE)

Objectives: By the end of the topic, trainees will be able to: a) Select personal protective equipment b) Describe how to use personal protective equipment c) Describe the advantages of PPE
Time Required: 2 hours
Learning Methodology: Group discussion, Trainer guided, short questions, Open ended questions, Site visit
Materials , tools and equipment Needed: • **Materials:** Soap solution, Solvent, Clothes rugs, white board, spray bottle, soft brushes, scrubber sponge, Broom, Mops. • **Tools:** Electric blower, cleaning drill brush, cleaners' corner & edge brush

- **Equipment** PPE's (Boots, masks, helmets, gloves, overcoats), dust pan and Air compressor.

Preparation:

- Preparation of workshop with vehicles
- Availability of tools materials and equipment to be used
- Contact garage manager for field visit.

Cross Cutting Issues:

- ❑ Ensure gender balance while forming groups, allocating tasks and during presentations
- ❑ Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all
- ❑ Promote financial education by emphasizing the need/importance of taking care of tools and equipment
- ❑ Ensure environment and sustainability regulations are followed while dealing with exhaust gases.

Prerequisites:

N/A

Activity 1: Problem-Solving

Task 12

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the illustration about the selection and use of PPE then answer the questions provided under task 12 in their trainee manuals.

   Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*

3. After the sharing session, refer students to **Key facts 2.2,** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 2: Guided Practice

Task 13

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario about the workshop hazards and answer the questions provided under task 13 in their trainee manuals.

   Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used

2. During the task, students should be given degree of independence to apply the knowledge and skills acquired in activity. Your role is to guide them by using probing questions such as W*hy? What? How?* to enable them come to informed responses.

3. During the task, use this opportunity to discuss or address any cross-cutting issues that may arise such as gender, inclusivity, financial education among others. Also attitudes and behavior changes should be handled during this activity.

4. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. *Encourage all students to give their views.*

5. After the sharing session, refer students to **Key Facts 2.2** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 3: Application

Task 14

Using an appropriate methodology such as individual work, pairs, or small groups, ask trainees to read the scenario under task 14 in their trainee manual and prepare needed PPEs for the interns and demonstrate how to use them properly to repair exhaust system.

Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used

This activity requires students to work independently with limited support from the trainer. During the task, students should be given a high degree of independence to apply the knowledge, skills and attitudes acquired to real life situations. Your role is to set clear instructions, methodology and timeframe for submitting the report.

Topic 2.3: Cleaning and arrangement of the workplace

Objectives: By the end of the topic, trainees will be able to: a) Explain cleaning procedures for the workplace. b) Explain procedures to arrange the workplace. c) Clean the workplace d) Arrange the workplace
Time Required: 2 hours
Learning Methodology: Group discussion, Trainer guided, short questions, Open ended questions, Site visit
Materials , tools and equipment Needed: • **Materials:** Soap solution, Solvent, Clothes rugs, white board, spray bottle, soft brushes, scrubber sponge, Broom, Mops. • **Tools:** Electric blower, cleaning drill brush, cleaners' corner & edge brush.

- **Equipment** PPE's (Boots, masks, helmets, gloves, overcoats), dust pan and Air compressor.

Preparation:

- Preparation of workshop with vehicles
- Availability of tools materials and equipment to be used
- Contact garage manager for field visit.

Cross Cutting Issues:

- ✓ Ensure gender balance while forming groups, allocating tasks and during presentations
- ✓ Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all
- ✓ Promote financial education by emphasizing the need/importance of taking care of tools and equipment
- ✓ Ensure environment and sustainability regulations are followed while dealing with engine oil.

Prerequisites:

N/A

Activity 1: Problem-Solving

Task 15

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the illustration about cleaning and arrangement of the workplace and answer the questions provided under task 15 in their trainee manuals.

   Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. Encourage all students to give their views.

3. After the sharing session, refer students to **Key facts 2.3** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 2: Guided Practice

Task 16

1. Using an appropriate methodology such as pair-share, small group discussions, guided discussions or large group discussion, guide trainees during their visit on procedures to clean the workplace, tools and equipment and answer their questions for more clarification, task 16 in their trainee manuals.
   Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used
2. During the task, students should be given degree of independence to apply the knowledge and skills acquired in activity 1. Your role is to guide them by using probing questions such as Why? What? How? to enable them come to informed responses.
3. During the task, use this opportunity to discuss or address any cross-cutting issues that may arise such as gender, inclusivity, financial education among others. Also attitudes and behavior changes should be handled during this activity.
4. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. Encourage all students to give their views.
5. After the sharing session, refer students to **Key Facts 2.3** and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 3: Application

Task 17

Using an appropriate methodology such as individual work, pairs, or small groups, ask trainees to read the scenario and answer the questions under task 17 in their trainee manuals.

Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used

This activity requires students to work independently with limited support from the trainer. During the task, students should be given a high degree of independence to apply the knowledge, skills and attitudes acquired to real life situations. Your role is to set clear instructions, methodology and timeframe for submitting the report.

Formative Assessment

1. List five items that are personal protective equipment (PPE).
   Answer: gloves, safety glasses, overall, safety shoes, ear protection, respiratory protection and head protection
2. What are the types of fire extinguishers and their usage?
   Answer:
3. What items are included in a typical first aid box?
   Answer: types of fire extinguisher including: Water, Foam, CO2, Dry Powder and Wet Chemical.
4. List at least five common automotive chemicals or products that may be considered hazardous materials.

Answer:

1) ***Used oil, including used oil filters and sorbents.***
2) ***Rags, towels, or paper towels that have come into contact with chemicals.***
3) ***Cleaners.***
4) ***Lead-acid batteries.***

5) ***Lead wheel weights.***

6) ***Automotive chemicals like antifreeze and refrigerants.***

7) ***Fluorescent lamps.***

8) ***Asbestos***

9) ***Fumes***

10) ***Solvents***

5. Name at least five precautions to which every technician should adhere when working with automotive products and chemicals.

Answer:

1) Never smoke while working on a vehicle or while working with any machine in the shop. It is good practice to never smoke in the shop, because of the flammable chemicals and fluids that could be nearby.

2) Playing around or horseplay is not appropriate for professional technicians. Such things as air nozzle fights, creeper races, or practical jokes can hurt people and have no place in the professional workplace.

3) To prevent serious burns, keep your skin away from hot metal parts such as the radiator, exhaust manifold, tailpipe, catalytic converter, and muffler.

4) When working with a hydraulic press, make sure that the pressure is applied in a safe manner. It is generally wise to stand to the side when operating the press. Always wear safety glasses.

5) Properly store all parts and tools by putting them away in a place where people will not trip over them. This practice not only cuts down on injuries, but also reduces time wasted looking for a misplaced part or tool.

6. Describe the use of fire extinguisher

Answer:

1) P - PULL THE PIN at the top of the extinguisher. The pin releases a locking mechanism and will allow you to discharge the extinguisher.

2) A - AIM at the base of the fire and not at the flames. ...

3) S - SQUEEZE the lever.

4) S - SWEEP from side to side.

7. Discus the good workplace precautions that should be followed in every repair

   Answer:

   1) Keep all aisleways and walking-working surfaces clear of material and debris.

   2) Keep all cords out of aisleways and walking-working surfaces. If this cannot be avoided, use floor cord covers or sturdy tape to secure cords so they do not pose a tripping hazard.

   3) Keep all work areas and machinery clear and free of materials and debris. Never remove metal chips or shavings with bare hands.

   4) Never block fire exits, fire extinguishers, first-aid kits, eyewashes/safety showers, electrical panels, electrical disconnects, emergency stop devices, or any other critical safety devices.

   5) Put away any tools or materials in their proper spot when finished with them.

8. Describe the types of cleaning methods in repair shop

   Answer:

   1) Abrasive cleaning: Materials to be cleaned by abrasive cleaning methods must be free of oil and grease, which can interfere with the proper operation of an abrasive cleaning machine. Following preclearing, two types of abrasive blasting are used for various cleaning applications. Shot is round and grit is sharp and angular. Several blast materials are used by rebuilders for cleaning parts. Steel shot and glass beads are used for automotive part cleaning when removal of the surface of the material being cleaned is not desired. Beads and shot come in various sizes, depending on the application.

   2) Wet cleaning or chemical cleaning: with petroleum solvents or water based chemical solutions like Alkaline (base), and Acid.

   3) Thermal cleaning: Many rebuilders use thermal cleaning—a cleaning procedure in which a high-temperature pyrolytic oven cooks oil and grease, turning them to ash. The hard, dry deposit that remains on the part is removed by shot blasting or jet washing.

9. Explain why cleanliness is important for workplaces

   Answer:

1) Well-being: Providing a clean work environment helps in maintaining the well-being of employees.

2) Productivity: Provisions for a clean environment can increase the productivity of employees.

3) Impression: A clean and tidy business space leaves a good impression on both its employees and its visitors.

4) Cost saving: By maintaining good levels of cleanliness in the workplace, companies can save on cleaning costs and refurbishments, which may become necessary if the premises are not properly maintained.

10. Discuss on skin and body protection in repair workshop

Answer:

- ***Head:***
  - ✓ ***Ensure that there are no dents or deformities on the shell and connections are tightened inside.***
  - ✓ ***Do not store in direct sunlight as extreme heat can cause damage.***
  - ✓ ***Choose appropriate cleaning agents as it can weaken the shells of hard hats and may eliminate electrical resistance.***
  - ✓ ***Always replace a hard hat if it was used for any kind of impact, even if the damage is unnoticeable.***
- ***Body protection***
  - ✓ ***Ensure that they are clean and free from cuts and burns.***
  - ✓ ***Always get a good fit to ensure full body protection.***
  - ✓ ***Ensure bodysuit is heat-resistant clothing when working with high-temperature hazards.***
- ***Hand protection:***
  - ✓ ***Ensure hand protection fits perfectly with no spaces and is free from cuts, burns and chemical residue.***
  - ✓ ***Always replace them if any sign of contamination was observed.***
  - ✓ ***Use rubber gloves when working with heat and electricity to reduce the risk of burn or electrical shock.***
- ***Foot Protection:***

- ✓ ***Ensure boots have slip-resistant soles that can protect against compression and impact.***
- ✓ ***Ensure the sole plate is in good condition to prevent punctures.***

- **Fall Protection:**
  - ✓ ***Ensure that the straps are free from tears, deformities and burn marks.***
  - ✓ ***Check the buckles if connected securely and tightly.***
  - ✓ ***Dispose of the equipment if used after a falling incident.***

11. What are the safety precautions to be applied in case of the hazardous situations below?

a) Batteries contain highly corrosive and potentially explosive acids……

Answer: Wear protective equipment when handling batteries including gloves, eyewear and hardhat.

b) Fuels and cleaning solvents are flammable……

Answer: It is good practice to never smoke in the shop, because of the flammable chemicals and fluids that could be nearby.

c) Exhaust fumes are poisonous……

Answer: Run the engine only in a well-ventilated area, to avoid the danger of poisonous carbon monoxide (CO) in the engine exhaust. If the shop is equipped with an exhaust ventilation system, use it. If not, use a hose and direct the exhaust out of the building.

d) During some repairs, technicians can be exposed to harmful dust particles and vapors……

Answer: harmful dust particles must be removed in workplace and disposed in dust bin, also wear respiratory protection when you are working where there is vapors.

e) High voltage on some types of vehicles present shock and burn hazards……

Answer:

1) Always wear high voltage insulating gloves when working on high voltage

2) ***Always ensure all tools are cleared away before you start any work near the source of power like the motors or generators because they pose an increased risk.***
3) ***Children should be kept out of repair areas, especially when you're working.***
4) ***Always make sure you maintain good housekeeping practices by keeping floors clean.***

Points to Remember

- Automobile mechanics and technicians often suffer injuries due to their work environment, tools, lack of appropriate protection, and machinery. Frequently these exposures can lead to poor health or even death if not appropriately addressed.
- Cuts are the leading causes of injury among automobile repair workers, with improper postures and repetitive work and tool design seen playing a role.
- Dressing safely for work is very important. Wear snug-fitting clothing, eye and ear protection, protective gloves, steel-toed shoes, and caps to cover long hair.
- Safety while using any tool or equipment is essential, and even more when using power tools. Before plugging in a power tool, make sure the power switch is off.
- Use care whenever it is necessary to move a vehicle in the shop. Carelessness and playing around can lead to a damaged vehicle and serious injury.
- Always connect an exhaust hose to the tailpipe of any running vehicle to help prevent the buildup of carbon dioxide (CO) inside a closed garage space.

Self-Reflection

1. Ask learners to re-take the self-assessment at the beginning of the unit. They should then fill in the table in the Trainee's Manual to identify their areas of strength, areas for improvement and actions to take to improve.

2. Discuss trainees' results with them. Identify any areas that are giving many trainees difficulties and plan to give additional support as needed (ex. use class time before you begin the next learning outcome to go through commonly identified difficult concepts).

LEARNING OUTCOME 3: REPAIR ENGINE LUBRICATING SYSTEM COMPONENTS

Figure 1: Service engine lubricating system

Learning outcome 3: Self-Assessment

1. Ask trainees to look at the unit Illustration in their Trainee Manuals and together discuss:
    a. What do you see in the illustration?
    b. What does the illustration above tell you?
    c. What topics do you think will be covered under this unit based on the illustration?
2. After the discussion, inform students that this unit is intended to provide them with the knowledge, skills and attitudes to identify engine cooling systems. They will cover classification of engine lubrication system and description of engine lubrication system components.

3. Ask trainees to fill out the self-assessment at the beginning of the unit in their Trainee Manuals. Explain that:
    a. The purpose of the self-assessment is to become familiar with the topics in the unit and for them to see what they know or do not know at the beginning.
    b. There is no right or wrong way to answer this assessment. It is for their own reference and self-reflection on the knowledge, skills and attitudes acquisition during the learning process.
    c. They should think about themselves: Do they think they have the knowledge, skills or attitudes to do this? How well?
    d. They read the statements across the top and put a check in the column that best represents their level of knowledge, skills or attitudes.
    e. At the end of the unit, they will do a self-reflection, which includes re-taking the self-assessment and identifying their strengths, areas of improvement and actions to be taken.

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify tools, materials and equipment	1. Select tools, materials and equipment for lubrication system	1. Pay attention to details while using the tools, materials and equipment
2. Outline lubrication system faults	2. Follow Diagnosis process Engine lubrication system	2. Demonstrate team spirit while working with others
3. Identify diagnosis process Engine lubrication system	3. Inspect faults	3. Be meticulous while repair engine lubricating system
4. Identify the correction techniques of faults	4. Fix engine lubricating system components faults	4. Be careful while testing engine lubricating system

Knowledge	Skills	Attitudes
	5. change oil	5. Respect safety precautions at workplace while repairing the engine lubricating system
		6. Comply with safety rules related to the handling of tools and equipment

Steps:

Discovery Activity

Task 18

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze illustrations provided under task 18 in their trainee manuals and answer the questions that follow.

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers with the class. Encourage all students to give their views.

   Make sure instructions are understood, all the students are actively participating and necessary materials/tools are given.

3. After the presentations/sharing session, inform students that this activity was not intended for them to give the right answers but to give them a picture of what they will cover in the unit.

4. Introduce Topic 3.1: Selection of Tools, Materials and Equipment

Topic 3.1: Selection of Tools, Materials and Equipment

Objectives: By the end of the topic, trainees will be able to:

a) Select tool, materials and equipment for lubrication system repair
b) Categorize materials, tools and equipment for lubrication system repair
c) Differentiate tools and equipment for lubrication system repair

Time Required: 5 hours

Learning Methodology:

Group discussion, Trainer guided, short questions, Open ended questions.

Materials, tools and equipment Needed:

- **Materials:** Engine oil, Oil filter, Rag, Rags, white board, Marker pen and Chalks, Black board. Drain pan, Engine oil, Oil filter, Rag, dump truck, Rags.
- **Tools:** Oil funnel, Complete tool box, Pliers, Spanners, Filter oil wrench, Oil funnel, Complete tool box, Spanners, gasket and seals kit, Oil filter wrench, Pliers, Allen key, Filler gauge, Complete tool box. Filter oil wrench, Spanners, Oil filter wrench, Pliers, Allen key, Filler gauge, oil pressure tester kit, scan tool, Complete tool box.
- **Equipment:** Vehicle, Engine lubricating system components, Drain pan, car lift, Digital multimeter, PPE.

Preparation:

Preparation of workshop, tools, material and equipment to be used.

Cross Cutting Issues:

- ✓ Ensure gender balance while forming groups, allocating tasks and during presentations
- ✓ Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all
- ✓ Promote financial education by emphasizing the need/importance of taking care of tools and equipment
- ✓ Ensure environment and sustainability regulations are followed while dealing with lubricants.

Prerequisites:

- Workshop safety
- Safety precautions at workplace
- Bench work

Activity 1: Problem Solving

Task 19

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario and answer the questions provided under task 19 in their trainee manuals.

   Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers to the class. Write their responses for reference. Encourage all students to give their views.

3. After the sharing session, refer students to Key Facts 3.1 in their trainees' manuals, and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 2: Guided Practice

Task 20

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to visit the school workshop, and answer the questions/perform the tasks provided under task 20 in their trainee manuals.

2. During the task, students should be given degree of independence to apply the knowledge and skills acquired in activity 1. Your role is to guide them by using probing questions such as Why? What? How? to enable them come to informed responses.

3. During the task, use this opportunity to discuss or address any cross-cutting issues that may arise such as gender, inclusivity, financial education, environment and sustainability among others. Also attitudes and behavior changes should be handled during this activity.

4. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers with the class. Write their responses for reference. Encourage all students to give their views.

   Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used.

5. After the sharing session, refer students to Key Facts 3.1 b in their trainees' manuals, and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 3: Application

Task 21

Using an appropriate methodology such as individual work, pairs, or small groups, ask trainees to visit the nearest garage and to produce a report on the strategies to select tools, materials and equipment for lubrication system.

Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used

This activity requires students to work independently with limited support from the trainer. During the task, students should be given a high degree of independence to apply the knowledge, skills and attitudes acquired to real life situations. Your role is to set clear instructions, methodology and timeframe for submitting the report.

Topic 3.2: Detection of Engine Lubricating System Components Faults

Objectives: By the end of the topic, trainees will be able to identify:

a) Inspect engine lubricating system components faults

b) List out the engine lubricating system parts faults

Time Required: 10 hours

Learning Methodology:

Group discussion, trainer guided, short questions, open ended questions, site visit.

Materials, Tools and Equipment Needed:

- **Materials:** Engine oil, Oil filter, Rag, Rags, white board, Marker pen and Chalks, Black board. Drain pan, Engine oil, Oil filter, Rag, dump truck, Rags.
- **Tools:** Oil funnel, Complete tool box, Pliers, Spanners, Filter oil wrench, Oil funnel, Complete tool box, gasket and seals kit, Spanners, Oil filter wrench, Pliers, Allen key, Filler gauge, Complete tool box. Filter oil wrench, Spanners, Oil filter wrench, Pliers, Allen key, Filler gauge, oil pressure tester kit, scan tool, Complete tool box.
- **Equipment:** Vehicle, Engine lubricating system components, Drain pan, car lift, Digital multimeter, PPE.

Preparation:

- Preparation of workshop
- Availability of tools, materials and equipment to be used

Cross Cutting Issues:

✓ Ensure gender balance while forming groups, allocating tasks and during presentations

	✓ Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all ✓ Promote financial education by emphasizing the need/importance of taking care of tools and equipment ✓ Ensure environment and sustainability regulations are followed while dealing with lubricants.
	**Prerequisites:** ❑ Workshop safety ❑ Bench work

Activity 1: Problem-Solving

Task 22

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario related to detection of engine lubricating system components faults and answer the questions provided under task 22 in their trainee manuals.

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers with the class. Write their responses for reference. Encourage all students to give their views.

   Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used

3. After the sharing session, refer students to Key Facts 3.2 in their trainees' manuals, and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 2: Guided Practice

Task 23

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario about detection of engine lubricating system components faults and answers the questions provided under task 23 in their trainee manuals.

2. During the task, students should be given degree of independence to apply the knowledge and skills acquired in activity 1. Your role is to guide them by using probing questions such as Why? What? How? to enable them come to informed responses.

3. During the task, use this opportunity to discuss or address any cross-cutting issues that may arise such as gender, inclusivity, and financial education among others. Also, attitudes and behavior changes should be handled during this activity.

4. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers with the class. Write their responses for reference. Encourage all students to give their views.

   Make sure instructions are understood, all the students are actively participating and necessary materials/tools and equipment are provided and being used

5. After the sharing session, refer students to Key Facts 3.2 in their trainees' manuals, and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 3: Application

Task 24

Using an appropriate methodology such as individual work, pairs, or small groups, ask trainees to read the scenario under task 24 in their trainee manual and to make a report on the detection of engine lubricating system components faults.

Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used

This activity requires students to work independently with limited support from the trainer. During the task, students should be given a high degree of independence to apply the knowledge, skills and attitudes acquired to real-life situations. Your role is to set clear instructions, methodology and timeframe for submitting the report.

Topic 3.3: Correction of Engine Lubricating System Components Faults

Objectives: By the end of the topic, trainees will be able to identify: a) Correct engine lubricating system components faults b) Explain procedures to correct lubrication system faults c) Maintain engine lubrication system
Time Required: 15 hours
Learning Methodology: Group discussion, trainer guided, short questions, open ended questions, site visit.

Materials, Tools and equipment Needed:

- **Materials:** Engine oil, Oil filter, Rag, Rags, white board, Marker pen and Chalks, Black board. Drain pan, Engine oil, Oil filter, Rag, dump truck, Rags.
- **Tools:** Oil funnel, Complete tool box, Pliers, Spanners, Filter oil wrench, Oil funnel, Complete tool box, Spanners, gasket and seals kit, Oil filter wrench, Pliers, Allen key, Filler gauge, Complete tool box. Filter oil wrench, Spanners, Oil filter wrench, Pliers, Allen key, Filler gauge, oil pressure tester kit, scan tool, Complete tool box.
- **Equipment:** Vehicle, Engine lubricating system components, Drain pan, car lift, Digital multimeter, PPE.

Preparation:

- Preparation of workshop with vehicles
- Availability of tools, materials and equipment to be used

Cross Cutting Issues:

- ✓ Ensure gender balance while forming groups, allocating tasks and during presentations
- ✓ Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all
- ✓ Promote financial education by emphasizing the need/importance of taking care of tools and equipment
- ✓ Ensure environment and sustainability regulations are followed while dealing with lubricants.

Prerequisites:

- ❑ Safety precautions at workplace
- ❑ Bench work
- ❑ Technical drawing

Activity 1: Problem-Solving

Task 25

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to propose solutions on how to correct faults identified in the previous activity, task 25 in their trainee manuals.

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers with the class. Write their responses for reference. Encourage all students to give their views.

   Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used

3. After the sharing session, refer students to Key Facts 3.3 in their trainees' manuals, and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 2: Guided Practice

Task 26

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario about the correction of engine lubricating system components faults and perform the tasks provided under task 26 in their trainee manuals.

2. During the task, students should be given degree of independence to apply the knowledge and skills acquired in activity 1. Your role is to guide them by using probing questions such as Why? What? How? to enable them come to informed responses.

3. During the task, use this opportunity to discuss or address any cross-cutting issues that may arise such as gender, inclusivity, and financial education among others. Also, attitudes and behavior changes should be handled during this activity.

4. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers with the class. Write their responses for reference. Encourage all students to give their views.

   Make sure instructions are understood, all the students are actively participating and necessary materials/tools and equipment are provided and being used

5. After the sharing session, refer students to Key Facts 3.3 in their trainees' manuals, and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 3: Application

Task 27

Using an appropriate methodology such as individual work, pairs, or small groups, ask trainees to read the scenario under task 27 in their trainee manual and to make a report on the correction of engine lubricating system components faults.

Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used.

This activity requires students to work independently with limited support from the trainer. During the task, students should be given a high degree of independence to apply the knowledge, skills and attitudes acquired to real-life situations. Your role is to set clear instructions, methodology and timeframe for submitting the report.

Topic 3.4: Changing of Engine Lubricant

Objectives: By the end of the topic, trainees will be able to identify:

a) Change engine lubricant
b) Check engine oil level
c) Test engine lubricating system performance
d) Explain procedures for testing engine lubricating system performance

Time Required: 5 hours

Learning Methodology:

Group discussion, trainer guided, short questions, open ended questions, brainstorming, site visit.

Materials, Tools and equipment Needed:

- **Materials:** Engine oil, Oil filter, Rag, Rags, white board, Marker pen and Chalks, Black board. Drain pan, Engine oil, Oil filter, Rag, dump truck, Rags.
- **Tools:** Oil funnel, Complete tool box, Pliers, Spanners, Filter oil wrench, Oil funnel, Complete tool box, Spanners, gasket and seals kit, Oil filter wrench, Pliers, Allen key, Filler gauge, Complete tool box. Filter oil wrench, Spanners, Oil filter wrench, Pliers, Allen key, Filler gauge, Complete tool box.
- **Equipment:** Vehicle, Engine lubricating system components, Drain pan, car lift, digital multimeter, PPE.

Preparation:

- ❑ Preparation of workshop with vehicles
- ❑ Availability of tools, materials and equipment to be used

Cross Cutting Issues:

- ✓ Ensure gender balance while forming groups, allocating tasks and during presentations

- ✓ Ensure inclusivity while allocating tasks to students and provide facilities/environment that enable/allows participation of all
- ✓ Promote financial education by emphasizing the need/importance of taking care of tools and equipment
- ✓ Ensure environment and sustainability regulations are followed while dealing with lubricants.

Prerequisites:

- ❑ Safety precautions in the worksh0p
- ❑ Bench work
- ❑ Technical drawing

Activity 1: Problem-Solving

Task 28

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, ask trainees to read and answer the questions related to the changing of engine lubricant and the performance of the system. They are provided under task 28 in their trainee manuals.

2. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers with the class. Write their responses for reference. Encourage all students to give their views.

   Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used.

3. After the sharing session, refer students to Key Facts 3.4 in their trainees' manuals, and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 2: Guided Practice

Task 29

1. Using an appropriate methodology such as individual work, pair-share, small group discussions, guided discussions or large group discussion, guide trainees to analyze the scenario about the changing of engine lubricant and perform the tasks provided under task 29 in their trainee manuals.

2. During the task, students should be given degree of independence to apply the knowledge and skills acquired in activity 1. Your role is to guide them by using probing questions such as Why? What? How? to enable them come to informed responses.

3. During the task, use this opportunity to discuss or address any cross-cutting issues that may arise such as gender, inclusivity, and financial education among others. Also, attitudes and behavior changes should be handled during this activity.

4. Using an appropriate methodology such as question and answer in a large group, pair presentations, or small group presentations, students share their answers with the class. Write their responses for reference. Encourage all students to give their views.

   Make sure instructions are understood, all the students are actively participating and necessary materials/tools and equipment are provided and being used.

5. After the sharing session, refer students to Key Facts 3.4 in their trainees' manuals, and discuss them together while harmonizing their responses provided in the sharing session and answer any questions they have.

Activity 3: Application

Task 30

Using an appropriate methodology such as individual work, pairs, or small groups, ask trainees to read the scenario under task 30 in their trainee manual and to make a report on engine oil changing and the system performance test including:

1. Changing of engine lubricant
2. Followed procedures
3. The lubrication system performance test for static and dynamic.

Make sure instructions are understood, all the students are actively participating and necessary materials/tools are provided and being used

This activity requires students to work independently with limited support from the trainer. During the task, students should be given a high degree of independence to apply the knowledge, skills and attitudes acquired to real-life situations. Your role is to set clear instructions, methodology and timeframe for submitting the report.

Formative Assessment

1. Which Tools, Materials and Equipment used to diagnose Lubrication system?

   Answer:

a) **Diagnostic Scan Tools:** Used to retrieve diagnostic trouble codes (DTCs) and obtain real-time data from the engine control module (ECM).

b) **Oil Pressure Gauge:** Measures the oil pressure within the lubrication system to ensure it is within the manufacturer's specified range.

c) **Oil Analysis Kits:** Used to collect oil samples for laboratory analysis, which can provide insights into the condition of the oil and identify any contaminants or wear particles.

d) Inspection Light: Provides additional illumination when inspecting components within the engine compartment for visual signs of issues.

e) **Wrenches and Sockets:** Essential for removing and tightening various components, such as the oil filter, drain plug, and oil pan.

f) Oil Filter Wrench: Specifically designed to remove and install oil filters, which may be tightly secured.

g) **Dipstick:** Used to check the oil level in the oil pan and ensure it falls within the recommended range.

h) Diagnostic Manual or Service Manual: Contains information on the specific lubrication system of the vehicle or machinery being diagnosed, including specifications and troubleshooting procedures.

i) Digital Multimeter: Measures electrical parameters and can be used to check the continuity of electrical components within the lubrication system.

2. Perform engine lubrication system components faults detection

   Answer:

   a) **Visual Inspection:** Inspect the engine compartment for any visible signs of oil leaks. Check around the oil pan, oil filter, and oil lines.

   b) **Check Oil Level:** Use the dipstick to check the oil level. Ensure that it falls within the recommended range. Low oil levels can indicate a leak or excessive oil consumption.

   c) **Oil Color and Consistency:** Observe the color and consistency of the engine oil. Clean and clear oil is normal, while dirty or discolored oil may indicate contamination or a need for an oil change.

   d) **Inspect the Oil Filter:** Examine the oil filter for any signs of damage, such as dents or leaks. Replace the oil filter if it is clogged or damaged.

   e) **Oil Pressure Test:** Connect an oil pressure gauge to the engine and start it. Monitor the oil pressure at different engine speeds. Low oil pressure may indicate a faulty oil pump or other issues.

   f) **Check for Oil Contamination:** Use an oil analysis kit to collect a sample of the engine oil. This analysis can reveal contaminants, wear particles, and the overall condition of the oil.

   g) **Inspect Oil Lines and Hoses:** Check all oil lines and hoses for signs of damage, wear, or leaks. Replace any damaged components.

h) **Inspect the Oil Pan:** Inspect the oil pan for dents, cracks, or other damage. Damaged oil pans can lead to leaks and loss of oil pressure.

i) **Inspect Oil Seals and Gaskets:** Check for leaks around oil seals and gaskets. Replace any seals or gaskets that are damaged or compromised.

j) **Examine the Oil Pump:** If possible, inspect the oil pump for wear or damage. Check for proper functioning and replace the pump if necessary.

k) **Check Oil Cooler (if applicable):** If the engine is equipped with an oil cooler, inspect it for leaks or damage. Ensure that it is effectively cooling the oil.

l) **Review Diagnostic Trouble Codes (DTCs):** Use a diagnostic scan tool to retrieve any DTCs related to the lubrication system. Address any issues indicated by the codes.

3. How can you correct lubrication components faults

Answer:

a) **Replace Damaged or Clogged Oil Filter:** If the oil filter is damaged or clogged, replace it with a new, compatible filter according to the manufacturer's specifications.

b) **Repair or Replace Faulty Oil Lines and Hoses:** Identify any damaged or leaking oil lines and hoses. Repair minor leaks, if possible, but it's often safer to replace damaged components with new ones.

c) **Fix Leaks Around Seals and Gaskets:** If there are leaks around oil seals or gaskets, replace the faulty components. Ensure that new seals and gaskets are installed correctly to prevent further leaks.

d) **Address Issues with the Oil Pump:** If the oil pump is faulty or not functioning properly, it may need to be replaced. Check for wear and damage, and follow manufacturer guidelines for pump replacement.

e) **Clean or Replace the Oil Pan:** If the oil pan is damaged or has accumulated debris, clean it thoroughly or replace it. A damaged oil pan can lead to leaks and insufficient oil supply.

f) **Clear Oil Passages and Lines:** Ensure that oil passages and lines are clear of debris or sludge. Use appropriate cleaning methods to clear any blockages.

g) **Check and Adjust Oil Pressure:** If the oil pressure is outside the recommended range, troubleshoot the issue. This may involve adjusting the oil pressure regulator or addressing problems with the oil pump.

h) **Inspect and Replace Faulty Oil Cooler (if applicable):** If the engine is equipped with an oil cooler, check for leaks or malfunctions. Replace the cooler if necessary to maintain effective oil cooling.

i) **Follow Manufacturer Recommendations:** Always refer to the manufacturer's service manual for specific guidelines on correcting lubrication system faults. This includes torque specifications, recommended replacement parts, and procedures.

j) **Perform Follow-Up Checks:** After addressing the faults, perform follow-up checks to ensure that the issues have been resolved. This may involve monitoring oil pressure, checking for leaks, and verifying proper oil circulation.

k) **Conduct a System Test:** Run the engine and monitor the lubrication system to ensure that all components are functioning as intended. Pay attention to oil pressure, temperature, and any abnormal noises.

4. Explain the steps followed while static engine performance testing

   Answer:

   a) **Prepare the Vehicle:** Ensure that the vehicle is in a safe and well-ventilated area. Set the parking brake and chock the wheels to prevent unintended movement.

   b) **Connect Diagnostic Equipment:** Use diagnostic scan tools and equipment to connect to the engine control module (ECM). This allows access to real-time data and potential error codes.

   c) **Check for Diagnostic Trouble Codes (DTCs):** Retrieve and note any diagnostic trouble codes stored in the ECM. Address any identified issues according to the service manual.

   d) **Inspect Engine Compartment:** Perform a visual inspection of the engine compartment for any visible issues, such as loose wires, disconnected hoses, or fluid leaks.

   e) **Monitor Engine Parameters:** With the engine running at idle, monitor various engine parameters, including:

      i. RPM (revolutions per minute)

ii. Coolant temperature
iii. Intake air temperature
iv. Throttle position
v. Mass airflow rate
vi. Oxygen sensor readings

f) **Check Ignition Timing:** Use a timing light to check and adjust ignition timing if necessary. Follow manufacturer specifications for proper timing.

g) **Examine Exhaust Emissions:** Assess the exhaust emissions for signs of irregularities. This can include the color of the exhaust smoke and the presence of unusual odors.

h) **Check Idle Speed:** Ensure that the engine is idling at the correct speed as specified by the manufacturer. Adjust the idle speed if necessary.

i) **Evaluate Vacuum Levels:** Measure intake manifold vacuum levels using a vacuum gauge. Deviations from the recommended vacuum levels can indicate issues with valves, piston rings, or other components.

j) **Inspect Drive Belts and Accessories:** Check the condition and tension of drive belts. Inspect accessory components such as the alternator, power steering pump, and air conditioning compressor.

k) **Monitor Fuel Pressure:** Use a fuel pressure gauge to check that the fuel system is maintaining the correct pressure during idle.

l) **Inspect for Abnormal Noises or Vibrations:** Listen for any abnormal noises, vibrations, or misfires. Identify and address any issues that may affect engine performance.

m) **Record Data:** Document all relevant data and measurements obtained during the static engine performance test. This information can be useful for reference and comparison during future tests.

n) **Perform Necessary Adjustments:** Based on the observations and measurements, make any adjustments required to optimize engine performance. This may include adjusting the idle speed, ignition timing, or addressing specific issues identified during the test.

o) **Conduct a Final Check:** After adjustments, recheck all parameters to ensure that the engine is operating within the specified tolerances.

5. Explain Dynamic engine performance test steps

   Answer:

   a) **Vehicle Preparation:** Ensure the vehicle is in good working condition, and all safety measures are in place. Check tire pressure, brake functionality, and suspension components.

   b) **Connect Diagnostic Equipment:** Use diagnostic scan tools to connect to the engine control module (ECM) for real-time data monitoring and potential error code retrieval.

   c) **Check for Diagnostic Trouble Codes (DTCs):** Retrieve and note any diagnostic trouble codes stored in the ECM. Address any identified issues according to the service manual.

   d) **Road Test Planning:** Plan a route that includes a variety of driving conditions, such as city driving, highway speeds, and uphill/downhill sections.

   e) **Engine Warm-Up:** Ensure the engine is adequately warmed up before conducting dynamic tests. This allows the engine to reach operating temperature.

   f) **Accelerate and Decelerate Tests:** Perform acceleration and deceleration tests to assess the engine's responsiveness and the smoothness of power delivery.

   g) **Highway Speed Testing:** Drive the vehicle at highway speeds to evaluate the engine's performance under constant speed conditions.

   h) **Full Throttle Acceleration:** Conduct full-throttle acceleration tests to assess the engine's ability to produce power under heavy load conditions.

   i) **Evaluate Gear Changes (Manual Transmission):** If the vehicle has a manual transmission, assess the smoothness of gear changes and ensure there are no unusual noises.

   j) **Monitor Instrument Cluster Readings:** Keep an eye on instrument cluster readings, including RPM, speed, coolant temperature, and fuel level.

   k) **Listen for Abnormal Noises:** Pay attention to any unusual engine noises, such as knocks, pings, or rattles, which may indicate mechanical issues.

   l) **Check for Vibration:** Evaluate the vehicle for abnormal vibrations, which could be indicative of issues with the engine or drivetrain components.

m) **Assess Braking Performance:** Evaluate the braking performance of the vehicle to ensure the brakes are functioning correctly and do not produce excessive noise.

n) **Evaluate Steering and Handling:** Assess the vehicle's steering response and handling characteristics to identify any issues with the suspension or steering components.

o) **Review Fuel Efficiency:** Monitor fuel consumption during the test to assess the engine's efficiency under different driving conditions.

p) **Record Data:** Document all relevant data, including observed issues, abnormal readings, and any specific driving conditions that may affect performance.

q) **Perform Post-Test Inspection:** After the dynamic test, inspect the engine compartment for signs of issues that may have become apparent during the test.

r) **Address Identified Issues:** Based on the observations and data collected during the dynamic test, address any identified issues through repairs or adjustments.

6. List the steps followed when diagnosing an oil pump.

   Answer:

   a) **Oil Pressure Check:** Begin by checking the oil pressure using an oil pressure gauge. This measurement will provide an initial indication of the pump's performance. Compare the measured pressure to the manufacturer's specifications.

   b) **Verify Oil Level:** Ensure that the engine has the correct oil level. Low oil levels can lead to reduced oil pressure, potentially impacting the pump's effectiveness.

   c) **Inspect Oil Filter:** Examine the oil filter for any signs of clogs or damage. A clogged filter can restrict oil flow, affecting the pump's ability to circulate oil.

   d) **Check for Oil Leaks:** Inspect the engine and surrounding areas for oil leaks. Leaks can reduce the amount of oil available to the pump and lead to decreased oil pressure.

   e) **Visual Inspection of Oil Pump:** Remove the oil pump cover or access panel to visually inspect the pump. Look for signs of wear, damage, or excessive clearances. Pay attention to the pump's gears, rotor, and housing.

   f) **Measure Oil Pump Clearances:** Use a feeler gauge to measure the clearances between the pump's gears and the housing. Excessive clearances can result in decreased oil pressure.

g) **Check for Pump Gear Wear:** Examine the pump gears for wear, scoring, or damage. Damaged gears can affect the pump's ability to create sufficient pressure.

h) **Inspect the Relief Valve:** Check the oil pump relief valve to ensure it is functioning correctly. A malfunctioning relief valve can lead to excessive oil pressure or insufficient pressure.

i) **Evaluate Pump Shaft:** Inspect the pump shaft for any signs of bending, scoring, or wear. A damaged pump shaft can impact the pump's efficiency.

j) **Verify Pump Drive:** Ensure that the pump is being driven properly by the engine. Check the drive chain, gear, or shaft to confirm that it is functioning as intended.

k) **Perform a Wet Compression Test:** Conduct a wet compression test to check for any improvements in oil pressure. This involves introducing a small amount of oil into the combustion chamber and retesting compression. Improved oil pressure may suggest worn piston rings or cylinder walls.

l) **Use Oil Pressure Test Kits:** Utilize specialized oil pressure test kits that allow for a more detailed assessment of oil pressure throughout the engine. This can help identify specific areas of concern.

m) **Check for Contaminants:** Look for contaminants in the oil, such as sludge or debris. Contaminants can affect the pump's operation and lead to reduced efficiency.

n) **Refer to Manufacturer Specifications:** Consult the manufacturer's specifications and service manual for recommended oil pressure values, clearances, and diagnostic procedures specific to the particular engine and oil pump.

7. Enumerate all steps followed when performing an engine oil change.

   Answer:

   a) **Gather Materials and Tools:** Collect all necessary materials and tools, including new engine oil, an oil filter, an oil filter wrench, a drain pan, a funnel, a socket set, and a wrench.

   b) **Ensure Safety:**

      i. Park the vehicle on a level surface.

      ii. Engage the parking brake.

      iii. Use wheel chocks to prevent movement.

c) **Run the Engine:** Start the engine and let it run for a few minutes. Warm oil flows more easily, facilitating better drainage.

d) **Raise the Vehicle:** Lift the front of the vehicle using a jack and secure it with jack stands. Ensure the vehicle is stable before crawling underneath.

e) **Locate the Oil Drain Plug:**

   i. Position the drain pan underneath the oil pan.

   ii. Use a socket wrench to remove the oil drain plug from the oil pan.

f) **Drain the Oil:**

   i. Allow the old oil to drain completely into the drain pan.

   ii. Wipe the drain plug clean and inspect it for any damage.

g) **Remove and Replace the Oil Filter:**

   i. Use an oil filter wrench to remove the old oil filter.

   ii. Apply a small amount of oil to the rubber gasket of the new oil filter.

   iii. Screw on the new oil filter hand-tight.

h) **Install the Drain Plug:**

   i. Reinstall the drain plug and tighten it to the manufacturer's specifications.

   ii. Double-check that the drain plug is secure to prevent oil leaks.

i) **Add New Engine Oil:**

   i. Position a funnel over the oil filler cap.

   ii. Pour the recommended amount and type of new engine oil into the engine.

j) **Check the Oil Level:**

   i. Start the engine and let it run for a minute.

   ii. Turn off the engine and wait a few minutes for the oil to settle.

   iii. Check the oil level using the dipstick and add more oil if necessary.

k) **Inspect for Leaks:**

   i. Look for any oil leaks around the oil filter and drain plug.

   ii. Address leaks promptly by tightening components or replacing gaskets if needed.

l) **Dispose of Used Oil:** Properly dispose of the used oil and the oil filter at a recycling center or an automotive service provider that accepts used oil.

m) **Record the Service:** Record the date, mileage, and type of oil used in the vehicle's maintenance log. This helps keep track of when the next oil change is due.

n) **Lower the Vehicle:** Carefully lower the vehicle from the jack stands.

o) **Dispose of Old Oil Filter:** Place the old oil filter in a plastic bag to prevent any residual oil from leaking during disposal.

Points to Remember

- Engine Lubricating System: Supplies the engine components with an adequate amount of lubricating oil. The correct pressure must be guaranteed in the process, and is used to keep the wear between moving parts as low as possible. It is intended to prevent the surfaces that slide on each other coming into contact by mean friction.
- Regularly changing the oil and oil filter according to the manufacturer's recommended schedule will help maintain the engine's longevity and performance.
- Repairing an oil filter is not recommended, not standard practice and may not be safe or effective. If you encounter a damaged or malfunctioning oil filter, it is better to replace it with a new, high-quality filter designed for your vehicle model.
- It is essential to prioritize safety when working on engine components. Always wear appropriate safety gear and follow safety precautions to avoid accidents and injuries.

Self-Reflection

1. Ask learners to re-take the self-assessment at the beginning of the unit. They should then fill in the table in the Trainee's Manual to identify their areas of strength, areas for improvement and actions to take to improve.
2. Discuss trainees' results with them. Identify any areas that are giving many trainees difficulties and plan to give additional support as needed (ex. use class time before you begin the next learning outcome to go through commonly identified difficult concepts).

Summative assessment (Integrated situation)

Integrated/Summative assessment

Integrated situation

GAKIZA is a driver from KIKU transport company Ltd, located in GASABO District, KIMIRONKO Sector. He was driving a HYUNDAI SANTA FE from his resident place at KIMIRONKO, on his way going at his working place located at NYARUGENGE District in GITEGA Sector. During his journey, he noticed a dramatic decrease in engine power caused by the malfunction of engine lubricating system. He called the head of KAZANA garage located near his working place for intervention. As an engine Mechanic, you are requested by the Head of the garage to solve the above-mentioned problem within 4 hours.

Tools	Screw drivers, Set of pliers, soft hummer, pressure tester tool kit, toolbox, spanners Set of screw drivers, Set of pliers
Equipment	Projector, Multimeter, computer, air compressor
Materials/ Consumables	Hot Water, shop rags, clamps, cooling system, components, drain pan, funnel

Assessable outcomes	Assessment criteria (Based on performance criteria)	Indicator	Observation		Marks allocation
			Yes	No	
1 Learningoutcome1: Prepare the workplace and apply safety (15%)	1.1 PPE are properly selected and worn as per safety measures	PPE are correctly selected			5
	1.2 Safety precautions of working area are appropriately applied before the work	Safety precautions of working area are properly applied			5

	1.3 Workplace is properly cleaned and arranged according to the standard	Workplace is correctly cleaned			5
2 Learning outcome 2: Describe engine lubricating system (35%)	2.1 Engine lubricating systems are properly classified according to the types of lubricating system	Engine lubricating systems are properly classified			10
	2.2 Engine lubricating system components are adequately identified according to the specifications	Engine lubricating system components are correctly identified			10
	2.3 Engine lubricating system components are adequately described according to the specifications	Engine lubricating system components are appropriately described.			15
3 Learningoutcome3: Repair engine lubricating system components (50%)	3.1. Tools, materials, and equipment are properly selected based on their function	Tools, materials, and equipment are correctly selected			5
	3.2. Engine lubricating system components faults are properly detected according to the diagnosis procedure.	Engine lubricating system components faults are adequately detected			15

	3.3. Engine lubricating system components faults are conveniently corrected according to the faults detected.	Engine lubricating system components faults are correctly corrected			15
	3.4. Engine oil is properly drained /filled according to the manufacturer's recommendations	Engine oil is methodically drained/filled			15
Total marks		**100**			
Percentage Weightage		**100%**			
Minimum Passing line % (Aggregate): 70%					

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