

# MINISTRY OF EDUCATION



Republic of Ghana

## TEACHING SYLLABUS FOR AUTO MECHANICS (SHS 1 - 3)

Enquiries and comments on this syllabus should be addressed to:

The Director  
Curriculum Research and Development Division (CRDD)  
P. O. Box 2739  
Accra  
Ghana.

Tel: 0302-683668  
0302-683651

September, 2010

# TEACHING SYLLABUS FOR AUTO MECHANICS

## RATIONALE FOR TEACHING AUTO MECHANICS

The rapid increase in industrialization and information technology has had significant impact on the motor industry. A large cadre of auto mechanics is presently needed for vehicle maintenance as a result of the country's continuing industrialization and development programmes. The cadre of motor vehicle service personnel who are needed now and will be needed in the future should be trained to be abreast with modern technology and techniques to be able to offer better customer service.

Auto mechanics, as a subject in the Senior High School, provides the student with knowledge and skills required in the work of a Motor Vehicle Mechanic. The subject helps the student to acquire knowledge and practical skills based on current science and technology needed for maintenance work on both old and modern vehicles.

## GENERAL AIMS

This syllabus is designed to help the student to:

1. Acquire relevant knowledge for repairing motor vehicles and other related machinery
2. Develop adequate knowledge and skills for employment in job areas such as service station and repair shops.
3. Develop adequate knowledge and skills for self employment
4. Acquire positive attitude towards practical skills
5. Adopt precautions for safe use and care of tools and resources in the workshop.
5. Provide an avenue for upward mobility into tertiary programme in Auto Mechanics.
6. Promote good customer relationship and take good care of customers' properties.

## SCOPE OF CONTENT

The scope of the Auto Mechanics syllabus is designed to provide requisite knowledge and confidence to students who will like to enter the Motor Industry to work in a Dealership, Repair shop or as Entrepreneurs owning their own garages and repair shops.

The course also provides students the foundation knowledge and skills for pursuing further education at the tertiary level. Some of the topics covered in the syllabus are:-

1. Development of the motor vehicle
2. Motor Vehicle Engines
3. Cooling system
4. Transmission System
5. Brake and Suspension systems
6. Wheel and Tyre
7. Automotive Electrical and Air conditioning systems
8. Safe Motoring

## PRE-REQUISITE SKILLS AND ALLIED SUBJECTS

Students offering the Auto Mechanics elective should have had good performance in English, Mathematics and in the Technical Skills option of the course in Basic Design and Technology offered at the Junior High School level. Satisfactory literacy and numeracy skills are important for success in this subject.

## ORGANIZATION OF THE SYLLABUS

The syllabus has been structured to cover three years of the Senior High School Programme. Each year's work consists of a number of sections with each section comprising a number of units. The structure of the syllabus is presented below.

### STRUCTURE AND ORGANIZATION OF AUTO MECHANICS SYLLABUS

| SHS 1  | SHS 2   | SHS 3   |
|--|---|---|
| <p><b>SECTION 1: HISTORY OF THE MOTOR VEHICLE (Page 1)</b></p> <p>Unit 1: Development of the motor vehicle</p>             | <p><b>SECTION 1: COOLING SYSTEM (Page 13)</b></p> <p>Unit 1: Water<br/>Unit 2: Air</p>  | <p><b>SECTION 1: FRONT AXLE AND STEERING (Page 33)</b></p> <p>Unit 1: Steering system<br/>Unit 2: Steering geometry<br/>Unit 3: Steering gear boxes<br/>Unit 4: Wheel alignment</p> |
| <p><b>SECTION 2: WORKSHOP SAFETY AND TOOLS (Page 2)</b></p> <p>Unit 1: Workshop safety<br/>Unit 2: Tools and equipment</p> | <p><b>SECTION 2: LUBRICATION SYSTEM (Page 16)</b></p> <p>Unit 1: Types and Layout<br/>Unit 2: Oil pumps<br/>Unit 3: Oil filters<br/>Unit 4: Ventilation<br/>Unit 5: Safety and warning devices<br/>Unit 6: Lubricants<br/>Unit 7: Oil Ratings</p>   | <p><b>SECTION 2: BRAKING SYSTEM (Page 35)</b></p> <p>Unit 1: Hydraulic brakes<br/>Unit 2: Servo units<br/>Unit 3: Pneumatic brakes<br/>Unit 4: Brake lining materials</p>           |
| <p><b>SECTION 3: VEHICLE LAYOUT (Page 4)</b></p> <p>Unit 1: Introduction to the motor vehicle</p>                          | <p><b>SECTION 3: TRANSMISSION SYSTEM (Page 18)</b></p> <p>Unit 1: Transmission system<br/>Unit 2: Clutch<br/>Unit 3: Fluid Flywheel<br/>Unit 4: Torque convertor<br/>Unit 5: Fault diagnosis<br/>Unit 6: Gearbox<br/>Unit 7: Selector mechanism<br/>Unit 8: Fault diagnosis of the gearbox<br/>Unit 9: Propeller shaft/universal joint<br/>Unit 10: Rear axle<br/>Unit 11: Method of supporting axle shaft<br/>Unit 12: Fault diagnosis of axle shaft</p> | <p><b>SECTION 3: FUEL INJECTION SYSTEM (Page 37)</b></p> <p>Unit 1: Electronic fuel ignition</p>  |

| SHS 1   | SHS 2   | SHS 3   |
|---|---|---|
| <p><b>SECTION 4: THE ENGINE (Page 5)</b></p> <p>Unit 1: Engine<br/> Unit 2: Principles and operation of engines<br/> Unit 3: Crank arrangement and firing orders<br/> Unit 4: Valve operating mechanism</p>     | <p><b>SECTION 4: SUSPENSION SYSTEM (Page 24)</b></p> <p>Unit 1: Suspension<br/> Unit 2: Shock absorbers<br/> Unit 3: Springs</p>  | <p><b>SECTION 4: AUTOMOTIVE ELECTRONICS (Page 38)</b></p> <p>Unit 1: Fundamentals of electronics<br/> Unit 2: Electronic ignition</p> |
| <p><b>SECTION 5: THE FUEL SYSTEM (Page 8)</b></p> <p>Unit 1: Fuel supply system<br/> Unit 2: Petrol supply<br/> Unit 3: Fuel pump<br/> Unit 4: Carburetor<br/> Unit 5: Diesel fuel<br/> Unit 6: Air cleaner</p> | <p><b>SECTION 5: WHEELS AND TYRES (Page 26)</b></p> <p>Unit 1: Wheels<br/> Unit 2: Tyres<br/> Unit 3: Tyre inflation</p>  | <p><b>SECTION 5: AUTOMOTIVE AIR- CONDITIONING (Page 40)</b></p> <p>Unit 1: Components of the Air Conditioner</p>                      |
| <p><b>SECTION 6: IGNITION SYSTEM (Page 11)</b></p> <p>Unit 1: Layout<br/> Unit 2: Components</p>  | <p><b>SECTION 6: ELECTRICAL SYSTEM (Page 28)</b></p> <p>Unit 1: Electrical Fundamentals<br/> Unit 2: Basic components<br/> Unit 3: Wiring<br/> Unit 4: Battery<br/> Unit 5: Starting<br/> Unit 6: Charging<br/> Unit 7: Lighting<br/> Unit 8: Auxiliary circuit</p> | <p><b>SECTION 6: SAFE MOTORING (Page 41)</b></p> <p>Unit 1: Highway code<br/> Unit 2: Safety devices</p>                              |
| <p><b>SECTION 7: EXHAUST SYSTEM (Page 12)</b></p> <p>Unit 1: Layout</p>   |   | <p><b>SECTION 7: FAULT DIAGNOSIS (Page 42)</b></p> <p>Unit 1: Diagnosis<br/> Unit 2: Evaluation</p>                                   |

## TIME ALLOCATION

The number of periods allocated AUTO MECHANICS in a week and for a year, from SHS1 - 3 is indicated in the table below.

| Year  | No. of periods per week | No. of teaching weeks/year | Total periods in a year | Total hours in a year |
|-------|-------------------------|----------------------------|-------------------------|-----------------------|
| 1     | 6                       | 36                         | 216                     | 144                   |
| 2     | 6                       | 36                         | 216                     | 144                   |
| 3     | 6                       | 24                         | 144                     | 96                    |
| Total | 18                      | 108                        | 576                     | 384                   |

## SUGGESTIONS FOR TEACHING THE SYLLABUS

Read this section very carefully to be able to follow the sequence of steps and processes prescribed for effective teaching and learning.

Teachers should identify resource persons who will assist them to teach some of the topics they may find difficult to teach. Classroom activities should be supplemented with field trips to garages and car dealerships in the community. The school should acquire some vital auto parts for teaching this subject and should also form good relationship with a garage in the community where students could be taken periodically for observation and practical work.

## SECTIONS AND UNITS

The syllabus has been planned on the basis of sections and units. Each year's work has been divided into sections. A section consists of a fairly homogeneous body of knowledge within the subject. Within each section are Units. A unit consists of a more homogeneous body of knowledge and skills. The teacher is expected to take the total number of sections and associated number of units prescribed for the year, and plan the lessons for each term such that the work in all the Sections and Units for each particular class will be adequately completed by the end of the school year. Each section of the syllabus is structured in five columns as follows:

- Units
- Specific Objectives
- Contents
- Teaching and Learning Activities
- Evaluation

### General Objectives

General Objectives have been listed at the beginning of each section of the syllabus, that is, just below the theme of the section. The general objectives specify the skills and behaviours the student should acquire after learning the units of the section. The general objectives form the basis for the selection and organization of the unit topics. Read the general objectives very carefully before you start teaching. After teaching all the units, go back and read the general aims and general objectives again to be sure you have covered both of them adequately in the course of your teaching.

Sections and Units: Each section of the syllabus is divided into units, where a unit consists of a body of knowledge and skills that form a logical aspect of the section.

Column 1 - Units: The Units in Column 1 provide the major topics of the section. You are expected to follow the unit topics according to the linear order in which they have been presented. However, if you find at some point that teaching and learning of a unit will be more effective if you branched to another unit before coming back to the unit in the sequence you are encouraged to do so.

Column 2 - Specific Objectives: Column 2 shows the Specific Objectives for each unit. The specific objectives begin with numbers such as 1.2.2 or 2.2.1. These numbers are referred to as "Syllabus Reference Numbers". The first digit in the syllabus reference number refers to the section; the second digit refers to the unit, while the third digit refers to the rank order of the specific objective. For instance, 1.2.2 means: Section 1, Unit 2 (of Section 1) and Specific Objective 2. In other words, 1.2.2 refers to Specific Objective 2 of Unit 2 of Section 1. Similarly, the syllabus reference number 2.2.1 simply means Specific Objective number 1, of Unit 2 of Section 2.

You will note also that specific objectives have been stated in terms of the students i.e. "*what the student will be able to do after instruction and learning in the unit.*" Each specific objective hence starts with the following: "The student will be able to.." This in effect, means that you have to address the learning problems of each individual student. It means individualizing your instruction as much as possible such that the majority of students will be able to master the objectives of each unit of the syllabus.

As has been said already, the order in which the unit topics appear should not necessarily be the teaching order. There should however, be a linkage in the order in which the units and specific objectives are treated. The teacher will have to study the syllabus carefully and plan ahead the activities the students will carry out during a particular lesson. Knowing the requirements of a lesson, the teacher should assemble the charts, tools and materials required for the activities well in advance. The collection of charts, tools and materials could be done by both the teacher and students if possible.

Resource persons may be invited to carry out demonstrations and talk about their work to the class where this is practicable. Field trips may be organized to auto mechanical workshops in the community for students to see the work done in such workshops.

Column 3 - Content: The "content" in the third column of the syllabus presents a selected body of information that you will need to use in teaching the particular unit. In some cases, the content presented is quite exhaustive. In some other cases, you could add more information to the content presented. In any case, try to find more information through reading and personal investigations to add to the content provided. The use of resource persons will in many cases, help to provide your class with more information and skills.

Column 4 -Teaching and Learning Activities (T/LA): T/LA that will ensure maximum student participation in the lessons is presented in Column 4. The teaching of this subject should be activity oriented. The major portion of class work and other assignments should emphasize practice. Group work and other participatory methods should be emphasized in the teaching and learning process. In this particular subject, students are expected to acquire valuable basic practical skills to serve as a foundation for further knowledge and skill development. Observe and also ensure that students exhibit skills and positive values of honesty, cooperation etc, in their behaviour and in creative activities. Stress the importance of these values especially when dealing with customers of workshops. The difference between workshops is not necessarily the quality of the knowledge and skill in the workshop, but the quality of the human relations, the punctuality of attendance to customers' complaints, honesty and timeliness in job completion. A list of tools and materials that can be used for teaching this syllabus can be found at the end of the syllabus.

Column 5 - Evaluation: Suggestions and exercises for evaluating the lessons of each unit are indicated in Column 5. Evaluation exercises can be in the form of oral questions, quizzes, class assignments, project work etc. Ask questions and set tasks and assignments that will challenge your students to apply their knowledge and skills in solving problems in auto mechanics and in developing positive attitudes as a result of having undergone instruction in this subject. Evaluation should also include observation of processes students go through in performing various activities. The suggested evaluation tasks are not exhaustive. You can develop other creative evaluation tasks to ensure that students master the instruction and behaviours implied in the specific objectives of each unit.

Lastly, bear in mind that the syllabus cannot be taken as a substitute for lesson plans. It is therefore necessary that you develop a scheme of work and lesson plans for teaching the units of this syllabus.

## PROFILE DIMENSIONS

Profile dimensions describe the underlying behaviours or abilities students are expected to acquire as a result of having gone through a period of instruction. Each of the specific objectives in this syllabus contains an action verb that specifies the type of learning or skill that the student should acquire by the end of the instructional period. A specific objective as follows: The student will be able to describe ...etc. contains an action verb "describe" that indicates what the student will be able to do after teaching and learning have taken place. Being able to "describe" something after the instruction has been completed means that the student has acquired "knowledge". Being able to explain, summarize, give examples, etc. means that the student has understood the lesson taught. Similarly, being able to develop, plan, construct etc, means that the student has learnt to create, innovate or synthesize knowledge.

Each of the action verbs in the specific objectives of the syllabus describes the behaviour the student will be able to demonstrate after the instruction. "Knowledge", "Application", etc. are dimensions that should be the prime focus of teaching, learning and assessment in schools.

Profile dimensions describe the underlying behaviours for teaching, learning and assessment. Auto Mechanics is a practical subject and the learning required is best achieved by practical application of skills learnt. The profile dimensions required in this subject and their respective weights are as follows:

|                             |     |
|-----------------------------|-----|
| Knowledge and Understanding | 20% |
| Application of Knowledge    | 30% |
| Practical Skills            | 50% |

Each of the dimensions has been given a percentage weight that should be reflected in teaching, learning and testing. The weights indicate the relative emphasis that the teacher should give in the teaching, learning and testing processes. The percentages indicate 50:50 proportional weighting for theory and practice. Combining the three dimensions in the teaching and learning process will ensure that auto mechanics is taught and studied not only at the cognitive level, but will also lead to the acquisition of practical skills in the subject. The explanation of the key words involved in each of the profile dimensions is as follows:

### *Knowledge and Understanding (KU)*

|               |   |
|---------------|---|
| Knowledge     | The ability to:<br>remember, recall, identify, define, describe, list, name, match, state principles, facts and concepts. Knowledge is simply the ability to remember or recall material already learned and constitutes the lowest level of learning.                          |
| Understanding | The ability to:<br>explain, summarise, translate, rewrite, paraphrase, give examples, generalise, estimate or predict consequences based upon a trend. Understanding is generally the ability to grasp the meaning of some material that may be verbal, pictorial, or symbolic. |

### *Application of Knowledge (AK)*

Ability to use knowledge or apply knowledge, as implied in this syllabus, has a number of learning/behaviour levels. These levels include application, analysis, innovation or creativity, and evaluation. These may be considered and taught separately, paying attention to reflect each of them equally in your teaching. The dimension "Use of Knowledge" or "application of knowledge" is a summary dimension of all four learning levels. Details of each of the four sub-levels of the dimension are as follows:

|                       |   |
|-----------------------|---|
| Application           | The ability to:<br>Apply rules, methods, principles, theories, etc. to concrete situations that are new and unfamiliar. It also involves the ability to produce, solve, operate, demonstrate, discover etc.   |
| Analysis              | The ability to:<br>Break down materials into its component parts; to differentiate, compare, distinguish, outline, separate, identify significant points etc, recognize unstated assumptions and logical facilities, recognize inferences from facts etc.   |
| Innovation/Creativity | The ability to:<br>Synthesize or put parts together to form a new whole. It involves the ability to combine, compile, compose, devise, suggest a new idea or possible ways, plan, revise, design, organize, create, and generate new solutions. The ability to create or innovate is the highest form of learning. The world becomes more comfortable because some people, based on their learning, generate new ideas, design and create new things.   |
| Evaluation            | The ability to:<br>Appraise, compare features of different things and make comments or judgments, contrast, criticize, justify, support, discuss, conclude, make recommendations etc. Evaluation refers to the ability to judge the worth or value of some materials, ideas etc., based on some criteria. Evaluation is a constant decision making activity. We generally compare, appraise and select throughout the day. Every decision we make involves evaluation. Evaluation is a high level ability just as application, analysis and innovation or creativity since it goes beyond simple knowledge acquisition and understanding. |

### **Practical Skills (PS)**

Practical skills involve demonstration of manipulative skills using tools/equipment and materials to carry out practical operations. The teaching and assessment of practical skills should involve projects and creative practical tasks.

“Practical Skills” is given 50 per cent of the teaching, learning and testing time to emphasize the point that Auto Mechanics involves very significant amount of practical skills at the SHS level. The remaining 50 per cent should be used for the theoretical aspect involving knowledge and understanding and application of knowledge on theoretical problems in auto mechanics.

Skills required for effective practical work are the following:

1. Handling Tools/Equipment and Materials
2. Observation
3. Perception
4. Creativity
5. Communication

Tools/Equipment/Material Handling: Students should be able to handle and use tools/equipment/materials properly for practical work to acquire the needed manual skills.

Observation: The student should be able to use his/her senses to make accurate observation of skills and techniques during demonstrations. The student in this case should be able to imitate the techniques he/she has observed for performing other tasks.

Perception: The student should be able to carry out the practical aspects of the subject using all the senses i.e. seeing, hearing, smelling, touching and tasting. The student should be encouraged to apply these senses to every project he/she undertakes. The sound of a well tuned engine is different from the sound of an engine that needs repair. Students should learn to use all their senses in this subject.

Originality/Creativity Students should be encouraged to be creative or original and be able to use new methods in carrying out projects. Encourage them to be original in the solutions they will adopt in solving practical problems on vehicles. You can help them to be creative and original by encouraging any little creative effort, technique and product they may develop.

Communication: Students should be guided to develop effective oral and written communication skills necessary for writing reports.

The action verbs provided under the various profile dimensions should help you to structure your teaching such as to achieve the set objectives. Select from the action verbs provided for your teaching, in evaluating learning before, during and after the instruction.

## **FORM OF ASSESSMENT**

It must be emphasized again that it is important that both instruction and assessment be based on the profile dimensions of the subject. In developing assessment procedures, select specific objectives in such a way that you will be able to assess a representative sample of the syllabus objectives. Each specific objective in the syllabus is considered a criterion to be achieved by the student. When you develop a test that consists of items or questions that are based on a representative sample of the specific objectives taught, the test is referred to as a "Criterion-Referenced Test". In many cases, a teacher cannot test all the objectives taught in a term, in a year etc. The assessment procedure you use i.e. class tests, home work, projects etc. must be developed in such a way that it will consist of a sample of the important objectives taught over a period.

The example on the next page shows an examination consisting of two papers, Paper 1 and Paper 2. Paper 3 will be the School Based Assessment (SBA) which is not shown in the table. Paper 1 will consist of objective-type items and structured questions. Paper 2 will consist of a practical test. The SBA will be based on all three dimensions as indicated. The distribution of marks for the objective test items, structured questions and the practical test should be in line with the weights of the profile dimensions already indicated and shown in the last column of the suggested examination table below.

Paper 1 of the examination will have two sections, A and B, which will comprise the multiple choice (objectives) and the structured questions respectively. Paper 2 will comprise the practical examination. The assessment structure below follows the structure used at the WASSCE.

**PAPER 1 (THEORY)** - This will consist of two (2) sections, A and B.

**Section A:-** Will consist of Forty (40) multiple choice/objective questions from the syllabus to be answered in ONE (1) hour for Forty (40) marks.

**Section B:-** Will consist of Five(5) Essay questions drawn from the syllabus. Students should be required to respond to Four (4) questions in ONE (1) hour for a total of sixty (60) marks.

**PAPER 2 (PRACTICALS):** This will consists of two practical assignments to be carried out in Two (2) hours for a total of 100 marks.

This pattern of examination can be adopted for the end-of-term and for the end of programme mock examination.

|              | Paper 1    |            | Paper 2          | Percentage Weighting | Marks       |
|--------------|------------|------------|------------------|----------------------|-------------|
|              | Section A  | Section B  | Essay-type paper |                      |             |
| Knowledge    | 40%        | -          | -                | 20%                  | -           |
| Application  | -          | 60%        | -                | 30%                  | 100%        |
| Practicals   | -          | -          | 100%             | 50%                  | 100%        |
| <b>Total</b> | <b>40%</b> | <b>60%</b> | <b>100%</b>      | <b>100%</b>          | <b>100%</b> |

### GUIDELINES FOR SCHOOL-BASED ASSESSMENT (SBA)

A new School Based Assessment system (SBA) will be introduced into the school system in 2011. The new SBA system is designed to provide schools with an internal assessment system that will help schools to achieve the following purposes:

- Standardize the practice of internal school-based assessment in all Senior High Schools in the country
- Provide reduced assessment tasks for subjects studied at SHS
- Provide teachers with guidelines for constructing assessment items/questions and other assessment tasks
- Introduce standards of achievement in each subject and in each SHS class
- Provide guidance in marking and grading of test items/questions and other assessment tasks
- Introduce a system of moderation that will ensure accuracy and reliability of teachers' marks
- Provide teachers with advice on how to conduct remedial instruction on difficult areas of the syllabus to improve class performance.

The arrangements for SBA may be grouped in categories as follows: Folio preparation, Project, Mid-Term Examination, Group Exercise, and End of Term Examinations.

1. Folio Preparation: These are tasks assigned to students to be completed in extended time. Folio preparation may include the following:
  - i) Specific Designs
  - ii) Investigative Study and Field visit reports.
2. Project: This will consist of a selected topic to be carried out by groups of students for a year. Segments of the project will be carried out each term toward the final project completion at the end of the year,

The projects may include the following:

- i) experiment
- ii) investigative study (including case study)
- iii) practical work assignment

A report must be written for each project undertaken.

3. Mid-Term Test: The mid-term test following a prescribed format will form part of the SBA
4. Group Exercise: This will consist of written assignments or practical work on a topic(s) considered important or complicated in the term's syllabus
5. End-of-Term Test: The end –of-term test is a summative assessment system and should consist of the knowledge and skills students have acquired in the term. The end-of-term test for Term 3 for example, should be composed of items/questions based on the specific objectives studied over the three terms, using a different weighting system such as to reflect the importance of the work done in each term in appropriate proportions. For example, a teacher may build an End-of-Term 3 test in such a way that it would consist of the 20% of the objectives studied in Term 1, 20% of objectives studied in Term 2 and 60% of the objectives studied in Term 3.

## GRADING PROCEDURE

To improve assessment and grading and also introduce uniformity in schools, it is recommended that schools adopt the following WASSCE grading structure for assigning grades on students' test results.

|           |               |   |           |
|-----------|---------------|---|-----------|
| Grade A1: | 80 - 100%     | - | Excellent |
| Grade B2: | 70 - 79%      | - | Very Good |
| Grade B3: | 60 - 69%      | - | Good      |
| Grade C4: | 55 - 59%      | - | Credit    |
| Grade C5: | 50 - 54%      | - | Credit    |
| Grade C6: | 45 - 49%      | - | Credit    |
| Grade D7: | 40 - 44%      | - | Pass      |
| Grade D8: | 35 - 39%      | - | Pass      |
| Grade F9: | 34% and below | - | Fail      |

In assigning grades to students' test results, you are encouraged to apply the above grade boundaries and the descriptors which indicate the meaning of each grade. The grade boundaries i.e., 60-69%, 50-54% etc., are the grade cut-off scores. For instance, the grade cut-off score for B2 grade is 70-79% in the example. When you adopt a fixed cut-off score grading system as in this example, you are using the criterion-referenced grading system. By this system a student must make a specified score to be awarded the requisite grade. This system of grading challenges students to study harder to earn better grades. It is hence a very useful system for grading achievement tests.

Always remember to develop and use a marking scheme for marking your class examination scripts. A marking scheme consists of the points for the best answer you expect for each question, and the marks allocated for each point raised by the student as well as the total marks for the question. For instance, if a question carries 20 marks and you expect 6 points in the best answer, you could allocate 3 marks or part of it (depending upon the quality of the points raised by the student) to each point, hence totaling 18 marks, and then give the remaining 2 marks or part of it for organisation of answer. For objective test papers you may develop an answer key to speed up the marking.

# SENIOR HIGH SCHOOL - YEAR 1

## SECTION 1

### HISTORY OF MOTOR VEHICLE

**General Objectives:** The student will:

1. be aware of the early development of motor vehicles.
2. appreciate changes and development motor vehicles have gone through over the years.

| UNIT   | SPECIFIC OBJECTIVES   | CONTENT  | TEACHING AND LEARNING ACTIVITIES   | EVALUATION  |
|--|---|--|--|---|
| <b>UNIT 1</b><br><br><b>DEVELOPMENT OF MOTOR VEHICLE</b> | The student will be able to:<br><br>1.1.1 describe the early means of transportation. | History and development of motor vehicle.<br>i. horse<br>ii. steam engine<br>iii. internal combustion engine<br>v. electric powered engine | Guide students to:<br><br>discuss early development of the motor vehicle<br><br>- Use magazines, films or other means to discuss the earlier methods of transportation<br><br>- visit library or internet café to read on the history and early development of transportation<br>- visit Museums especially the Science Museum in Accra to see the early type of vehicle<br>- discuss among themselves about the early means of transport. | Students to:<br><br>trace the history of transportation in Ghana.<br><br><br><br>write group report and discuss in class after visit. |

# SENIOR HIGH SCHOOL - YEAR 1

## SECTION 2

### WORKSHOP SAFETY AND TOOLS

**General Objectives:** The student will:

1. observe safety measures to avoid accidents in the workshop.
2. know the safety methods in the handling of tools and equipment.
3. acquire skills for fire fighting.

| UNIT  | SPECIFIC OBJECTIVES   | CONTENT  | TEACHING AND LEARNING ACTIVITIES   | EVALUATION   |
|---|---|--|--|--|
| <b>UNIT 1</b><br><br><b>WORKSHOP SAFETY</b> | The student will be able to:<br><br>2.1.1 explain the importance of safety in a workshop.<br><br>2.1.2 differentiate between the various types of safety in a workshop. | Importance of safety in a workshop.<br><br>Regulations and safety measures in the workshop.<br><br>Types of safety in the workshop:<br><u>Personal safety in the workshop</u> <ol style="list-style-type: none"> <li>i. Good ventilation</li> <li>ii. Cleanliness of shop</li> <li>iii. Proper use of protective clothing</li> <li>iv. Provision of guard around rotating parts</li> <li>v. Proper storage of inflammable material</li> <li>vi. Use of rigid support for raised vehicles, etc.</li> </ol> <u>Customer safety in the workshop</u> <ol style="list-style-type: none"> <li>i. Good ventilation</li> <li>ii. Cleanliness of shop</li> <li>iii. Proper storage of inflammable materials</li> <li>iv. Warning signs of danger areas</li> <li>v. Keeping customers away from rotating machines and other dangerous machines</li> <li>vi. Insuring against workshop accidents</li> </ol> | Discuss with students the: <ul style="list-style-type: none"> <li>- importance of safety in a work shop</li> <li>- difference between personal and customer safety</li> <li>- effects of non adherence to safety practices</li> </ul> Guide students to discuss various ways for ensuring workshop safety for workers and customers.<br><br>Using questions and answers, let students explain the importance of good ventilation, cleanliness in the shop (and the remaining list in content)<br><br>Assist students to discuss the importance of taking insurance against accidents in the workshop | Students to:<br><br>summarize the safely precautions required in the workshop<br><br>make and display signs warning customers of dangers in the workshop |

| UNIT   | SPECIFIC OBJECTIVES   | CONTENT  | TEACHING AND LEARNING ACTIVITIES   | EVALUATION  |
|--|---|--|--|---|
| <b>UNIT 1 (CONT'D)</b><br><br><b>WORKSHOP SAFETY</b> | The student will be able to:<br><br>2.1.3 identify the various types of fire.<br><br>2.1.4 demonstrate the use of equipment for fighting various fires. | Types of fire in the workshop<br>i. fuel and oil<br>ii. electrical<br>iii. toxic substance<br><br>Types of fire extinguisher:<br>i. foam type<br>ii. dry powder<br>iii. sand<br>iv. water<br>v. wet blanket, etc.  | Guide students to discuss the possible causes of fire in a workshop (See content).<br><br>Guide students to discuss some of the toxic substances that may be found in a workshop<br><br>Demonstrate using an extinguisher to put off fire. Guide students to practice.<br>-Discuss other methods for extinguishing fire<br><br><b>Note:</b> Invite Fire Service officers to help students demonstrate the various methods.   | Students to :<br><br><br><br>write out comments and demonstrate the process of putting off fuel fire using dry chemical extinguisher. |
| <b>UNIT 2</b><br><br><b>TOOLS AND EQUIPMENT</b>      | 2.2.1 select the correct tool or equipment for a given operation.   | Selection of Tools and Equipment<br><br><u>Hand tools (Mechanic's)</u><br>Torque wrench<br>File<br>Chisel<br>Hammer<br>Valve spring compressor<br>Spanner (assorted) etc<br><br><u>Special purpose equipment</u><br><br>i. <u>Measuring Instruments:</u><br>Calipers<br>Steel rule<br>Feeler gauges (set), etc.<br>Micrometers<br><br>ii. <u>Other Workshop Equipment</u><br>Drilling machine<br>Air compressor<br>Axle stand<br>Bench vice<br>Grinding machine<br>Mobile crane, etc | Using hand tools, help students to demonstrate the safe use of each of the tools under content.<br><br>Demonstrate how the measuring instruments and other equipment listed in content are used in the auto industry paying attention to safety precautions.<br><br><b>Note:</b><br>Take students to a well equipped workshop in the locality to see some of the measuring instruments and other workshop equipment listed in content.<br><br>In the classroom, help students to discuss the various equipment they observed on the visit and the safety precautions one should observe in using the equipment | list a number of hand tools and equipment and describe how they are used.<br><br><br><br>write report in groups and discuss in class. |

# SENIOR HIGH SCHOOL - YEAR 1

## SECTION 3

### VEHICLE LAYOUT

**General Objectives:** The student will:

1. acquire knowledge on the layout of chassis for both car and truck
2. be aware of differences in chassis construction.
3. be aware of the functions of the main components of motor vehicles

| UNIT  | SPECIFIC OBJECTIVES   | CONTENT  | TEACHING AND LEARNING ACTIVITIES  | EVALUATION   |
|---|---|--|---|--|
| <b>UNIT 1</b><br><br><b>INTRODUCTION TO THE MOTOR VEHICLE</b> | <p>The student will be able to:</p> <p>3.1.1 identify types of body, chassis construction and drive arrangements of the motor vehicle.</p> <p>3.1.2 explain the functions of the main components of the motor vehicle</p> <p>3.1.3 describe the main components and their positions on the motor vehicle.</p> | <p>Identification of body, chassis and drive arrangements of vehicles</p> <p>Main components and their functions:</p> <ol style="list-style-type: none"> <li>i. Engine</li> <li>ii. Transmission</li> <li>iii. Body</li> <li>iv. Steering</li> <li>v. Suspension</li> <li>vi. Wheels/tyres</li> <li>vii. Brakes</li> <li>viii. Clutch</li> <li>ix. Gear box</li> </ol> <p>Components and their positions on motor vehicles - cars and trucks:</p> <ul style="list-style-type: none"> <li>- Engine</li> <li>- Clutch</li> <li>- Gear box</li> <li>- Propeller shaft/drive shaft</li> <li>- Rear axle</li> </ul> | <p>Guide students to inspect and discuss the differences in the body, chassis and drive arrangements of</p> <ol style="list-style-type: none"> <li>i. cars</li> <li>ii. trucks</li> </ol> <p>Discuss the functions of the main components of cars and trucks.</p> <p>Guide students to demonstrate the methods of securing and locking the components to the chassis.</p> <p>Guide students to observe and discuss why the main components are positioned in their various places on cars and trucks.</p> | <p>Students to:</p> <p>compare the differences between the chassis of cars and trucks and present a report.</p> <p>draw illustrations of the components studied.</p> |

# SENIOR HIGH SCHOOL - YEAR 1

## SECTION 4 THE ENGINE

**General Objectives:** The student will:

1. be aware of the different types of engines.
2. develop knowledge on the working principles of an engine.
3. acquire skills in dismantling and reassembling an engine using correct methods.
4. develop skills in carrying out engine maintenance.

| UNIT                               | SPECIFIC OBJECTIVES  | CONTENT   | TEACHING AND LEARNING ACTIVITIES  | EVALUATION   |
|------------------------------------|--|---|---|--|
| <b>UNIT 1</b><br><br><b>ENGINE</b> | The student will be able to:<br><br>4.1.1 identify types of engine.<br><br>4.1.2 explain the purpose of an engine.<br><br>4.1.3 describe the main component parts of the engine. | Types of engine:<br>i. Petrol<br>ii. Diesel<br><br>Purpose of an engine.<br><br>Main parts of the engine:<br>i. engine block<br>ii. cylinder head<br>iii. crankshaft<br>iv. flywheel<br>v. connecting rod<br>vi. piston and rings<br>vii. camshaft<br>viii. valves<br>ix. tappets | Use sketches, chart or real objects to guide students to differentiate between petrol and diesel engine.<br><br>Discuss the purpose of the engine<br><br>Using a dismantled engine, discuss the various components listed in content and their positions in the engine.<br><br>Organize a visit to local vehicle repair workshop. | Students to:<br><br>differentiate between the petrol engine and the diesel engine.<br><br><br><br><br><br><br><br><br><br>write group report and discuss in class after visit. |

| UNIT   | SPECIFIC OBJECTIVES  | CONTENT  | TEACHING AND LEARNING ACTIVITIES  | EVALUATION  |
|--|--|--|---|---|
| <b>UNIT 2</b><br><br><b>PRINCIPLES AND OPERATION OF ENGINES</b>  | <p>The student will be able to:</p> <p>4.2.1 state the advantages and disadvantages of petrol and diesel engines.</p> <p>4.2.2 describe the construction and operation of the 2-stroke and 4-stroke petrol and diesel engines.</p> <p>4.2.3 differentiate between the single and multi cylinder engines.</p> | <p>Advantages and Disadvantages of Petrol and diesel engines.</p> <p>Construction and operation of the 2-stroke, 4-stroke internal combustion engines: (Petrol and diesel).</p> <p>Comparison of single and multi cylinder engines.<br/>Advantages and Disadvantages</p> | <p>Discuss the advantages and disadvantages of petrol and diesel engines.</p> <p>Use sketches or chart to:</p> <ul style="list-style-type: none"> <li>- explain the construction and operation of 2 and 4 stroke petrol engines.</li> <li>- illustrate the construction and operation of 2 and 4 strokes diesel engines.</li> </ul> <p>Guide students to:</p> <ul style="list-style-type: none"> <li>- dismantle 2 and 4 stroke petrol and diesel engines.</li> <li>- examine the cylinder bore, crankshaft, valve seat and face, crankshaft etc. for wear and cracks.</li> <li>- reassemble engines.</li> </ul> <p>Students to discuss the differences in single and multi cylinder engines.</p> | <p>Students to:</p> <p>compare the advantages and disadvantages of petrol and diesel engines.</p> <p>analyze the constructional difference between petrol and diesel engines.</p> <p>sketch the crankshaft of a four and six cylinder in-line engines and label the main parts.</p> |
| <b>UNIT 3</b><br><br><b>CRANK ARRANGEMENTS AND FIRING ORDERS</b> | <p>4.3.1 identify the crank arrangements and firing orders</p>   | <p>Crankshaft arrangement and firing orders:</p> <ul style="list-style-type: none"> <li>- 2,4 and 6 cylinder in-line engines.</li> <li>- 2, 4, and 6 cylinder Vee cylinder engines.</li> <li>- 4 cylinder opposed.</li> </ul>  | <p>Guide students to:</p> <ul style="list-style-type: none"> <li>- examine the crank arrangement of a 4 and 6 cylinder in-line engines noting their firing orders.</li> <li>- observe the crank arrangement of Vee 4 and 6 cylinder engines.</li> </ul>   |   |

| UNIT  | SPECIFIC OBJECTIVES  | CONTENT  | TEACHING AND LEARNING ACTIVITIES  | EVALUATION   |
|---|--|--|---|--|
| <b>UNIT 4</b><br><br><b>VALVE OPERATING MECHANISM</b> | <p>The student will be able to:</p> <p>4.4.1 explain crankshaft positions and the functions of valve operating mechanism on an engine.</p> <p>4.4.2 explain the valve timing terms</p> <p>4.4.3 sketch a valve timing diagram of a four stroke engine, showing an overlap period .</p> | <p>Crankshaft positions and valve operating mechanism for:</p> <ul style="list-style-type: none"> <li>- side valve</li> <li>- overhead valve</li> <li>- overhead camshaft</li> </ul> <p>Valve Timing Terms:</p> <ol style="list-style-type: none"> <li>i. lead</li> <li>ii. lag</li> <li>iii. overlap</li> </ol> <p>Valve timing diagram<br/>4 - stroke engine .</p> | <p>Use sketches or charts to explain the operation of the valve operating mechanism.</p> <p>Group students to discuss the meaning of the valve terms listed in content.</p> <p>Guide students to perform valve timing on an engine and determine the overlap period</p> <p>Guide students to perform valve adjustment on overhead and side valve engines.</p> | <p>Students to:</p> <p>sketch the valve timing diagram and show valve opening and closing positions.</p> <p>Calculate the valve overlap.</p> |

# SENIOR HIGH SCHOOL - YEAR 1

## SECTION 5

### THE FUEL SYSTEM

**General Objectives:** The student will:

1. be aware of the general layout of fuel supply systems.
2. be aware of the different types of fuel supply system.
3. recognize all component parts in the fuel supply system.
4. acquire knowledge on the working principles of various units in the fuel system.
5. acquire knowledge in servicing and maintenance of units.
6. acquire knowledge detecting and rectifying faults detecting and rectifying faults.

| UNIT  | SPECIFIC OBJECTIVES  | CONTENT   | TEACHING AND LEARNING ACTIVITIES  | EVALUATION   |
|---|--|---|---|--|
| <b>UNIT 1</b><br><br><b>FUEL SUPPLY SYSTEMS</b>   | The student will be able to:<br><br>5.1.1 identify the type of fuel supply system.<br><br>5.1.2 explain the purpose of the fuel supply system.<br><br>5.2.3 sketch the layout of petrol supply system. | Types of fuel supply systems:<br>- Petrol<br>- Diesel<br><br>Purpose of Fuel supply systems.<br><br>Layout and main components:-<br>i. tank<br>ii. pipeline<br>iii. filter<br>iv. pump<br>v. carburetor | Using models assist students to observe the fuel supply system.<br><br>Group students to discuss the purpose of fuel supply system.<br><br>Assist student to sketch the layout of the components.   | Students to:<br><br>sketch and label the component parts of the fuel supply system for both petrol and diesel engines. |
| <b>UNIT 2</b><br><br><b>PETROL SUPPLY SYSTEMS</b> | 5.2.1 explain the functions of the main components.<br><br>5.2.2 describe the operation of petrol supply system.<br><br>5.2.3 state the properties of petrol and diesel fuels.                         | Functions of the components.<br><br>Operation of petrol supply system.<br>i. gravity feed<br>ii. force feed.<br><br>Properties of fuels.  | Discuss the functions of the main components.<br>Use sketches or chart to discuss the construction and operation of the gravity and the force feed systems.<br><br>Discuss the operation of petrol supply system.<br><br>Discuss the properties of petrol and diesel fuels. |  |

| UNIT                                    | SPECIFIC OBJECTIVES   | CONTENT   | TEACHING AND LEARNING ACTIVITIES   | EVALUATION   |
|---|---|---|--|--|
| <b>UNIT 3</b><br><br><b>FUEL PUMP</b>   | The student will be able to:<br><br>5.3.1 explain the advantages and disadvantages of mechanical and electrical fuel pumps<br><br>5.3.2 describe the construction and operation of mechanical and electrical fuel pumps, sketch and label the main parts<br><br>5.3.3 sketch and label main parts of mechanical and electrical fuel pumps   | Advantages and disadvantages of mechanical and electrical fuel pumps<br><br>Mechanical and Electrical fuel pumps.<br><br>Main parts of components of mechanical and electrical fuel pumps   | Using mechanical and electrical fuel pumps, assist students to discuss the advantages and disadvantages of each type.<br><br>Use sketches or charts to discuss explain the construction and operation of mechanical and electrical fuel pumps.<br><br>Guide students to dismantle a mechanical fuel pump, examine the parts, reassemble and test for satisfactory operation.   | Students to:<br><br>sketch and label the main parts of mechanical and electrical fuel pumps  |
| <b>UNIT 4</b><br><br><b>CARBURETORS</b> | 5.3.4 dismantle and reassemble a mechanical fuel pump and test for satisfactory operation.<br><br>5.4.1 state the advantages and disadvantages of the multi-jet carburetors.<br><br>5.4.2 explain the functions and operation of the simple carburetor<br><br>5.4.3 explain the mixture strength for engine speed and load.<br><br>5.4.4 sketch and label the multi-jet carburetors and describe their operation. | Dismantling and Reassembling a mechanical fuel pump.<br><br>Advantages and disadvantages of the multi-jet carburetors.<br><br>Functions and operation of the simple carburetor.<br><br>Air-fuel ratios.<br><br>Multi Carburetors: fixed jet types<br>Element of combustion. | Guide students to discuss the advantages and disadvantages of the multi-jet carburetors.<br><br>Use sketches or chart to discuss the functions and operation of the simple carburetor<br><br>Discuss the air fuel ratios for the following operations:<br>i. cold starting<br>ii. slow running<br>iii. normal running<br>iv. rich mixture<br>v. fuel economy<br><br>Using a sketch, discuss the operation of a multi jet carburetor.<br>Guide students to sketch and label the parts of the multi-jet carburetor | sketch multi jet carburetors and describe their operation.<br><br>state the advantages and disadvantages of the multi-jet carburetors.<br><br>sketch a simple carburetor and describe its operation. |

| UNIT                                     | SPECIFIC OBJECTIVES  | CONTENT  | TEACHING AND LEARNING ACTIVITIES  | EVALUATION   |
|--|--|--|---|--|
| <b>UNIT 5</b><br><br><b>DIESEL FUEL</b>  | The student will be able to:<br><br>5.5.1 identify the main components of the diesel fuel supply system and describe its operation.<br><br>5.5.2 sketch the layout of the diesel fuel supply system. | Main components and operation.<br>i. fuel tank<br>ii. lift pump<br>ii. injection pumps (in-line and D. P. A.)<br>iii. filters<br>iv. injectors<br><br>Layout of diesel fuel system.            | Guide students to discuss the units and operations of the components under content.<br><br>- remove and replace fuel filters<br>- bleed/expel air from the system.<br>- explain the purpose of heater plugs and injectors and state their location on the engine.<br>- explain the importance of fuel filtration.<br>-test an injector for serviceability.<br><br>Using sketches or charts discuss the layout of the diesel fuel supply system. | Students to:<br><br>describe the process of expelling air from the fuel system.<br><br>sketch the layout of the diesel fuel system and label the parts.        |
| <b>UNIT 6</b><br><br><b>AIR CLEANERS</b> | 5.6.1 explain the purpose of the air filter/cleaner.<br><br>5.6.2 sketch and describe the operation of air filter/cleaner.   | Purpose of Air Cleaners<br>i. paper element<br>ii. oil bath<br>The process of filtering the air by paper or oil –bath types<br><br>Operation of Air/Filter<br>i. paper element<br>ii. oil bath | Use sketches, charts or real objects to discuss the importance of the air cleaner.<br><br>service air cleaners<br>a. paper type<br>b. oil bath type.  | students to sketch and discuss the operation the air filter/cleaners in groups.<br><br>describe the process of cleaning the paper element type of air cleaner. |

# SENIOR HIGH SCHOOL - YEAR 1

## SECTION 6

### IGNITION SYSTEM

**General Objectives:** The student will:

1. be aware of the ignition system layout.
2. recognize component parts and their functions.
3. apply acquired skills in detecting and correcting faults in the ignition system.

| UNIT              | SPECIFIC OBJECTIVES  | CONTENT  | TEACHING AND LEARNING ACTIVITIES  | EVALUATION  |
|-------------------|--|--|---|---|
| <b>UNIT 1</b>     | The student will be able to:   |  |   | Students to:  |
| <b>LAYOUT</b>     | 6.1.1 explain the purpose of the coil ignition system.                                       | Coil ignition system:<br>Layout<br>Battery<br>Switch<br>Coil<br>Distributor<br>Condenser<br>Spark plug<br>Advance and retard mechanisms        | Use sketches, chart or real objects to:<br>- discuss the purpose of the coil ignition system<br>- show the main components and describe the operation   | describe the operation of the coil ignition system with a sketch.                           |
|                   | 6.1.2 sketch and label the main components of the conventional type of coil ignition system. | Function of the spark plug, heat range and measurement of air gap  | Students to sketch and label the main components of the conventional type of coil ignition system   | clean and adjust contact breaker point gap and reset spark plug gap.                        |
| <b>UNIT 2</b>     | 6.2.1 identify and describe the function of a spark plug.                                    | Heat range ad measurement of the air gap.  | Discuss the function of spark plugs on an engine.<br>- Guide students to discuss the heat range of spark plug<br>- Measure and adjust spark plug gap.   |   |
| <b>COMPONENTS</b> | 6.2.2 identify heat range and measure the air gap.   |  |   |   |
|                   | 6.2.3 explain the purpose of the components system and the operation of the ignition system  | Component Parts: (i). ignition coil<br>(ii). contact breaker<br>(iii). condenser<br>Operation: Advance and retard mechanism of the distributor | Guide students to remove<br>-Contact set, clean, refit and reset gap.<br>-Spark plug, clean, reset gap and refit.<br>-Start engine, advance and retard ignition and let students note the engine performance. |   |
|                   | 6.2.4 set ignition timing on a petrol engine.  | Ignition Timing on a Petrol engine   | Guide students to:<br>i) perform ignition timing on a petrol engine<br>ii) check the ignition timing using timing light and reset when necessary  | be in groups to discuss the effect of retarded and advanced ignition on engine performance. |

# SENIOR HIGH SCHOOL - YEAR 1

## SECTION 7

### EXHAUST SYSTEM

**General Objectives:** The student will:

1. be aware of the exhaust layout on a vehicle.
2. acquire knowledge of the functions of the exhaust system.
3. know how to rectify faults in the exhaust system.

| UNIT                               | SPECIFIC OBJECTIVES   | CONTENT   | TEACHING AND LEARNING ACTIVITIES  | EVALUATION  |
|------------------------------------|---|---|---|---|
| <b>UNIT 1</b><br><br><b>LAYOUT</b> | The student will be able to:<br><br>7.1.1 identify faults in the exhaust system and repair.<br><br>7.1.2 explain the purpose of the exhaust system<br><br>7.1.3 sketch and label the main components of the exhaust system<br><br>7.1.4 sketch a silencer and describe its operation. | Faults in the exhaust system<br><br>Purpose of the exhaust system.<br><br>Main components of exhaust system<br>1. manifold<br>2. flange<br>3. exhaust pipe<br>4. silencer/muffler<br>5. tail pipe<br><br>Silencer assembly: Expansion and Absorption types. | Demonstrate ways of finding faults in the exhaust system and repairing them.<br><br>Use sketch, chart or real objects to:<br><br>- discuss the purpose of the exhaust system.<br><br>- discuss the operation of the exhaust system.<br><br>Guide students to inspect the layout of a vehicle's exhaust system.<br><br>Use charts or sketches to discuss the operation of the expansion and absorption types of silencers. | Students to:<br><br>check exhaust system for leakage and rectify. |

# SENIOR HIGH SCHOOL - YEAR 2

## SECTION 1

### COOLING SYSTEMS

**General Objectives:** The student will:

1. recognise the importance of cooling system.
2. be aware of the different types of cooling systems and their operations.
3. apply knowledge acquired in detecting and correcting fault in cooling system.

| UNIT                              | SPECIFIC OBJECTIVES   | CONTENT   | TEACHING AND LEARNING ACTIVITIES  | EVALUATION  |
|-----------------------------------|---|---|---|---|
| <b>UNIT 1</b><br><br><b>WATER</b> | The student will be able to:<br><br>1.1.1 identify the types of cooling system.<br><br>1.1.2 state the advantages and disadvantages of the water cooling system.<br><br>1.1.3 explain the purpose of cooling system.<br><br>1.1.4 describe the construction and operation of the water cooling system.<br><br>1.1.5 identify components of cooling system<br><br>1.1.6 sketch the layout of the water cooling system and label the main parts | Types of cooling system:<br>i. water<br>ii. air<br><br>Advantages and disadvantages of the water cooling system<br><br>Purposes of cooling system:<br>i. water<br>ii. air<br><br>Construction and operation of the water cooling system.<br><br>Components of water cooling system:<br>i. thermosyphon<br>ii. pump assisted<br><br>Layout of main parts of water cooling system:<br>i. radiator<br>ii. water hose<br>iii. engine block<br>iv. thermostat.<br>v. pump<br>vi. fan | Using chart or real object, assist students to identify the two main types of cooling system.<br><br>Discuss the advantages and disadvantages of water cooling system.<br><br>Discuss the purpose of the cooling systems<br><br>Discuss the operation of the water cooling system<br><br>Use sketches or chart to show the difference in construction between<br>i. thermosyphon<br>ii. pump assisted cooling system.<br><br>Guide students to examine the layout of the water cooling system | Students in groups, to examine the differences noted between water and air cooling systems on a motor vehicle and present a report for discussions. |

| UNIT                                       | SPECIFIC OBJECTIVES  | CONTENT   | TEACHING AND LEARNING ACTIVITIES  | EVALUATION   |
|--|--|---|---|--|
| <b>UNIT 1 (CONT'D)</b><br><br><b>WATER</b> | <p>The student will be able to:</p> <p>1.1.7 explain the purpose of the main components of water cooling system and describe their construction and operation</p> <p>1.1.8 identify the two types of Thermostat and describe their construction and operation.</p> <p>1.1.9 compare the Thermostats.</p> | <p>Components of the water cooling system:</p> <p>i. radiator<br/>ii. water pump<br/>iii. pressure cap</p> <p>Types of thermostat</p> <p>i. bellows<br/>ii. wax pellet</p> <p>Comparison of thermostat</p> <p>i. bellows<br/>ii. wax pellet</p> | <p>Using charts, sketches or real objects guide students to:</p> <p>- show the following components of the water cooling system on a vehicle and discuss how each of them operate</p> <p>e.g</p> <p>i. radiator<br/>ii. thermostat<br/>iii. water pump<br/>iv. pressure cap<br/>v. water hose<br/>v. fan</p> <p>Using sketches, chart or real objects Discuss the construction and operation of Thermostat and test for correct operation.</p> <p>Assist students to discuss and test for correct operations.</p> | <p>Students to:</p> <p>identify the position of the following on a vehicle</p> <p>i. radiator<br/>ii. water pump<br/>iii. water hoses<br/>iv. thermostat<br/>v. fan</p>                          |
| <b>UNIT 2</b><br><b>AIR</b>                | <p>1.2.1 explain the advantages and disadvantages of the air cooling system</p> <p>1.2.2 describe the operation of the air cooling system.</p> <p>1.2.3 sketch the layout of the air cooling system and label the main parts.</p>  | <p>Air-cooling system:<br/>Advantages and disadvantages.</p> <p>Operation of air cooling system.</p> <p>Layout of Air cooling system:<br/>- fan</p>   | <p>Group students to discuss the advantages and disadvantages of the air cooling systems.</p> <p>Discuss the operation of air cooling system.</p> <p>Use sketches or chart to discuss the construction of the air cooling system.</p>   | <p>sketch the layout of the following cooling systems and describe their operating mechanisms:</p> <p>i. thermosyphon<br/>ii. pump assisted<br/>iii. air cooled<br/>iv. label the main parts</p> |

# SENIOR HIGH SCHOOL - YEAR 2

## SECTION 2

### LUBRICATION SYSTEM

**General Objectives:** The student will:

1. be aware of the layout and path of oil flow in engine lubrication system.
2. acquire knowledge on the various methods of lubrication and lubrication systems.
3. acquire knowledge on the general concept of oil pumps and oil filters.
4. be aware of problems in lubrication system.

| UNIT   | SPECIFIC OBJECTIVES   | CONTENT   | TEACHING AND LEARNING ACTIVITIES  | EVALUATION   |
|--|---|---|---|--|
| <b>UNIT 1</b><br><br><b>TYPES AND LAYOUT</b> | The student will be able to:<br><br>2.1.1 identify types of engine lubrication system.<br><br>2.1.2 explain the purpose of the lubrication system.<br><br>2.1.3 describe how oil is distributed in the engine.<br><br>2.1.4 sketch a line diagram to show the layout and path of oil flow of wet and dry sump engine lubrication systems. | Engine lubrication systems<br>i. wet sump<br>ii. dry sump<br><br>Lubrication system:<br>Wet and Dry sumps.<br><br>Modes of oil distribution<br>i. splash<br>ii. mist<br>iii. pressure<br><br>Layout and path of oil flow of wet and dry sump engine imbrications system . | Use sketches or chart to identify the differences in construction between the wet and dry sump lubrication systems.<br><br>Using chart or sketches discuss the purpose of the lubrication system.<br><br>Using charts or sketchers demonstrate how oil is distributed in the engine by the following methods.<br>i. splash<br>ii. mist<br>iii. pressure<br><br>Use sketches or chart to show the layout and path of oil flow of the wet and dry sump lubrication system.<br>Discuss the operation of the wet and dry sump lubrication system. | Students to:<br><br><br><br><br><br><br>State the advantages of the wet sump lubrication system.<br>Sketch the layout of the wet sump lubrication system.<br><br>Students to sketch the layout and path of oil flow in the wet sump engine |

| UNIT                                    | SPECIFIC OBJECTIVES   | CONTENT   | TEACHING AND LEARNING ACTIVITIES  | EVALUATION   |
|---|---|---|---|--|
| <b>UNIT 2</b><br><br><b>OIL PUMPS</b>   | <p>The student will be able to:</p> <p>2.2.1 identify the various types of oil pumps.</p> <p>2.2.2 explain the purpose of an oil pump</p> <p>2.2.3 describe the construction and operation of oil pumps.</p> <p>2.2.4 over hall pumps and test for correct operation.</p> | <p>Type of oil pumps</p> <p>i. gear<br/>ii. rotor<br/>iii. vane</p> <p>Purpose of Oil pumps.</p> <p>Construction and operation of oil pumps:</p> <p>i. gear type<br/>ii. rotor type</p> <p>Oil pumps servicing.</p> | <p>Use sketches, charts or real objects to identify the following oil pumps:</p> <p>i. gear type<br/>ii. rotor type<br/>iii. vane type</p> <p>Group students to discuss the purpose of the oil pump</p> <p>Group students to discuss the construction and operation of oil pumps in content.</p> <p>Guide students to dismantle the various types of oil pumps and examine the parts for wear and reassemble. Test for correct operation.</p> | <p>Students to:</p> <p>sketch and describe the construction and operation of rotor type oil pump.</p>                      |
| <b>UNIT 3</b><br><br><b>OIL FILTERS</b> | <p>2.3.1 explain the purpose of oil filters and give examples of each type.</p> <p>2.3.2 sketch and describe the construction and operation of oil filters.</p> <p>2.3.3 describe methods of filtration.</p>  | <p>Purpose of Oil filters:</p> <p>i. full flow<br/>ii. by pass</p> <p>Construction and operation of oil fitters Methods of filtration</p> <p>i. full flow<br/>ii. by pass filters.</p>                              | <p>Group students to discuss the purpose of oil filters.</p> <p>Use sketches or charts to discuss the construction and functions of:</p> <p>i. full flow<br/>ii. by pass filters</p> <p>Guide students to remove and replace oil filter on an engine.</p>   | <p>describe the procedure for draining and filling an engine with oil.</p> <p>students to sketch the types of filters.</p> |

| UNIT   | SPECIFIC OBJECTIVES   | CONTENT   | TEACHING AND LEARNING ACTIVITIES   | EVALUATION  |
|--|---|---|--|---|
| <b>UNIT 4</b><br><br><b>VENTILATION</b>                | The student will be able to:<br><br>2.4.1 explain the purpose of the crankcase ventilation system.  | Purpose of crankcase ventilation system.  | Discuss the purpose of the crankcase ventilation system.<br>Guide students to identify the type on an engine.  | Students to:  |
| <b>UNIT 5</b><br><br><b>SAFETY AND WARNING DEVICES</b> | 2.4.2 describe the operation of the positive type.<br><br>2.5.1 identify safety and warning devices<br><br>2.5.2 explain the purpose of safety/warning devices. | Operation of crankcase ventilation<br><br>Safety and warning devices.<br><br>Purpose of and warning devices.<br>i. oil pressure relief valve<br>ii. oil pressure warning lamp<br>iii. oil gauge<br>iv. dipstick | Group students to discuss the operation of the crankcase ventilation system using sketches or charts.<br><br>Using a vehicle, assist students to identify safety and warning devices<br><br>Using illustrations discuss the following on a vehicle and explain their purposes:<br>i. oil pressure relief valve<br>ii. warning lamp<br>iii. oil gauge | Describe the operation of the<br>i. oil pressure relief valve<br>ii. oil pressure warning lamp<br>iii. oil gauge. |
| <b>UNIT 6</b><br><br><b>LUBRICANTS</b>                 | 2.6.1 identify the type of lubricants used on vehicles.<br><br>2.6.2 state the purpose of lubricants.   | Types of lubricants<br>i. engine<br>ii. gear box .<br>iii. final drives<br>iv. hub, steering system etc.<br><br>Lubricants<br>i. oil<br>i. grease   | Guide students to differentiate between the following lubricants:<br>i. engine oil<br>ii. gear oil<br>iii. grease<br><br>Discuss the need for lubricants in vehicles.<br>Guide students to use the dipstick to check the oil level in the sump.  |   |
| <b>UNIT 7</b><br><br><b>OIL RATINGS</b>                | 2.7.1 explain the terms used for oil ratings  | Term used for oil ratings:<br>i. viscosity<br>ii. SAE numbers<br>iii. viscosity index   | Guide students to brainstorm for the meanings of the following lubricating terms:<br>i. Viscosity<br>ii. SAE numbers<br>iii. Viscosity index   | Explain the following<br>i. Viscosity<br>ii. SAE number<br>iii. Viscosity index.                                  |

# SENIOR HIGH SCHOOL - YEAR 2

## SECTION 3 TRANSMISSION SYSTEM

**General Objectives:** The student will:

1. be aware of the layout of components in the transmission system and their names
2. develop knowledge of the functions of various components in the transmission system.
3. develop skills in detecting and rectifying faults in the transmission system.

| UNIT  | SPECIFIC OBJECTIVES  | CONTENT  | TEACHING AND LEARNING ACTIVITIES  | EVALUATION  |
|---|--|--|---|---|
| <b>UNIT 1</b><br><br><b>TRANSMISSION SYSTEM</b> | <p>The student will be able to:</p> <p>3.1.1 identify the types of transmission</p> <p>3.1.2 explain the purpose of the transmission system</p> <p>3.1.3 sketch the layout and label the main components of the conventional transmission system</p> | <p>Types of transmission</p> <p>i. manual</p> <p>ii. automatic</p> <p>Transmission system.</p> <p>- manual</p> <p>- automatic</p> <p>Layout of the conventional transmission system.</p>   | <p>Using charts, show types of transmission system used on vehicles to students.</p> <p>Discuss the purpose of the transmission system.</p> <p>Use sketches or real objects to discuss the layout of the conventional transmission system of a vehicle.</p>   | <p>Students to:</p> <p>sketch the layout of the conventional transmission system and label the main components.</p> |
| <b>UNIT 2</b><br><br><b>CLUTCH</b>              | <p>3.2.1 identify types of clutch</p> <p>3.2.2 describe the functions of the clutch.</p> <p>3.2.3 describe how the clutch systems operate.</p> <p>3.2.4 demonstrate the method of clutch actuation.</p>  | <p>Type of clutches</p> <p>i. single plate:</p> <ul style="list-style-type: none"> <li>• multi-spring</li> <li>• diaphragm spring</li> </ul> <p>ii. Multi – plate</p> <p>Functions of the clutch</p> <p>Operations of the clutch system.</p> <p>Methods of clutch actuation:</p> <p>i. cable/mechanical</p> <p>ii. hydraulic</p> | <p>Use sketches, charts or real objects to discuss the construction and operation of single and multi plate clutches</p> <p>Discuss the functions of a clutch in vehicles.</p> <p>Using chart and models discuss the operations of the clutch system.</p> <p>Guide students to demonstrate the method of actuating the clutch on a vehicle.</p> | <p>compare the advantages of multi-spring and diaphragm spring clutches.</p>  |

| UNIT   | SPECIFIC OBJECTIVES  | CONTENT  | TEACHING AND LEARNING ACTIVITIES   | EVALUATION  |
|--|--|--|--|---|
| <b>UNIT 3</b><br><br><b>FLUID FLYWHEEL</b>   | The student will be able to:<br><br>3.3.1 identify the fluid fly wheel.<br><br>3.3.2 explain the advantages and disadvantages of the fluid flywheel.<br><br>3.3.3 sketch and label the main parts of the fluid flywheel assembly<br><br>3.3.4 describe the construction and operation of the fluid flywheel.<br><br>3.3.5 compare the friction clutch to the fluid Flywheel. | Fluid flywheel<br><br>Advantages and Disadvantages of fluid flywheel.<br><br>Construction and Operation. Flywheel assembly<br><br>Friction clutch and Fluid flywheel.<br><br>Comparison of the friction clutch and the fluid flywheel. | Using chart, sketches or real objects identify the fluid flywheel from other clutches.<br><br>Discuss the advantages and disadvantages of fluid flywheel.<br><br>Use sketches or chart to discuss the Construction and operation of fluid flywheel assembly.<br><br>Using charts, help students to compare the friction clutch and fluid flywheel. | Students to:<br><br>- sketch a fluid flywheel and describe its principles of operation:<br>- label the main parts<br>- state its advantages and disadvantages |
| <b>UNIT 4</b><br><br><b>TORQUE CONVERTOR</b> | 3.4.1 explain the purpose of the Torque converter.   | Purpose of Torque converter.   | Use sketches, charts or real objects to help students discuss the purpose of the torque converter.<br>- distinguish the constructional difference(s) between it and a fluid flywheel   | explain the constructional differences between fluid flywheel and torque converter.   |

| UNIT  | SPECIFIC OBJECTIVES  | CONTENT  | TEACHING AND LEARNING ACTIVITIES  | EVALUATION   |
|---|--|--|---|--|
| <b>UNIT 5</b><br><br><b>FAULT DIAGNOSIS</b> | The student will be able to:<br><br>3.5.1 diagnose and rectify minor faults<br><br>3.5.2 bleed the hydraulic clutch system.  | Fault diagnosis:<br>-Excessive Pedal free play<br>Insufficient pedal free play<br>-Slip<br>-Drag<br>-Judder<br><br>Bleeding Hydraulic clutch system.                           | Guide students to:<br>- examine the various clutch units noting any fault found.<br><br>- bleed the hydraulic clutch system.<br>- adjust clutch pedal free play.  | Students to<br><br>students to list out the causes and remedies of the following:<br>- excessive Pedal free Play<br>- insufficient pedal free play<br>- slip<br>- drag<br>- judder |
| <b>UNIT 6</b><br><br><b>GEARBOX</b>         | 3.6.1 explain the purpose of the gearbox<br><br>3.6.2 state the advantages and disadvantages of the gearbox<br><br>3.6.3 sketch and describe the operation of various types of gearbox | Purpose of the gearbox<br><br>Advantages and Disadvantages of gearboxes.<br><br>Types and operation of gearboxes:<br>i. sliding mesh<br>ii. constant mesh<br>iii. synchromesh. | Group students to discuss the purpose of gearbox.<br><br>Discuss the advantages and disadvantages of the gearbox.<br><br>Use sketches or chart to show the construction and operation of the following gearboxes:<br>i. sliding-mesh<br>ii. constant-mesh<br>iii. synchromesh | sketch and label the sliding and synchromesh gearboxes, stating the advantages and disadvantages of both gearboxes submit for assessment.  |

| UNIT   | SPECIFIC OBJECTIVES   | CONTENT  | TEACHING AND LEARNING ACTIVITIES   | EVALUATION   |
|--|---|--|--|--|
| <b>UNIT 7</b><br><br><b>SELECTOR MECHANISM</b>               | The student will be able to:<br><br>3.7.1 identify the various types of selector and interlock mechanisms<br><br>3.7.2 explain the operating principles of the selector and the interlock mechanisms<br><br>3.7.3 sketch the interlock mechanism for 3 and 4 speed gearboxes. | Selector and interlock mechanisms<br><br>Operating principles of the Selector and Interlock mechanisms.<br><br>Interlock mechanism.                                | Guide students to:<br>- dismantle, and examine the following parts of a gear box.<br>i. selector shaft and fork<br>ii. interlock mechanism<br><br>Use sketches or real objects to discuss the operating principles of the selector and interlock mechanisms.   | Students to<br><br>sketch and label an interlock mechanism suitable for 3 and 4 speed gearboxes and explain how it works.  |
| <b>UNIT 8</b><br><br><b>FAULT DIAGNOSIS OF THE GEARBOX</b>   | 3.8.1 detect and rectify minor gear box faults.   | Fault diagnosis.   | Help students to dismantle a synchromesh gearbox, examine the gears, bearings, shafts etc. for wear, cracks and other faults, rectify and reassemble.  | discuss the causes and remedies for the following gear box faults in groups and write reports:<br>i. gear lever difficult to move.<br>ii. gear difficult to engage.<br>iii. gear slipping out of mesh.<br>iv. gear noisy.<br>v. oil leakages from gearbox. |
| <b>UNIT 9</b><br><br><b>PROPELLER SHAFT/ UNIVERSAL JOINT</b> | 3.9.1 identify the various types of:<br>i. propeller shafts<br>ii. universal joint<br>iii. explain the constructional difference between the hotchkiss and torque tube shafts.  | Propeller shafts:<br>i. open type<br>ii. torque tube or close type<br><br>Universal joints:-<br>i. constant velocity joint<br>ii. Hooks joint<br>iii. layrub joint | Using charts sketches or real objects, show types of propeller shaft and universal joints on a vehicle.<br><br>Using sketches or real object discuss the construction of:<br>Hotchkiss drives<br>Torque tube drives.<br><br>The constructional features of:<br>- constant velocity joint.<br>- hooks type joints.<br>- layrub joint. | sketch to show the<br>i. open type<br>ii. torque tube type of propeller shafts<br><br>sketch and label a constant velocity type universal joint.   |



| UNIT  | SPECIFIC OBJECTIVES  | CONTENT  | TEACHING AND LEARNING ACTIVITIES   | EVALUATION   |
|---|--|--|--|--|
| <b>UNIT 11</b><br><br><b>METHOD OF SUPPORTING AXLE SHAFTS</b> | The student will be able to:<br><br>3.11.1 identify the three methods of supporting axle shafts.<br><br>3.11.2 explain the advantages and disadvantages of axle shaft. | Methods of supporting axle shaft:<br>i. Semi-floating<br>ii. Three-quarter floating<br>iii. Fully-floating<br><br>Advantages and disadvantages:<br>i. Semi-floating<br>ii. Three quarter floating<br>iii. Fully floating | Using sketches, charts or real object, discuss the constructional features of the three methods of supporting axle shafts.<br><br>Group students to discuss the advantages and disadvantages of each shaft.<br><br>Report on group discuss in class. | Students to:<br><br>sketch and label the 3 methods of supporting axle shafts.  |
| <b>UNIT 12</b><br><br><b>FAULT DIAGNOSIS OF AXLE SHAFT</b>    | 3.12.1 check and rectify rear axle faults.   | Fault diagnosis.<br>i. Noise<br>ii. Oil leakage<br>iii. Excessive back lash etc.   | Guide students to dismantle rear axle and examine the faulty parts. Eg.<br>i. worn and broken gear teeth<br>ii. broken axle shaft<br>iii. worn out bearings<br>iv. defective seals, etc.   | identify the causes and remedies for the following rear axle faults:<br>i. oil leakage<br>ii. noise<br>iii. torque not being transmitted |

# SENIOR HIGH SCHOOL - YEAR 2

## SECTION 4

### SUSPENSION SYSTEM

**General Objectives:** The student will:

1. be aware of the layout of suspension system on a motor vehicle.
2. acquire knowledge on the working principles of the suspension system.
3. recognize different types of suspension and understand their working principle.

| UNIT                                   | SPECIFIC OBJECTIVES  | CONTENT  | TEACHING AND LEARNING ACTIVITIES   | EVALUATION  |
|--|--|--|--|---|
| <b>UNIT 1</b><br><br><b>SUSPENSION</b> | The student will be able to:<br><br>4.1.1 identify types of suspension system.<br><br>4.1.2 explain the purpose of the suspension system.<br><br>4.1.3 explain the advantages of independent suspension<br><br>4.1.4 describe an independent suspension system and its working principles<br><br>4.1.5 sketch the layout of the rigid and Independent front suspension systems and label their main parts. | Types of suspension systems:<br>i. rigid<br>ii. independent<br><br>Purpose of Suspension system.<br><br>Advantages and Disadvantages of independent suspension.<br><br>Working principles of Independent suspension system<br>i wishbone<br>ii Macpherson types<br><br>Layout of rigid and independent suspension systems. | Group students to discuss types of suspension systems and preset report in class.<br>Discuss the purpose of the suspension system. Guide students to examine the suspension system of cars and trucks and note the differences.<br><br>Group students to discuss the advantages of independent suspension.<br><br>Using sketches, charts or real object discuss the differences in construction between the wishbone and Macpherson type of suspension.<br>- discuss the working principles of both types.<br><br>Using sketches, charts or real object discuss the arrangement of rigid and independent front suspension systems. | Students to:<br><br>explain the advantages and disadvantages of independent front suspension as compared to the rigid type.<br><br>explain the reason why the lower arm is made longer than the upper one<br><br>sketch the wishbone type of suspension system. |

| UNIT  | SPECIFIC OBJECTIVES   | CONTENT  | TEACHING AND LEARNING ACTIVITIES  | EVALUATION  |
|---|---|--|---|---|
| <b>UNIT 2</b><br><br><b>SHOCK ABSORBERS</b> | The student will be able to:<br><br>4.2.1 identify the different types of shock absorber.<br><br>4.2.2 explain the purpose of shock absorbers.<br><br>4.2.3 sketch and describe the construction and operation of the telescopic shock absorber | Types of shock absorbers<br>i. telescopic<br>ii. piston<br><br>Purpose of dampers/shock absorbers<br><br>Constriction and Operation Telescopic Type.   | Assist students to identify shock absorbers.<br><br>Group students to discuss the purpose of shock absorbers on vehicles.<br><br>Using sketches, chart or real object discuss the construction of the telescopic and piston types of shock absorber.<br><br>Guide students to remove and test telescopic shock absorber for serviceability.   | Students to:<br><br><br><br><br><br><br>sketch the telescopic shock absorber, label the parts and describe its operation.   |
| <b>UNIT 3</b><br><br><b>SPRINGS</b>         | 4.3.1 identify different types of spring.<br><br>4.3.2 explain the purpose of springs in the suspension system<br><br>4.3.3 describe the construction and operation of the leaf and coil springs and state their comparative advantages         | Identification of spring<br>i. semi elliptic<br>ii. coil spring<br>iii. rubber spring<br>iv. torsion bar<br>v. air spring<br><br>Purpose of Springs.<br><br>Construction, Operation and advantages of:<br>i. leaf spring<br>ii. coil spring. | Use different types of springs to show the differences in the springs used for the suspension system of a vehicle. (See content)<br><br>Using sketches, chart or real objects discuss the purpose of springs on vehicles.<br><br>Using sketches, chart or real object discuss the construction and operation of a suspension system using<br>i. leaf springs<br>ii. coil spring<br><br>Group students to discuss the advantages of each of the springs listed in content. | give reasons for the differences between the types of spring used on cars and trucks.<br><br>outline the necessary maintenance required for leaf springs.<br><br>sketch a leaf spring assembly, label the parts and state why the leaves are made of different lengths. |

# SENIOR HIGH SCHOOL - YEAR 2

## SECTION 5

### WHEELS AND TYRES

**General Objectives:** The student will:

1. develop awareness of different types of wheels and tyres.
2. recognize the constructional difference between radial and cross ply tyres.
3. acquire skills in tyre servicing.

| UNIT                               | SPECIFIC OBJECTIVES  | CONTENT  | TEACHING AND LEARNING ACTIVITIES   | EVALUATION   |
|------------------------------------|--|--|--|--|
| <b>UNIT 1</b><br><br><b>WHEELS</b> | The student will be able to:<br><br>5.1.1 identify the various types of wheel rims and explain their purposes.<br><br>5.1.2 describe the effects of faulty wheels on vehicle running                 | Types of wheel rims<br>i. pressed steel<br>ii. wire spoke<br><br>Effects of faulty wheels on vehicle running:<br><br>Identification of faulty wheels on:<br>i. pressed steel<br>ii. wire spoke | Use sketches or real objects (rims) to<br>-discuss the need for wheels and tyres on vehicles<br>-differentiate between types of wheel rims listed content.<br><br>Using real object, under assist students to identify faults on wheels and discuss the effects on vehicle running             | Students to:<br><br>sketch the following wheel rims<br>i. well base<br>ii. flat base<br>iii. divided |
| <b>UNIT 2</b><br><br><b>TYRES</b>  | 5.2.1 identify types of tyre<br><br>5.2.2 explain the advantages of tubeless tyres over tubed tyres.<br><br>5.2.3 describe the constructional difference between tubed and tubeless tyre assemblies. | Types of tyre<br>i. tubed<br>ii. tubeless<br><br>Advantages and disadvantages of tubeless and tubed tyres.<br><br>Constructional differences between tubed and tubeless tyres                  | Using real objects, assist students to identify tubed and tubeless tyres .<br><br>Group students to discuss the advantages and disadvantages of tubeless and tubed tyres<br><br>Using real objects, guide students to discuss the constructional differences between tubed and tubeless tyres. | state the advantages and disadvantages of tubed and tubeless tyres.                                  |

| UNIT  | SPECIFIC OBJECTIVES   | CONTENT   | TEACHING AND LEARNING ACTIVITIES   | EVALUATION  |
|---|---|---|--|---|
| <b>UNIT 2 (CONT'D)</b><br><br><b>TYRES</b><br><br><b>(Tyre sizes)</b> | The student will be able to:<br><br>5.2.4 describe the construction of tyres.<br><br>5.2.5 describe the markings on a tyre.   | Tyre construction<br>i. radial<br>ii. cross ply<br><br>Tyre sizes and markings (reasons for markings)   | Using sketches, charts or real objects discuss the constructional difference between radial and cross ply tyres<br><br>Using sketches, charts or real objects discuss the following:<br><br>i. reasons for markings on a tyre<br>ii. size of tyre<br>iii. types of tyre<br>iv. types of tyre construction.   | Students to:<br><br>sketch to show the constructional difference between the radial and cross-ply tyres and label their parts   |
| <b>UNIT 3</b><br><br><b>TYRE INFLATION</b>                            | 5.3.1 explain the importance of inflating pressure in relation to load, tyre life and vehicle handling and tyre balancing.<br><br>5.3.2 explain the purpose and processes of tyre balancing.<br><br>5.3.3 describe the safety precautions to be observed when changing wheels or tyres and inflating pressure.<br><br>5.3.4 demonstrate how to inflate a tyre | Importance of inflating tyre (observing correct pressure in relation to load and tyre life etc.)<br><br>Tyre balancing<br>i. dynamic<br>ii. static.<br><br>Safety precaution in changing wheels<br><br>Inflation of tyres | Group students to discuss the importance of inflating tyre to the correct pressure in relation to load, tyre life and vehicle handling. Group leaders present report for further discussion.<br><br>Guide students to discuss the purposes and importance of tyre balancing.<br><br><b>Note:</b> Take students to a filling station which has facilities for tyre balancing for students to observe the equipment and the tyre balancing process if possible. Group students to brainstorm the safety aspect of changing wheels.<br><br><b>Note:</b> Provide guidelines for tyre pressure given load, tyre life etc. Demonstrate method of inflating tyres | state the importance of correct tyre pressure.<br><br>be in groups, to balance road wheels. Write report and discuss in class.<br><br>students to explain the effects of:<br>i under inflation<br>ii over inflation |

# SENIOR HIGH SCHOOL - YEAR 2

## SECTION 6 ELECTRICAL SYSTEM

**General Objectives:** The student will:

1. acquire basic concept of electrical system on motor vehicle.
2. acquire skills in wiring motor vehicle.
3. acquire knowledge and skills in caring and maintaining vehicle batteries and charging system.
4. be aware of the functions of the main components of starting a vehicle.

| UNIT  | SPECIFIC OBJECTIVES   | CONTENT   | TEACHING AND LEARNING ACTIVITIES   | EVALUATION   |
|---|---|---|--|--|
| <b>UNIT 1</b><br><br><b>ELECTRICAL FUNDAMENTALS</b> | The student will be able to:<br><br>6.1.1 explain basic electrical terms<br><br>6.1.2 draw simple electrical circuits, state Ohm's law. Use Ohm's law to solve problems in electrical circuits. | Basic electrical terms:<br>i. A.C<br>ii. D.C<br><br>Electrical circuits.<br>i. Series<br>ii. Parallel<br>iii. Series –Parallel combination<br><br>Ohm's Law.<br><br>$V = I R$ | Using sketches or charts<br>- discuss basic electrical terms<br>- discuss the difference between series and parallel circuits<br>- discuss Ohm's Law<br><br>Students to draw simple electrical circuits. Guide students to use Ohm's law to solve simple calculations on series and parallel circuits. | Students to:<br><br>in groups, to build simple series and parallel circuits.<br><br><u>Exercises</u><br>solve problems on series and parallel circuits |
| <b>UNIT 2</b><br><br><b>BASIC COMPONENTS</b>        | 6.2.1 describe the functions of basic electrical components.  | Electric components:<br>i. relay<br>ii. resistor<br>iii. lamp<br>iv. fuse<br>v. switch  | Group students to discuss the functions of the electric components listed in content   | in groups to identify components in a circuit and describe their functions   |

| UNIT                                | SPECIFIC OBJECTIVES  | CONTENT   | TEACHING AND LEARNING ACTIVITIES   | EVALUATION   |
|-------------------------------------|--|---|--|--|
| <b>UNIT 3</b><br><br><b>BATTERY</b> | <p>The student will be able to:</p> <p>6.3.1 explain the purpose of the battery</p> <p>6.3.2 sketch and describe the construction and functions of lead acid battery</p> <p>6.3.3 check the strength of a battery using basic equipment</p> <p>6.3.4 prepare electrolyte and check its strength</p> <p>6.3.5 maintain and charge the lead acid battery</p> | <p>Purpose of Battery</p> <p>Battery construction<br/> i battery case<br/> ii plates</p> <p>Battery testing:<br/> i hydrometer,<br/> ii voltmeter<br/> iii. high-rate discharge tester.</p> <p>Preparation of Electrolyte.</p> <p>Battery care and maintenance.</p> | <p>Using sketches, charts or real object discuss the purpose of a lead acid battery</p> <p>Using sketches, charts or real object, discuss the constructional and functions of the lead acid battery.</p> <p>Guide students to perform simple test on batteries using the equipment listed in content</p> <p>Using sulphuric acid, distilled water and other essential items guide students to::<br/> - guide students to prepare an electrolyte.<br/> - use a hydrometer to check the strength of the electrolyte.</p> <p>Guide students to:<br/> - examine battery case for cracks;<br/> - inspect terminals for corrosion and wear, level of electrolyte in cells and top up where necessary.<br/> - connect battery to a charger and charge battery.<br/> - use high rate discharge tester to check the condition of a fully charged battery.</p> | <p>Students to:</p> <p>be in groups to check condition of a lead acid battery using voltmeter and hydrometer.</p> <p>in groups to:<br/> - prepare electrolyte for a lead acid battery.<br/> - use a hydrometer to check the strength of electrolyte</p> <p>be in groups, to charge a battery and use high rate discharge tester to check battery condition</p> |

| UNIT                                 | SPECIFIC OBJECTIVES   | CONTENT   | TEACHING AND LEARNING ACTIVITIES  | EVALUATION   |
|--------------------------------------|---|---|---|--|
| <b>UNIT 4</b><br><br><b>STARTING</b> | <p>The student will be able to:</p> <p>6.4.1 explain the purpose of the starting system, sketch its layout and label its components</p> <p>6.4.2 describe the functions of the main components of the starting system</p> <p>6.4.3 overhaul a starter motor.</p>                                  | <p>Purpose of the starting system, Layout and components.</p> <p>Components of the starting system:<br/> i. armature<br/> ii. casing<br/> iii. brushes etc.</p> <p>Overhauling a starter motor</p>  | <p>Using sketches or charts discuss the purpose of the starting system.<br/> -Guide students to sketch the layout of the starting system</p> <p>Using illustrations show the main components of the starting system and explain their functions.</p> <p>Guide students to dismantle, examine and reassemble a starter motor.</p>            | <p>Students to:</p> <p>to draw the starting circuit and label it.</p> <p><u>Group Exercise</u><br/> A driver found it difficult to start his car. The fault was traced to the starter. What could be some of the problems with the starter and how can it be repaired and made to work well again?</p> |
| <b>UNIT 5</b><br><br><b>CHARGING</b> | <p>6.5.1 explain the purpose of the charging system.</p> <p>6.5.2 describe the construction and operation of the main components of the charging system, DC and AC generators and state their advantages</p> <p>6.5.3 sketch the layout of the charging system and label the main components.</p> | <p>Purpose of Charging system.</p> <p>Comparison of D.C and A.C Generators Construction, operation, advantages and disadvantages:<br/> i. dynamo (D.C.)<br/> ii. alternator (A.C.)</p> <p>Layout of the charging system<br/> i. dynamo<br/> ii alternator</p> | <p>Using sketches or chart discuss the purpose of the charging system.</p> <p>Discuss the construction and operation of DC and AC generators.</p> <p>Group students to brainstorm the advantages and disadvantages of DC and AC generators.<br/> Use sketches or chart to help students identify the components of the charging system.</p> | <p>state the difference in construction between DC/AC generators. Explain the operating principle of the AC generator.</p> <p>sketch the charging system and label the main components</p>   |

| UNIT                                 | SPECIFIC OBJECTIVES   | CONTENT  | TEACHING AND LEARNING ACTIVITIES   | EVALUATION   |
|--------------------------------------|---|--|--|--|
| <b>UNIT 6</b><br><br><b>WIRING</b>   | <p>The student will be able to:</p> <p>6.6.1 identify the wiring systems used on motor vehicles</p> <p>6.6.2 state reasons for making wires in strands and using different sizes of cable/wires in a circuit</p> <p>6.6.3 explain the reasons for colour coding of wires.</p> <p>6.6.4 solder wires and join cables to connectors</p> | <p>Wiring systems.<br/>- earth return<br/>- insulated earth return</p> <p>Reasons for sizes of cables/Wires</p> <p>Reasons for Colour coding of wires.</p> <p>Cable joining and connectors.</p>  | <p>Using sketches, chart or suitable materials discuss the difference between the earth and insulated earth return wiring systems.</p> <p>Guide students to select suitable cable/wire of different sizes and colours to construct insulated earth and earth return circuits. Discuss the reasons for making wires in strands</p> <p>Group students to discuss reasons for using different colours and sizes of wire.</p> <p>Demonstrate the methods for soldering wires and the process of clipping wires to connectors for students to practice.</p> | <p>Students to sketch an</p> <p>(i) earth return circuit</p> <p>(ii) insulated earth return circuit</p> <p>- state the difference between the two circuits</p> <p>Students to join cable by soldering.</p> |
| <b>UNIT 7</b><br><br><b>LIGHTING</b> | <p>6.7.1 identify types of bulbs used on motor vehicles.</p> <p>6.7.2 explain the purpose of the lighting system</p> <p>6.7.3 sketch the layout of a simple lighting system,</p>  | <p>Identification of bulbs on motor vehicles:</p> <p>i. single contact</p> <p>ii. double contact</p> <p>iii. pre-focus</p> <p>iv. tungsten-halogen</p> <p>Lighting system.</p> <p>Layout of lighting system</p> <p>Main components of lighting system.</p> <p>i. switch</p> <p>ii. fuse</p> <p>iii. lamp</p> | <p>Show the different types of bulbs to students and discuss the places where each of the bulbs is used.</p> <p>Discuss the purpose of the lighting system on the motor vehicle.</p> <p>Using sketches or charts show the main components and describe their functions.</p>  | <p>Sketch a simple lighting system of a motor vehicle.</p>   |



# SENIOR HIGH SCHOOL - YEAR 3

## SECTION 1

### FRONT AXLE AND STEERING

**General Objectives:** The student will:

1. acquire knowledge of the principle of operation of the steering system.
2. be aware of the construction and operation of the steering gear box.
3. acquire skills of checking and correcting steering system fault.

| UNIT  | SPECIFIC OBJECTIVES   | CONTENT  | TEACHING AND LEARNING ACTIVITIES  | EVALUATION  |
|---|---|--|---|---|
| <b>UNIT 1</b><br><br><b>STEERING SYSTEM</b>   | The student will be able to:<br><br>1.1.1 explain the purpose of the steering system.<br><br>1.1.2 sketch and identify the various parts of the steering system and explain its operation | Front axle and steering arrangement.<br><br>Components and operation of the steering system.                       | Using sketches, chart or real objects discuss the purpose of the steering system.<br><br>Using sketches or real objects assist students identify parts of the steering system on a vehicle to students and discuss how the steering system operates | Students to:<br><br>discuss the differences in the steering systems' arrangement for<br>i. cars<br>ii. trucks   |
| <b>UNIT 2</b><br><br><b>STEERING GEOMETRY</b> | 1.2.1 explain Ackerman principle.<br><br>1.2.2 explain castor, camber K.P.I and Toe in/Toe out and their effect on the steering system  | Ackerman Principle<br><br>- Castor angle<br>- Camber angle<br>- K.P.I. (king pin inclination )<br>- Toe-in/Toe-out | Using sketches or charts, discuss the Ackerman principle.<br><br>Discuss the principles underlying the following terms i.e. castor, camber, K.P.I, toe-in and toe-out, their role and effect on the steering system.                                | sketch and explain the following:<br>i. Castor<br>ii. Camber<br>iii. KPI<br>iv. Toe-in/Toe-out<br><br>discuss the effects of each of the terms in content:<br>(i) camber<br>(ii) castor<br>(iii) K.P.I<br>(iv) toe-in-toe-out |

| UNIT  | SPECIFIC OBJECTIVES   | CONTENT  | TEACHING AND LEARNING ACTIVITIES   | EVALUATION  |
|---|---|--|--|---|
| <b>UNIT 3</b><br><br><b>WHEEL ALIGNMENT</b>     | <p>The student will be able to:</p> <p>1.3.1 carry out minor repairs on the steering system.</p> <p>1.3.2 check wheel alignment</p>   | <p>Steering faults.</p> <p>i. ball joints</p> <p>ii. tie rod ends</p> <p>iii. steering gear boxes</p> <p>iv. wheel hub</p> <p>Wheel alignment process:</p> <p>-Check, remove and replace faulty parts</p> <p>-Adjust steering boxes and wheel hubs where necessary.</p> <p>-Wheel alignment.</p> | <p>Use a vehicle and guide students to check and rectify minor steering faults as in content.</p> <p>Guide students to</p> <p>-adjust front hub.</p> <p>-carry out the wheel alignment process using the alignment gauge to measure toe-in and toe-out.</p>  | <p>Students to:</p> <p>discuss the effect of the following terms:</p> <p>i. camber</p> <p>ii. caster</p> <p>iii. KPI</p> <p>iv. toe-in toe-out</p> <p>be in groups to check front wheel alignment using wheel alignment gauges.</p> |
| <b>UNIT 4</b><br><br><b>STEERING GEAR BOXES</b> | <p>1.4.1 identify the various types of steering gear boxes and describe characteristics</p> <p>1.4.2 explain the advantages and disadvantages of steering gearboxes.</p> <p>1.4.3 describe the construction and operation of types of steering gearboxes.</p> | <p>Types of steering gear boxes</p> <p>i. Rack and pinion</p> <p>ii. Recirculating ball</p> <p>iii. Cam and peg</p> <p>Advantages and disadvantages.</p> <p>i. rack and pinion</p> <p>ii. recirculating ball.</p> <p>Construction and operation of various gear boxes</p>                        | <p>Using charts or real objects guide students to identify different types of gear boxes and their characteristics.</p> <p>Discuss the advantages and disadvantages of each gearbox. Guide students to carry out adjustments on gearboxes</p> <p>Using sketches, chart or real objects discuss the construction and operation of steering gear boxes listed in contents.</p> | <p>sketch</p> <p>i. Rack and pinion</p> <p>ii. Recirculating ball steering gearboxes and label them.</p> <p>iii. Indicate the position for adjustment on the sketch</p>   |

# SENIOR HIGH SCHOOL - YEAR 3

## SECTION 2 BRAKING SYSTEM

**General Objectives:** The student will:

1. acquire knowledge of the principles of the braking system.
2. recognize the layout of components in the braking system.
3. acquire knowledge on brake lining material and method of attachment.
4. acquire skills in fault diagnosis in the braking system.

| UNIT   | SPECIFIC OBJECTIVES   | CONTENT  | TEACHING AND LEARNING ACTIVITIES   | EVALUATION  |
|--|---|--|--|---|
| <b>UNIT 1</b><br><br><b>HYDRAULIC BRAKES</b> | <p>The student will be able to:</p> <p>2.1.1 explain the purpose of the braking system.</p> <p>2.1.2 describe the operation of the hydraulic braking system</p> <p>2.1.3 explain the advantages and the disadvantages of hydraulic brakes.</p> <p>2.1.4 sketch the layout of the hydraulic braking system and label its parts.</p> <p>2.1.5 compare the drum brake and disc brakes.</p> | <p>Hydraulic brake arrangement</p> <p>Types and operation of hydraulic brakes<br/>i. drum<br/>ii. disc</p> <p>Advantages and Disadvantages of hydraulic brakes.</p> <p>Layout and types of hydraulic braking system:<br/>i. drum type<br/>ii. disc type</p> <p>Comparison of drum and disc brakes.</p> | <p>Use sketches or charts to:</p> <ul style="list-style-type: none"> <li>- discuss the purpose of the braking system.</li> <li>- discuss the operation of drum brakes using leading and trailing shoes, Two leading shoes arrangement and Disc brake.</li> <li>- discuss the operation of the hydraulic braking system using all disc.</li> <li>- describe the operation of the master and wheel cylinders.</li> </ul> <p>Guide students to:</p> <ul style="list-style-type: none"> <li>- discuss the need for bleeding the braking system.</li> <li>- discuss the advantages and disadvantages of hydraulic brakes.</li> <li>- discuss the various types of braking system and their parts i.e. drum and disc brakes.</li> </ul> <p>Discuss the advantages and disadvantages of drum and disc brakes.</p> | <p>Students to:</p> <p>sketch the layout of the hydraulic braking system having drum at rear and disc at the front.</p> <p>bleed the hydraulic system (all drum) and (disc and drum types).</p> <p>be in groups, to bleed the hydraulic braking system.</p> |

| UNIT                                     | SPECIFIC OBJECTIVES   | CONTENT  | TEACHING AND LEARNING ACTIVITIES  | EVALUATION  |
|--|---|--|---|---|
| <b>UNIT 2<br/>SERVO</b>                  | The student will be able to:<br><br>2.2.1 explain the purpose, construction and operation of the servo unit.                      | The Servo unit.  | Use sketches or charts to:<br><br>- discuss the purpose construction and operation of the servo unit.   | Students to:<br><br>sketch a hydraulic braking system incorporating a servo unit and label its parts      |
| <b>UNIT 3<br/>PNEUMATIC BRAKES</b>       | 2.3.1 explain the reason for the use of pneumatic brakes.   | Air brakes.  | - discuss the reasons for the use of pneumatic brakes.  |   |
| <b>UNIT 4<br/>BRAKE LINING MATERIALS</b> | 2.4.1 analyze the composition of brake lining material and methods of attachment.   | Analysis of Brake lining material.   | <u>Class discussion</u><br>Brainstorm why articulated trucks use air brakes and discuss the points raised.<br><br>Discuss with students the composition of brake lining material and methods of attachment to shoe and pad support plate. | be indicate in writing causes and rectification of the following brake faults:                            |
|  | 2.4.2 outline the requirements and composition of brake fluid.  | Brake fluid requirements   | Discuss the need for the use of brake fluid in the hydraulic braking system.<br>Discuss the requirements, composition and safety measures to be observed in handling brake fluid.   | i. lack of stopping power<br>ii. grabbing brakes<br>iii. brake pulling to one side<br>iv. spongy pedal    |
| <b>UNIT 5<br/>FAULT DIAGNOSIS</b>        | 2.5.1 rectify simple brake faults   | Rectification of brake faults:<br>i. lack of stopping power<br>ii. grabbing brakes<br>iii. brake pulling to one side<br>iv. spongy pedal<br>v. brake binding | Using sketches assist students to diagnose brake faults on a vehicle and rectify  |   |
|  | 2.5.2 compare the braking systems for cars/light duty vehicles and heavy duty trucks in terms of efficiency and maintenance costs | Comparison of braking system for saloon cars and heavy duty trucks   | Students to compare the braking system for the two categories of vehicles in content and give reasons for the choice of braking system<br><br><b>Note:</b><br>Drivers should not rest their foot on the brake pedal.                      | Students in groups, to develop a system for preventing brake failure in saloon cars and heavy duty trucks |

# SENIOR HIGH SCHOOL - YEAR 3

## SECTION 3

### FUEL INJECTION SYSTEM

**General Objectives:** The student will:

1. acquire knowledge of the general principles of petrol injection used on motor vehicles
2. recognize the components of the two systems and their working principles

| UNIT  | SPECIFIC OBJECTIVES   | CONTENT  | TEACHING AND LEARNING ACTIVITIES   | EVALUATION   |
|---|---|--|--|--|
| <b>UNIT 1</b><br><br><b>ELECTRONIC FUEL INJECTION</b> | The student will be able to:<br><br>3.1.1 explain the purpose of the electronic fuel injection system<br><br>3.1.2 examine the petrol injection systems<br><br>3.1.3 examine the various components of the electronic fuel injection system and state their purposes. | Electronic injection system.<br><br>Type of systems<br>i. single point injection<br>ii. multi point injection<br><br>Purpose of components of the electronic fuel injection system | By the aid of a sketch or chart discuss purpose of the electronic fuel injection system.<br><br>Use sketches, charts or real objects to assist students identify the layout of the petrol injection system on a vehicle.<br>i. single point<br>ii. multi point<br><br>Using sketches, real objects and charts discuss the various components of the electronic fuel injection system and their purpose:<br><br>i. Electronic Control Unit ( ECU)<br>II Sensors<br>ii. Actuator | Students to:<br><br>identify the major components in the<br>i. single point injection system<br>ii. multi point injection system on a vehicle. |



| UNIT  | SPECIFIC OBJECTIVES   | CONTENT   | TEACHING AND LEARNING ACTIVITIES   | EVALUATION  |
|---|---|---|--|---|
| <b>UNIT 2</b><br><br><b>ELECTRONIC IGNITION</b> | <p>The student will be able to:</p> <p>4.2.1 explain the advantages of electronic ignition system as compared to the conventional type.</p> <p>4.2.2 describe the operation of transistorized ignition system with a sketch</p> | <p>Advantages of Electronic ignition system.</p> <p>Transistorized and electronic ignition system:</p> <p>i. Inductive</p> <p>ii. Hall effect</p> | <p>Guide students to discuss the advantages of the electronic ignition system as compared to the conventional ignition system</p> <p>Using sketches or chart discuss the operation of transistorized ignition system:</p> <p>i. inductive</p> <p>ii. hall effect</p> | <p>Students to:</p> <p>compare the advantages of the transistorized ignition system to the conventional one.</p> <p>sketch the inductive transistorized ignition system, label the main parts and describe its operation.</p> |

# SENIOR HIGH SCHOOL - YEAR 3

## SECTION 5

### AUTOMOTIVE AIR CONDITIONING

**General Objectives:** The student will:

1. acquire knowledge on the purpose of automotive air conditioning.
2. develop knowledge on the components and operation of the cooling system used on motor vehicles.

| UNIT  | SPECIFIC OBJECTIVES   | CONTENT   | TEACHING AND LEARNING ACTIVITIES  | EVALUATION  |
|---|---|---|---|---|
| <b>UNIT 1</b><br><b>COMPONENTS OF THE AIR CONDITIONER</b> | The student will be able to:<br>5.1.1 explain the purpose of vehicle air conditioning system.<br>5.1.2 describe the basic operation of the air conditioning system.<br>5.1.3 sketch the layout of an air conditioning system used on motor vehicles and label the main parts. | Vehicle air conditioning.<br>Principles of operation of vehicle air conditioning system.<br>Layout and identification of major components<br>i. compressor<br>ii. condenser<br>iii. evaporator<br>iv. dryer | Use sketches charts or real objects to discuss the purpose of the vehicle air conditioning system.<br>Discuss the basic operation of the air conditioning system on vehicles.<br>Using sketches, charts or a vehicle discuss the components in the air-conditioning system. | Students in groups to identify component parts on an air conditioning system. |

# SENIOR HIGH SCHOOL - YEAR 3

## SECTION 6

### SAFE MOTORING

**General Objectives:** The student will:

1. recognize the importance of safety on the road
2. be conversant with the highway code for safe motoring

| UNIT                           | SPECIFIC OBJECTIVES  | CONTENT  | TEACHING AND LEARNING ACTIVITIES  | EVALUATION  |
|--------------------------------|--|--|---|---|
| <b>UNIT 1<br/>HIGHWAY CODE</b> | <p>The student will be able to:</p> <p>6.1.1 explain the importance of safety devices on vehicles to the driver and other road users</p> <p>6.1.2 explain the importance of the highway code and some of the major regulations for driving in Ghana</p> <p>6.1.4 explain the causes of road accidents and suggest possible solutions for their prevention</p> <p>6.1.3 interpret the various road signs.</p> | <p>Safety devices:</p> <ol style="list-style-type: none"> <li>i. seat belt</li> <li>ii. air bag</li> <li>iii. crash helmet</li> <li>iv. fire extinguisher</li> <li>v. triangle</li> </ol> <p><u>Safe Motoring:</u> The Highway Code<br/><b>Note:</b> The Ghana Highway Code is in two parts. Use the information in the first part including the pictures on road crossing, overtaking, road junctions, regulations at the roundabout and the section on motorway driving for the lessons on this objective.</p> <p>Some common causes of road accidents</p> <ol style="list-style-type: none"> <li>i. over speeding</li> <li>ii. overtaking</li> <li>iii. driving when tired</li> <li>iv. poor eye sight</li> <li>v. drunk driving</li> <li>vi. lack of proper maintenance of vehicles,</li> </ol> <p><u>Road signs:</u> Use the information in the Appendix section of the highway code: signals to road users, traffic control signals, traffic signs etc for the lessons on this topic</p> | <p>Group students to discuss the uses of each of the safety devices listed in content and the occasions each of them should be used.</p> <p><u>Class exercise</u><br/>State the reason why it is important for a driver and passengers to wear their seat belt?</p> <p>Use sketches, charts and the Ghana Highway Code to:</p> <ul style="list-style-type: none"> <li>- discuss the importance of the highway code.</li> <li>- help students to apply the rules and regulations in driving on the roads</li> </ul> <p>Group students to discuss some common causes of road accidents (See content).<br/>-Students to discuss precautions drivers must take to prevent each of the listed causes of road accidents.<br/>-Students to discuss how accidents could be avoided on our roads. (<b>Note:</b> Consider both pedestrians and drivers)</p> <p>Group students to discuss the regulations on warning signs (the commonest ones), informatory signs, regulatory signs and roadway markings<br/>Students to discuss the effects of not obeying road signs.</p> | <p>Students to:</p> <p>list the necessary safety items that should be on a moving vehicle and give reasons</p> <p>sketch and identify road signs.</p> <p>be in groups to discuss the causes of some accidents, offer suggestions and report in class.</p> <p><u>Class test</u><br/>Organize a short class test on road regulations and road signs</p> |

# SENIOR HIGH SCHOOL - YEAR 3

## SECTION 7

### FAULT DIAGNOSIS

**General Objectives:** The student will:

1. acquire skills in fault diagnosis and rectification on a vehicle.
2. develop skills in evaluation of vehicle condition and writing report.

| UNIT                                   | SPECIFIC OBJECTIVES  | CONTENT   | TEACHING AND LEARNING ACTIVITIES   | EVALUATION   |
|--|--|---|--|--|
| <b>UNIT 1</b><br><br><b>DIAGNOSIS</b>  | The student will be able to:<br><br>7.1.1 diagnose simple faults using test equipment. | Engine Tune Up.<br>i. Compression gauge<br>ii. Exhaust gas analyzer<br>iii. Vacuum gauge<br>iv. Tach-Dwell Meter<br>v. Ignition timing light<br>vi. Multi meter | Using an engine guide students to:<br>- determine the condition of engine cylinders using compression gauge.<br>- check air-fuel ratio using exhaust gas analyzer.<br>- check engine speed and contact set gap using Tach-Dwell Meter<br>- check ignition timing using stroboscopic timing light.<br>- check voltage, resistance and serviceability of components in circuits using multi-meter. | Students to:<br><br>students in groups to perform the following test on an engine:<br>i. compression test<br>ii. ignition timing.  |
| <b>UNIT 2</b><br><br><b>EVALUATION</b> | 7.2.1 write a concise report on a vehicle after inspection.                            | Report writing.   | Use a complete vehicle to:<br>- guide students to examine the condition of the following systems using test equipment where necessary, or visual inspection and report on findings.<br><br>i. brakes<br>ii. engine<br>iii. suspension<br>iv. body, etc   | individually, to write report on the condition of the vehicle after the inspection. (The report should provide information on some of the actions that should be taken to put the vehicle in good working condition) |

## **BIBLIOGRAPHY**

1. MOTOR VEHICLE TECHNOLOGY  
AND PRACTICAL WORK  
BY J.A. DORLAN
  
2. TECHNOLOGY FOR MOTOR MECHANICS  
BOOKS 1 – 4  
BY S.C. MUDD
  
3. FUNDAMENTALS OF MOTOR VEHICLE  
TECHNOLOGY  
BY HILLIER & PITTUK
  
4. VEHICLE AND ENGINE TECHNOLOGY  
BY HEINZ HEISTER
  
5. MOTOR VEHICLE MECHANICS TEXT BOOK  
BY F.K. SULLEY
  
6. MOTOR VEHICLE TECHNOLOGY  
FOR MECHANICS  
BY P.P.J. READ AND V.C. REID

## TOOLS & EQUIPMENT LIST

- |                                   |   |
|-----------------------------------|---|
| 1. Mechanics Tools Kit Set        | 29. Bench vice  |
| 2. Torque wrench                  | 30. Mobile crane  |
| 3. Valve spring compressor        | 31. Trolley jack  |
| 4. Piston ring compressor         | 32. Set axle stands   |
| 5. Oil filter wrench              | 33. Set Tap & Dies (mm. UNF)  |
| 6. Valve seat cutter              | 34. Dividers  |
| 7. Valve refacing machine         | 35. Inside calipers   |
| 8. Compression gauge              | 36. Outside calipers  |
| 9. Vacuum gauge                   | 37. Inside micrometer Set   |
| 10. Tach. Dwell angle gauge       | 38. Vernier gauge   |
| 11. Ignition timing light         | 39. Hacksaw frame c/w blade   |
| 12. Inspection lamp               | 40. Surface gauge   |
| 13. High rate discharge tester    | 41. Volt meter  |
| 14. Spark plug cleaner            | 42. Ammeter   |
| 15. Battery charger               | 43. Hydrometer  |
| 16. Air compressor                | 44. Oil can   |
| 17. Bench drill                   | 45. Dial gauge with magnetic base                                       |
| 18. Hand drill                    | 46. Set punches (hollow and pin)  |
| 19. Surface plate                 | 47. Set feeler gauges   |
| 20. Vee block (Set)               | 48. Set drill bits  |
| 21. Set wheel alignment gauge     | 49. Set files: - flat, half round, round, triangular, square (Assorted) |
| 22. Castor, camber, K.P.I. gauges | 50. Chisels   |
| 23. Set Steering turn table       | 51. Set screw drivers (Flat blade)                                      |
| 24. Vulcanizing machine           | 52. Set Screw driver (Phillips)   |
| 25. Tyre levers (assorted)        | 53. Outside micrometer (Metric)   |
| 26. Tyre inflator                 | 54. Outside micrometer (Imperial)                                       |
| 27. Tyre pressure gauge           | 55. Set Centre punch  |
| 28. Work bench                    | 56. Armature testing growler  |
|                                   | 57. Head lamp aimer   |
|                                   | 58. Injector test rig   |