MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY
TANZANIA INSTITUTE OF EDUCATION

MECHANICAL ENGINEERING SYLLABUS FOR TECHNICAL SECONDARY SCHOOLS
FORM I - IV

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Tanzania Institute of Education
P.O. Box 35094
Dar es Salaam
Tanzania.

Tel: + 255 22-2773005/ + 255 22 277 1358
Fax: +255 -22 277 4420
E-mail: director.general@tie.go.tz
Website: www.tie.go.tz

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DECLARATION

The Mechanical Engineering Syllabus is approved for use in Technical Secondary Schools in Tanzania.

Approved by Dr Lyabwene M. Mtatiabwa

Signature .....

Date 20 / 09 / 2019

Ag. Commissioner for Education,
Ministry of Education, Science and Technology,
P.O. Box 10,
Dodoma.

Tel. +255 222 110150
+ 255 222 110179
+255 222 110146
Fax: +255 222 113271

TABLE OF CONTENTS

1.0 Introduction

This Mechanical Engineering Syllabus is a revised version of 1993 syllabus. Although, some of the subject contents of the phased out syllabus have been retained, changes have been effected in the arrangement of topics and sub topics, addition of new topics and removal of irrelevant and outdated contents. The revised version has taken into consideration the current social, political, economic, global and technological development as well as emerging cross-cutting issues.

This revised syllabus observed a paradigm shift from content based to competencies based pedagogy to give room for the learners to build skills and competencies in Mechanical Engineering. It encourages the constructivist approaches to teaching and learning where the learner participates actively in the construction of knowledge, skills and attitude.

The Syllabus covers diversity of topics to be covered in four years of secondary education, i.e. from Form One to Form Four in Tanzania. Mechanical Engineering syllabus contains Automotive Engineering and Manufacturing Engineering contents. All students shall learn Mechanical Engineering topics in Form One and Two and opt for either Automotive Engineering or Manufacturing Engineering field in Form Three.

2.0 Objectives of Education in Tanzania

Objectives of Mechanical Engineering Syllabus reflect the general objectives of education in Tanzania, which are to:

a) guide and promote the development and improvement of the personalities of the citizens of Tanzania, their human resources and effective utilization of those resources in bringing about individual and national development;
b) promote the acquisition and appreciation of culture, customs and traditions of the people of Tanzania;
c) promote the acquisition and appropriate use of literacy, social, scientific, vocational, technological, professional and other forms of knowledge, skills and attitudes towards the development and improvement of the condition of man and society;

d) develop and promote self-confidence and inquiring mind, understanding and respect for human dignity and human rights and readiness to work hard for personal self-advancement and national development;
e) promote and expand the scope of acquisition, improvement and upgrading of mental, practical, productive and other skills needed to meet the changing needs of industry and the economy;
f) enable every citizen to understand and uphold the fundamentals of the national constitution as well as the protecting human and civil rights, obligations and responsibilities; and
g) promote love for work, self and wage employment and improved performance in the production and service sectors.

3.0 Objectives of Secondary Education in Tanzania

Objectives of Mechanical Engineering Syllabus reflects the objectives of secondary education, which are to:

a) consolidate, broaden and develop a deeper understanding of the ideas and concepts acquired at the primary level;
b) enhance and further develop an appreciation for cultural values including national unity, identity, democracy, ethics, personal integrity, readiness to work, human rights, customs, traditions, civic responsibilities and obligations;
c) develop linguistic ability and effective use of communication skills in Kiswahili, English, and at least one foreign language;
d) develop readiness for tertiary and higher education, vocational, technical and professional training;
e) inculcate a sense and ability for self-study, self-confidence and self advancement in new frontiers of science and technology, academic and occupational knowledge and skills; and
f) develop readiness to join the world of work.

4.0 General Competencies

By the end of the four years course, the student should demonstrate competencies in:

a) providing the needed skills and labour for improved performance in industry and other economic and social service sector;

b) Applying technical drawing knowledge and skills in preparing Mechanical Engineering drawings,
c) maintaining mechanical and automotive engineering systems and machines;
d) providing technical services to various mechanical and automotive industries;
e) exploring socio-economic factors as considerations in own subject, career and study choices; and
f) applying Computer Aided Design (CAD) knowledge and skills in mechanical engineering.

5.0 General Objectives

By the end of the four years course, the student should be able to:

a) test the performance of mechanical engineering systems using appropriate testing tools;
b) run mechanical engineering systems according to rules and procedures laid down;
c) service and fix mechanical and automotive engineering systems;
d) explore socio-economic factors as considerations in own subject, career and study choices;
e) use various engineering materials in Manufacturing Engineering works;
f) use machine tools and equipment to Manufacturing and Automotive Engineering industries;
g) use technical drawing knowledge and skills in Manufacturing and Automotive Engineering drawings; and
h) use various computer applications knowledge and skills in Mechanical Engineering drawings.

6.0 Structure and Organisation of the Syllabus Content

This syllabus has two parts. The first part comprises class level competencies and class level objectives. The second part is the syllabus content and presented in the table. It includes; topic, sub-topic specific objectives to be achieved, teaching and learning strategies, teaching and learning resources, assessment criteria/tools and number of period.

6.1 Class level competencies

Class level competencies are general competencies intended to be achieved within the class level or within each year of study. Class level competencies reflect the skills, knowledge and attitudes which the learner should demonstrate within that level of study. However, these competencies are not discrete but rather continuous. It is possible that a particular competency may require more than one year to be developed.

6.2 Class level objectives

The class level objectives are objectives intended to be achieved within a class level. These are specific instructional objectives at a particular class level. The class level objectives in this syllabus are stated in general terms and they have been derived from the competencies. For each competencies intended to be achieved, one or more objectives have been stated in order to achieve it.

6.3 Topics/sub-topics

This part describe the matter dealt within a subject. The major topics in this syllabus have been derived from the class level competencies and objectives. Every major topic has been divided into several sub-topics. Each sub-topic comprises of a portion of the content of the topic in question. The sub-topics have also been arranged to attain a logical order and facilitate learning process. The horizontal treatment of this syllabus is controlled by the sub-topics. This means that for every sub-topic, there are teaching and learning strategies; teaching and learning resources, assessment strategies and the estimated number of periods.

6.4 Specific objectives

This includes statements that describe results in terms of knowledge, attitude, skills aspiration and behaviour that a student is expected to achieve and perform after attaining the programme. They also reflect the process of attaining the specified competencies within the cognitive, affective and psychomotor domains.

6.5 Teaching and learning strategies

Teaching/learning strategies indicate what the teacher and the students are expected to be doing in the process of teaching and learning. The teaching/learning strategies in this syllabus are simply suggestive, i.e. not exhaustive. The teacher is free to use them or design his/ her own strategies. The teacher is expected to work as a facilitator for supporting the students to learn. Participatory and cooperative learning based activities are encouraged for the students to work in groups and participate in learning processes effectively.

6.6 Teaching and learning resources

In the teaching and learning of this syllabus, many resources will be needed. In case the commercial materials needed are not available, the teacher and students should work together to collect or improvise alternative resources available in the school environment.

6.7 Assessment

The suggested assessment strategies in this syllabus are based on the specific instructional objectives. The formative and summative assessment approaches should be geared towards mastering all the competencies and skills developed within the course. Instrument of assessment should ensure that all the levels of cognitive, affective and psychomotor domains are observed.

6.8 Number of periods

The number of periods has been allocated per sub-topic. Topics with relatively wider content will need more time than others.

MECHANICAL ENGINEERING

FORM I

CLASS LEVEL COMPETENCIES

By the end of Form I, the student should have ability to:

a) explore socio-economic factors as considerations in own subject, career and study choices;

b) explore ranges of mechanical skills and apply them in mechanical engineering fields;

c) apply safety management skills in maintaining and serving mechanical engineering system and workshops;

d) use effectively different types of hand tools and machine tool and;

e) draw and read geometrical figures.

CLASS LEVEL OBJECTIVES

By the end of Form I, the student should be able to:

a) identify engineering jobs according to economic sectors and work settings;

b) explain the duties and importance of mechanical engineer in a society;

c) identify and differentiate mechanical engineering workshops as related to other workshops;

d) explain and apply safety management's rules and procedures in mechanical engineering;

e) use workshop tools, equipment and materials in mechanical engineering workshop; and

f) use engineering drawing knowledge in mechanical engineering

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
1.0 INTRODUCTION TO SCIENCE, ENGINEERING AND TECHNOLOGY	1.1 Basic Terms used in Mechanical Engineering	The student should be able to: a) Define the term Science, Technology and Engineering. b) Define the term Mechanical Engineering. c) Distinguish the term Science, Technology, Engineering and Mechanical engineering.	i) The teacher to use questions to guide students to: – Define the term science, technology and engineering. – Define the term mechanical engineering. ii) The teacher to arrange students in groups and guide them to distinguish the term science, technology, engineering and mechanical engineering. iii) Students to present their responses for sharing and discussion. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i) and (ii).	• Chalkboard • Manila sheet • Multimedia projector • Poster with different examples of science, engineering and technological works	1. Is the student able to define the term science, technology and engineering? 2. Is the student able to define the term mechanical engineering? 3. Is the student able to distinguish the term science, technology, engineering and mechanical engineering?	2
	1.2 Relationship between Science, Engineering and Technology	The student should be able to: a) Identify the relationship between Science, and Technology.	i) The teacher to arrange students in groups and guide them to: – Identify the relationship between science, and technology. – Identify the relationship between science, and engineering.	• Chalkboard • Manila sheet • Multimedia projector	1. Is the student able to identify the relationship between science, and technology?	1

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		b) Identify the relationship between Science, and engineering. c) Explain the relationship between Science, Technology, Engineering and Mechanical engineering.	– Explain the relationship between Science, Technology, Engineering and Mechanical engineering. ii) Students to present their responses for sharing and discussion. iii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i).	• Poster with different examples of science, engineering and technological works	2. Can the student identify the relationship between science, and engineering? 3. Can the student explain the relationship between science, technology, engineering and mechanical engineering.?	
	1.3 Mechanical Engineering Applications	The student should be able to: a) Identify application of Science and Technology in daily life. b) Identify the application of Science and Technology in Mechanical engineering.	i) The teacher to guide students in groups to: – Identify application of science and technology in daily life. – Identify contribution of mechanical engineering field in social-economic development ii) The teacher to use questioning strategies (i.e. what, why and how questions) to guide students to identify the application of Science and Technology in Mechanical engineering.	• Chalkboard • Manila sheet • Multimedia projector • Poster with different examples of science, engineering and technological works	1. Is the student able to identify application of science and technology in daily life? 2. Can the student identify the application of science and technology in mechanical engineering?	2

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		c) Identify contribution of mechanical engineering field in social-economic development	iv) Students to present their responses for sharing and discussion. v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).		3. Can the student identify the contribution of mechanical engineering field in social-economic development?	
2.0 MECHANICAL ENGINEERING JOBS AND OCCUPATIONS	2.1 Types of Mechanical Engineering Professionals	The student should be able to: a) Identify Mechanical engineering professional. b) Define different Mechanical engineering occupations. c) Explain the qualifications for different Mechanical engineering occupations.	i) The teacher to use brainstorming questions to guide students to identify Mechanical engineering professional. ii) The teacher to arrange students in groups and guide them to: – Define different Mechanical engineering occupations (i.e., artisan, craft person, technician, and engineers). – Categorize the Mechanical engineering jobs according to economic sector. – Explain the qualifications of different Mechanical engineering occupations iii) Students to present their responses for sharing and discussion.	• Board • Manila sheet • Flip chart • Multimedia projector • Poster with different examples of science, engineering and technological works	1. Can the student identify Mechanical engineering professional? 2. Is the student able to define different Mechanical engineering occupations? 3. Can the student explain the qualifications of different Mechanical engineering occupations?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		d) Categorize the Mechanical engineering jobs according to economic sector.	iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).		4. Can the student categorize the mechanical engineering jobs according to economic sector?	
	2.2 Duties and Functions of Engineering Personnel	The student should be able to: a) Identify the duties of mechanical engineering personnel. b) Explain the responsibilities of mechanical engineering personnel. c) Differentiate the duties and responsibilities of Mechanical engineering personnel with other engineering personnels.	i) The teacher to use questions to guide students to identify duties of Mechanical engineering personnel. ii) Students to present their responses for sharing and discussion. iii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).	• Manila sheet • Flip chart • Multimedia projector • Posters	1. Is the student able to identify the duties of mechanical engineering personnel? 2. Is the student able to explain the responsibilities of engineering personnel? 3. Is the student able to differentiate the duties and responsibilities of mechanical engineering personnel with other engineering personnels?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	2.3 The Importance of Mechanical Engineering Field in a Society	The student should be able to: a) Explain the importance of Mechanical engineering fields in the society. b) Identify Mechanical engineering job opportunities in the society. c) Analyse the contributions of Mechanical engineering fields in the socio-economic development.	i) The teacher to arrange students in groups and guide them to: – Explain the importance of mechanical engineering field in the society. – Identify mechanical engineering job opportunities in the society. – Analyse the contributions of mechanical engineering fields in the socio-economic development ii) Students to present their responses for sharing and discussion. iii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i) and (ii).	• Chalk board • Manila sheet • Flip chart • Multimedia projector • Posters • Marker pen	1. Is the student able to explain the importance of mechanical engineering fields in the society? 2. Can the student identify mechanical engineering job opportunities in the society? 3. Can the student analyse the contributions of mechanical engineering fields in the socio-economic development?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
3.0 WORKSHOP MANAGEMENT AND SAFETY RULES	3.1 Introduction to Workshop Rules and Safety	The student should be able to: a) Define the rules of personal safety in different Mechanical engineering workshops. b) Explain the term workshop safety rules. c) Explain machine safety rules in different Mechanical engineering workshops. d) Explain the workshop safety rules to follow in manual lifting techniques in engineering workshops.	i) The teacher to use questions to guide students to: – Define the rules of personal safety in different mechanical engineering workshops. – Explain the term workshop safety rules. ii) The teacher to arrange students in groups and guide them to: – Explain machine safety rules in different mechanical engineering workshops. – Explain the workshop safety rules to follow in manual lifting techniques in engineering workshops. iii) Students to present their responses for sharing and discussion. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).	• Manila sheet • Flip chart • Multimedia projector • Fire extinguisher • Posters with different lifting techniques • DVD/VCD • Computer • Poster/pictures with different safety symbols • Visiting area with potential risks of accidents • Warning tape	1. Is the student able to define the rules of personal safety in different mechanical engineering workshops? 2. Is the student able to explain the term workshop safety rules? 3. Is the student able to explain machine safety rules in different mechanical engineering workshops? 4. Is the student able to explain the workshop safety rules to follow in manual lifting techniques in engineering workshops?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	3.2 Accidents Causes and Prevention	The student should be able to: a) Explain the main causes of accidents in Mechanical engineering workshop. b) Describe how to prevent Accidents in Mechanical engineering workshop. c) Explain the procedures to follow in manual lifting techniques in Mechanical engineering workshop.	i) The teacher to organise students in groups and guide them to: – Explain the main causes of accidents in mechanical engineering workshop. – Describe how to prevent accidents in mechanical engineering workshop. – Explain procedures to follow in manual lifting techniques in mechanical engineering workshop. ii) Students to present their responses for sharing and discussion. iii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i) and (ii).	• PPE (gloves, industrial boots, masks, ear plugs, overcoat overall, etc) • First Aid kit • Fire extinguisher • Warning tape • Posters showing safety signs	1. Is the student able to explain the main causes of accidents in mechanical engineering workshop? 2. Can the student describe how to prevent accidents in mechanical engineering workshop? 3. Is the student able to explain procedures to follow in manual lifting techniques in mechanical engineering workshop?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	3.3 Management of Accidents	The student should be able to: a) Describe how to use personnel protective equipment (PPE) in mechanical engineering. b) Use personnel protective equipment (PPE) in mechanical engineering workshop. c) Explain how to provide first Aid in mechanical engineering workshops. d) Apply safety procedures and regulation at mechanical engineering workshops.	i) The teacher to organise students in groups and guide them to: – Describe how to prevent accidents in mechanical engineering workshop. – Describe how to use personnel protective equipment (PPE) in mechanical engineering workshop. ii) The teacher to use questioning strategies (what, why and how questions) to guide students to explain how to provide first aid in mechanical engineering workshops. iii) The teacher to create activities and guide students to: – Use personnel protective equipment (PPE) in mechanical engineering workshop. – Apply safety procedures and regulation at mechanical engineering workshops.	• PPE (gloves, industrial boots, masks, ear plugs, overcoat, overall, etc) • First Aid kit • Fire extinguisher • Warning tap • Posters showing safety signs	1. Is the student able to describe how to use personnel protective equipment (PPE) in mechanical engineering? 2. Can the student use personnel protective equipment (PPE) in mechanical engineering workshop? 3. Can the student explain how to provide first Aid in mechanical engineering workshops?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		e) Apply workshop safety procedures and regulations in using mechanical tools and equipment.	– Apply workshop safety procedures and regulations in using mechanical tools and equipment iv) With the help of prepared assessment guideline, the teacher should guide the students to asses the activities performed in (ii). v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iv).		4. Can the student apply safety procedures and regulation at mechanical engineering workshops? 5. Can the student apply workshop safety procedures and regulations in using mechanical tools and equipment?	
4.0 WORKSHOP TOOLS AND EQUIPMENT	4.1 Tools and Equipment Used in Mechanical Engineering Workshop	The student should be able to: a) Define the term hand tools and machine tools. b) Identify mechanical hand tools and machine tools.	i) The teacher to use questions to guide students to: – Define the term hand tools and machine tools. – Identify mechanical hand tools and machine tools. ii) The teacher to arrange students in groups and guide them to: – Describe the use of each hand tools in mechanical engineering workshop.	• Different types of Mechanical Engineering workshops • Manila sheet • Flip chart • Multimedia projector • Marker pen • Poster with different types of hand tools and m/c tools	1. Is the student able to define the term hand tools and machine tools? 2. Is the student able to identify mechanical hand tools and machine tools?	14

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		c) Describe the use of each tool in mechanical engineering workshop. d) List all hand tools and machine tools used in different Mechanical Engineering workshops.	– List all hand tools and machine tools used in different mechanical engineering workshops (welding, motor vehicle, machine tool, refrigeration, air conditioning and foundry workshops). iii) Students to present their responses for sharing and discussion. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i) and (ii).		3. Is the student able to describe the use of each tools in mechanical engineering workshop? 4. Is the student able to list all hand tools and machine tools used in different Mechanical Engineering workshops?	
	4.2 Use of Mechanical Tools and Equipment	The student should be able to: a) Explain on how to use workshop tools and equipment to perform simple mechanical engineering tasks.	i) The teacher to arrange students in groups and guide them to: – Explain on how to use workshop tools and equipments to perform simple engineering tasks e.g. marking of work piece, measuring properly.	• Tools and equipment • Ferrous and non ferrous material • Poster showing different materials • Multimedia • TV set • Computer • VHS/CD/VCD/ DVD	1. Can the student explain on how to use workshop tools to perform simple mechanical engineering tasks?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		b) Describe on how to use different types of engineering tools and equipments to perform simple mechanical engineering tasks c) Use of workshop tools in performing simple mechanical engineering tasks. d) Use workshop equipment to perform simple engineering tasks eg marking of work piece, measuring properly?	– Describe on how to use different types of engineering tools and equipments to perform simple mechanical engineering tasks ii) The teacher to design activities and guide students to demonstrate how to use workshop tools and equipment in performing simple mechanical engineering tasks (i.e., measuring, marking, holding, cutting, holding etc) iii) With the help of prepared assessment guideline, the teacher should guide the students to asses the tasks performed on part (i). iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).		2. Can the student describe on how to use different types of engineering equipment to perform simple mechanical engineering tasks? 3. Can the student use workshop tools to perform simple mechanical engineering tasks? 4. Can student use workshop equipment to perform simple engineering tasks eg marking of work piece, measuring properly?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
5.0 ENGINEERING DRAWING I	5.1 Introduction to Engineering Drawing	The student should be able to: a) Define engineering drawing as a universal language in industry. b) Identify different types of engineering drawings. c) Explain the meaning of draughtsman ship.	i) The teacher to use questions to guide students to: – Define engineering drawing as a Universal language in industry. – Explain the meaning of draughtsman ship. ii) The teacher to arrange students in groups and guide them to identify different types of engineering drawings. iii) Students to present their responses for sharing and discussion. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii)	• Drawing instruments • Manila sheet • Drawing room • Drawing sheets	1. Is the student able to define engineering drawing as a universal language in industry? 2. Can the student identify different types of drawings? 3. Can the student explain the meaning of draughtsman ship?	2
	5.2 Drawing Office Tools	The student should be able to: a) Define the term drawing office tools. b) Identify drawing office tools.	i) The teacher to use questions to guide students to: – Define the term drawing office tools. – Identify drawing office tools.	• Drawing room • Drawing instruments • Manila sheet • Marker pen	1. Can the student define the term drawing office tools? 2. Can the student identify drawing office tools?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		c) Explain the uses of each drawing office tools. d) Explain how to care and handle drawing office tools. e) Use drawing office tools	ii) The teacher to arrange students in groups and guide them to: – Explain the uses of each drawing office tools. – Explain how to care and handle drawing office tools. iii) The teacher to create activities for students to use drawing office tools. iv) Students to present their responses for sharing and discussion. v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).	• Poster showing different types of drawing instruments • TV • VHS • CD/VCD/DVD • Computer	3. Can the student explain the uses of each drawing office tools. 4. Is the student able to explain how to care and handle drawing office tools? 5. Can the student use drawing office tools?	
	5.3 International Standard Organization (ISO) Sheet Layout and Sketching	The student should be able to: a) Define the term ISO. b) Identify different types of drawing sheet sizes.	i) The teacher to use questions to guide students to: – Define the term ISO. – Identify different types of drawing sheet sizes. – Identify different types of drawing lines.	• Drawing sheets • Drawing instruments • Drawing tables/ boards • Posters showing different types of lines	1. Can the student define the term ISO? 2. Can the student differentiate types of drawing sheet sizes?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		c) Identify different types of drawing lines. d) Make layout of drawing sheet. e) Make a sketch. f) Make letter and print. g) Fold a large drawing sheets to A4 format sheet. h) Make a title block.	ii) The teacher to create activities for students to: – Make drawing layout. – Produce a sketch. – Make layout of drawing sheet. – Make Letter and Print. – Fold a large drawing sheets to A4 format sheet. – Draw a tittle block at different layouts. iii) Students to present their work for sharing and discussion. iv) With the help of prepared assessment guideline, the teacher should guide the students to assess activities performed in part (iii). ii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iv).	• Posters showing different types of drawing sheet sizes	3. Can the student Identify different types of drawing lines? 4. Can the student make layout of drawing sheet? 5. Can the student make a sketch? 6. Can the student make Letter and Print? 7. Can the student make tittle block with different paper layout? 8. Can the student fold a large drawing sheets to A4 format sheet?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	5.4 Construction of Geometric Figures	The student should be able to: a) Define the term geometric figures as applied in engineering drawing. b) Draw different types of geometric figures in engineering. c) Construct different types of geometric plane figures (triangles, quadrilaterals triangles, polygons and circles). d) Construct different types of geometrical in three dimensional figures.	i) The teacher to use questions to guide students to define the terms line, angles, lettering, plane figures and dimensioning as applied in engineering drawing. ii) The teacher to create activities for students to: – Construct perpendicular lines and divide a line into equal parts. – Construct and bisect different types of angles. – Draw different types of geometric figures in engineering. – Construct different types of geometric plane figures (triangles, quadrilaterals, triangles, polygons and circles). – Construct different types of geometries in three dimensional figures. iii) Students to present their work for sharing and discussion.	• Standard drawing sheets • Drawing board • Drawing Instruments • Posters showing different types of lines, angles and plane figures	1. Can the student define the term geometric figures as applied to engineering drawing? 2. Can the student draw different types of geometric figures in engineering? 3. Can the student accurately construct different types of geometric plane figures (triangles, quadrilaterals, polygons, circles, tangents)?	8

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
			iv) With the help of prepared assessment guideline, the teacher should guide the students to assess activities performed in part (ii). v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iv)		4. Can the student accurately construct different types of geometries in three dimensional figures?	
	5.5 Similar Figures	The student should be able to: a) Define similar figures. b) Explain the meaning of enlargement of similar figures. c) Draw different types of similar figures. d) Construct different types of plane similar figures.	i) The teacher to use questions to guide students to: – Define the term similar figures. – Explain the concept of enlargement of similar figures. – Explain the concept of enlarging and reducing of figures. – Explain the concept of equal areas. ii) The teacher to create activities for students to: – Draw different types of similar figures.	• Standard drawing sheets • Drawing board • Drawing Instruments • Poster with different types of plane figures	1. Is the student able to define similar figures? 2. Is the student able to explain the concept of enlargement of similar figures? 3. Can student accurately draw different types of similar figures? 4. Can student construct different types of plane similar figures?	8

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		e) Construct different types of three dimensional similar figures.	– Construct different types of similar figures. iii) Construct different types of three dimensional similar figures. iv) Students to present their work for sharing and discussion. v) With the help of prepared assessment guideline, the teacher should guide the students to assess activities performed in part (ii). vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iv).		5. Can student construct different types of three dimensional similar figures?	

FORM II

CLASS LEVEL COMPETENCIES

By the end of Form II, the student should demonstrate the ability to:

a) test the performance of machines using proper testing tools and equipment;
b) use engineering tools, equipments and materials in performing different mechanical engineering tasks;
c) show understanding the functions of machines equipment and tools in performing different mechanical engineering tasks;
d) draw views of engineering components; and
e) make simple engineering joints.

CLASS LEVEL OBJECTIVES

By the end of Form II, the student should be able to:

a) select and use various engineering materials, tools and equipment in performing different engineering tasks;
b) use proper testing tools and equipment in testing the performance of mechanical engineering machines;
c) describe the functions of machines equipment and tools in performing different mechanical engineering tasks;
d) identify dimension of drawings and draw views of engineering components; and
e) identify and make simple engineering joints.

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
1.0 ENGINEERING MATERIALS	1.1 Introduction to Engineering Materials (Metals and non-metals)	The student should be able to: a) Explain the meaning of engineering materials. b) List types of ferrous metals and their application. c) List types of non-ferrous metals and their applications. d) List types of ferrous and non-ferrous alloys and their applications e) Explain the advantages and disadvantages of different types of engineering materials	i) The teacher to use questions to guide students to: – Explain the meaning of engineering materials. – List various materials used in engineering. – List types of ferrous metals and their applications. – List types of non-ferrous metals and their applications – List types of ferrous and non-ferrous alloys and their applications. ii) The teacher to arrange students in groups and guide them to: – Explain the advantages and disadvantages of different types of engineering materials. – Explain different applications of engineering materials. – List types of non-metals and their applications iii) Students to present their responses for sharing and discussion.	• Different types of engineering materials • Different products made of different engineering materials • Different types of alloys (steel, bronze, carbide, etc)	1. Is the student able to explain the meaning of engineering material? 2. Is the student able to list types of ferrous metals and their applications? 3. Is the student able to list different types of ferrous and non-ferrous metals and their applications? 4. Can the student able to list down ferrous and non-ferrous alloys and their applications? 5. Can the student explain the advantage and disadvantages of different engineering materials?	8

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		f) Explain different applications of engineering materials. g) List types of non-metals and their applications	iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part(i-iii).		6. Can the student explain different applications of engineering materials? 7. Is the student able to list types of non-metals and their applications?	
	1.2 Engineering Materials Properties	The student should be able to: a) Define the term mechanical properties of engineering materials. b) Identify mechanical engineering materials by physical and chemical methods.	i) The teacher to use questions to guide students to: – Define the term mechanical properties of engineering materials. – Identify different mechanical engineering materials. – Identify mechanical engineering materials by physical properties such as appearance, spark test, colour code and chemical properties such as rusting, corrosion, chemical reaction etc ii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii)	• Different types of engineering materials • Poster showing different engineering materials. • Colour codes • Griding machine • Fluids (water, salt, chemical etc)	1. Is the student able to define the term mechanical properties of engineering materials? 2. Can the student identify mechanical engineering materials by physical and chemical methods?	6

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		c) Identify mechanical engineering materials by physical identification (appearance, spark testing, colour code etc) and chemical identification (corrosion, rusting, reactions etc)			3. Can the student identify mechanical engineering materials by physical identification (appearance, spark testing, colour code etc) and chemical identification (corrosion, rusting, reactions etc)	
	1.3 Production of Engineering Materials-Metals (Ferrous and non-ferrous metals)	The student should be able to: a) Define the term iron ores. b) Explain the process of iron ore production. c) List different types of furnaces used in production of engineering materials.	i) The teacher to use questions to guide students to: – Define the term iron ores. – Identify types of iron ores used to produce pig iron. – List different types of furnaces used in production of engineering materials. ii) The teacher to arrange students in groups and guide them to: – Explain the process of iron ore production.	• Different types of iron ores • Different types of carbon steel materials • Blast furnace model • Cupola furnace model • Poster showing different types of furnaces	1. Can the student define the term iron ore? 2. Is the student able to explain the process of iron ore production? 3. Is the student able to list different types of furnaces used in production of engineering materials?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		c) Explain working principle of furnaces used in production of engineering materials. d) Explain how iron alloys (cast iron, steel etc) are produced.	– Explain the working principle of furnaces used in production of engineering materials. – Explain the process of production of cast iron and carbon steel. – Explain the working principles of cupola furnace. – Explain the working principle of other furnaces such as Bessemer converter, etc. – Explain how cast iron and carbon steel are produced. – Explain how to obtain correct charges to produce pig iron. – Explain how to obtain steel from furnaces iii) Students to present their responses for sharing and discussion. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).		4. Is the student able to explain working principles of the furnaces in production of engineering materials? 5. Is the student able to explain production of cast iron and carbon steel?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	1.4 Production of Engineering Materials - Non Metals	The students should be able to: a) Define the term non-metal. b) Describe types of non-metals. c) List different types of non-metals used as engineering materials. d) Differentiate between metals and non-metals. e) Explain different applications of non-metals. f) Analyse advantages and disadvantages of non-metals.	i) The teacher to use questions to: - Define the term non-metal - Identify types of non-metals - List different types of non-metals used as engineering materials ii) The teacher to arrange students in groups and guide them to: - Explain the advantages and disadvantages of different types of non-metals used in engineering materials - Explain the different applications of non-metals used in engineering materials iii) Students to present their responses for sharing and discussion: iv) The teacher should give feedback and used students responses as feedback to support students in performing the tasks given in part (i-iv)	• Different types of non-metal materials (plastic, fibres, ceramic, etc) • Poster showing different types of non-metals • Poster showing differences between non-metal and metal • Chalk • Black board • Manila sheet • Marker pen	1. Can the student define the term non-metal? 2. Can the student identify types of non-metals? 3. Can the student list different types of non-metals? 4. Can the student Differentiate between metal and non-metals? 5. Can the student explain the application of non-metals? 6. Can the student analyse advantages and disadvantages of non-metals?	8

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
2.0 METAL WORK TECHNOLOGY	2.1 Hand Tools and Measuring Tools	The student should be able to: a) Select and use hand tools for carrying out various bench works. b) Select and use measuring tools (e.g. vernier calipers, height gauge, combination set etc) for metal work in the workshop. c) Select and use work holding devices for metal work.	i) The teacher to create activities for students to: – Select and use hand tools for carrying out various bench works. – Select and use various measuring tools in metal work in the workshop. – Select and use work holding devices for metal work. ii) Students to present their work for sharing and discussion. iii) With the help of prepared assessment guideline, the teacher should guide the students to assess activities performed in part (i).	• Hand tools • Measuring tools • Holding devices • Samples of work pieces • Surface table	1. Can the student select and use hand tools for carrying out various metal work in the workshop? 2. Is the student able to select and use measuring tools for metal work in the workshop? 3. Is the student able to select and use work holding devices for metal work?	6
	2.2 Metal Joining Process	The student should be able to: a) Explain the process of metal joining. b) Identify different types of metal joining processes.	i) The teacher to use questions to guide students to explain the process of metal joining. ii) The teacher to arrange students in groups and guide them to: – Identify different types of metal joining processes.	• Poster showing pictures of metal joining • Tools and equipments for gas welding, arc welding etc	1. Is the student able to explain the process of metal joining? 2. Is the student able to identify different types of metal joining processes?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		c) Explain different types of permanent metal joining processes d) Identify types of gases used for gas welding operations. e) Explain different types of gases used for gas welding process and their advantages and disadvantages. f) Describe temporary metal joining process (screws, bolts and nuts).	– Identify permanent metal joining processes (i.e., welding, soldering, brazing). – Explain different types of gases used for gas welding process and their advantages and disadvantages – Describe temporary metal joining process (screws, bolts and nuts). iii) Students to present their responses for sharing and discussion. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).	• Bolts, nuts, screw, pins, rivets • Soldering guns, fluxes, filler rods	3. Is the student able to explain different types of permanent metal joining processes? 4. Is the student able to identify types of gases used for gas welding operations? 5. Is the student able to explain different types of gases used for gas welding process and their advantages and disadvantages? 6. Describe temporary metal joining process (screws, bolts and nuts)?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	2.3 Electric Arc Welding	The student should be able to: a) Explain electric arc welding process. b) Describe various electric arc welding techniques. c) List different types of arc welding electrodes. d) Carry out arc welding. e) Explain advantages and disadvantages of electric arc welding.	i) The teacher to use questions to guide students to: – Explain electric arc welding process. – Describe various electric arc welding techniques. – List different types of arc welding electrodes. ii) The teacher to use role play methods to guide students to demonstrate the activities on carrying out arc welding. iii) The teacher to use questioning strategies (what, why and how questions) to guide students to explain advantages and disadvantages of electric arc welding. iv) Students to present their responses for sharing and discussion. v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iv).	• Poster showing pictures of metal joining • Tools and equipment for arc welding • Welding machines • Electrodes • Welding shields • PPE	1. Is the student able to explain electric arc welding process? 2. Is the student able to describe various electric arc welding techniques? 3. Is the student able to list different types of arc welding electrodes? 4. Can the student carry out arc welding? 5. Is the student able to explain advantages and disadvantages of electric arc welding?	8

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	2.4 Gas Welding	The student should be able to: a) Define the term gas welding. b) Explain various gas welding processes. c) Describe the temperature of various gas flames. d) Carry out gas welding. e) Explain advantages and disadvantages of using gas welding.	i) The teacher to use questions to guide students to: – Define the term gas welding. – Explain various gas welding processes. – Describe the temperature of various gas flames ii) The teacher to create activities and guide students to carry out gas welding. iii) The teacher to use questioning strategies to guide students to explain advantages and disadvantages of using gas welding. iv) Students to present their responses for sharing and discussion. v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iv)	• Poster showing pictures of metal joining • Tools and equipment for gas welding • Gas welding plants • Filler rods • Work piece	1. Is the student able to define the term gas welding? 2. Is the student able to explain various gas welding processes? 3. Is the student able to describe the temperature of various gas flames? 4. Is the student able to carry out gas welding? 5. Is the student able to explain advantages and disadvantages of using gas welding?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	2.5 Simple Machine Tools	The student should be able to: a) Identify different types of simple machine tools. b) Identify different types of drilling machines. c) Describe parts and material of a drill bit. d) Explain how a grinding operation is related to other metal cutting operation. e) Identify different types of grinding discs. f) Explain surface finish of grinding operations.	i) The teacher to use questions to guide students to: – Identify different types of simple machines tools. – Identify different types of drilling machines. ii) The teacher to arrange students in groups and guide them to: – Describe parts and materials of drill bit parts. – Explain how grinding operation is related to other metal cutting operation. – Explain surface finish of grinding operations. – Identify different types of grinding machines and grinding discs. – Identify coding on grinding discs and its applications. – Explain the effect of pitch of power hacksaw blade and thickness of the work piece.	• Drilling machine • Drill bits • Grinding machine • Grinding disc • Power hacksaw • Multimedia projection • DVD/VCD • TV • Poster showing different types of drilling, grinding, machines and power hacksaw • Manila • Power hacksaw blade	1. Is the student able to identify different types of simple machine tools? 2. Is the student able to identify different types of drilling machines? 3. Is the student able to name parts and material of a drill bit? 4. Is the student able to explain how a grinding operation is related to other metal cutting operations? 5. Is the student able to identify different types of grinding disc?	8

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		g) Identify different types of grinding machines and grinding discs. h) Identify coding on grinding discs and its applications. i) Explain the effect of pitch of power hacksaw blade and thickness of the work piece. j) Select power hacksaw blade by considering number of teeth per unit length (pitch).	iii) The teacher to create activities to guide students to select power hacksaw blade by considering number of teeth per unit length(pitch). iv) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii). v) Students to present their responses for sharing and discussion. vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iv)		6. Can the student explain surface finish of grinding operations? 7. Can the student identify different types of grinding machines and grinding discs? 8. Can the student identify coding on grinding discs and its applications? 9. Can the student explain the effect of pitch of power hacksaw blade and thickness of the work piece? 10. Can the student select power hacksaw blade by considering number of teeth per unit length (pitch)?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
3.0 ENGINEERING DRAWING II	3.1 Pictorial Drawing (Oblique, Isometric)	The student should be able to: a) Define the term pictorial drawing. b) Define the term oblique and isometric projection. c) Construct oblique drawing using cavalier and cabinet methods. d) Construct isometric circles, cylinders, cones, pyramids, prisms.	i) The teacher to use questions to guide students to: – Define the term pictorial drawings. – Define the term isometric and oblique projection. ii) The teacher to create activities for students to: – Construct oblique drawing using cavalier and cabinet methods. – Construct isometric circles, cylinders, cones, pyramids, prisms. iii) Students to present their work for sharing and discussion. iv) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii). v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iv)	• Standard drawing sheets • Drawing board • Drawing Instruments • Poster showing different isometric and pictorial drawing	1. Is the student able to define the term pictorial drawing? 2. Is the student able to define the term oblique and isometric projection? 3. Can the student construct oblique drawing using cavalier and cabinet methods? 4. Can the student construct isometric circles, cylinders, cones, pyramids, prisms?	16

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	3.2 Scales	The student should be able to: a) Explain the term scale as used in a drawing. b) Identify different types of scales. c) Explain the importance of each type of scale. d) Use scales when drawing an object.	i) The teacher to use question to guide students to: – Explain the term scale as used in a drawing. – Identify different types of scales (e.g. plain and diagonal scales). – Explain the importance of scales. ii) The teacher to create activities for students to: – Select proper scale – Draw objects by using suitable scale. – Construct plain and diagonal scale. – Read scales plain and diagonal. iii) Students to present their work for sharing and discussion. iv) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iv)	• Scale rule • Drawing boards • Drawing Instruments • Drawing sheets	1. Is the student able to explain the term scale as used in a drawing? 2. Is the student able to identify different types of scales? 3. Is the student able to explain the importance of each type of scale? 4. Can the student use scales when drawing an object?	8

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	3.3 Dimensioning and symbols	The student should be able to: a) Identify different types of dimensioning and symbols. b) Describe the importance of dimensioning and symbols. c) Explain rules of dimensioning and symbols. d) Describe different types of dimensioning and symbols e) Carry out dimensioning in several orthographic projection drawings	i) The teacher to arrange students in groups and guide them to: – Identify different types of dimensioning and symbols. – Explain rules of dimensioning and symbols. ii) The teacher to use questioning strategies (what, how, and why questions) to guide students to: – Describe the importance of dimensioning and symbols. – Explain the importance of different types of dimensioning and symbols. (e.g. overall and detail dimension). iii) The teacher to design activities for students to do dimensioning in several orthographic projection drawings. iv) Students to present their work/ responses for sharing and discussion. v) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii).	• Drawing boards • Drawing instruments/ equipment • Drawing sheets • Poster showing different types of dimensioning and symbols	1. Can the student identify different types of dimensioning and symbols? 2. Can the student describe the importance of dimensioning and symbols? 3. Is the student able to explain rules of dimensioning and symbols? 4. Can the student describe different types of dimensioning and symbols? 5. Can the student carry out dimensioning in several orthographic projection drawings?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
			vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-v)			
	3.4 Free Hand Sketching	The student should be able to: a) Explain free hand sketching as related to other engineering drawing procedures. b) Explain the importance of free hand sketching in engineering fields. c) Identify motion of drawing lines. d) Sketch straight lines, circles, arcs, pictorial drawings and orthographic projections.	i) The teacher to arrange students in groups and guide them to: – Explain free hand sketching as related to other engineering drawing procedures. – Explain the importance of free hand sketching in engineering fields. ii) The teacher to use questions to guide students to identify motion of drawing lines. iii) The teacher to create activities for students to: – Practice sketching lines, circles, arcs, pictorial drawings and orthographic projections. – Practice sketching procedures.	• Drawing boards • Drawing papers • Drawing instruments	1. Is the student able to explain free hand sketch as related to other engineering drawing procedures? 2. Explain the importance of free hand sketching in engineering fields. 3. Can the student identify motion of drawing lines?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
			iv) With the aid of prepared assessment guideline, the teacher should guide the students to perform activities in part (iii). v) Students to present their responses for sharing and discussion. vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-v)		4. Is the student able to sketch straight lines circles, arcs, pictorial drawings and orthographic projections?	
	3.5 Intersections of Cylinders	The student should be able to: a) Identify procedures used to develop and draw intersection of objects. b) Identify procedures and relationships between development and intersection of object.	i) The teacher to arrange students in groups and guide them to: – Identify procedures used to develop and draw intersection of objects. – Identify procedures and relationships between development and intersection of object. ii) The teacher to create activities for students to: – Locate intersection point when cylinders meet at right angle to each other.	• Model of solid intersection of object • Drawing boards • Drawing instruments	1. Can the student identify procedures used to develop and draw intersection of object? 2. Can the students identify procedures and relationships between development and intersection of object?	8

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		c) Locate intersection point when cylinders meet at right angle to each other. d) Draw the intersection of two similar and two dissimilar diameters of cylinders intersecting at right angle to each other.	– Draw the intersection of two similar and two dissimilar diameters of cylinders intersecting at right angle to each other. v) Students to present their work for sharing and discussion. iii) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iv)		3. Is the student able to locate intersection point when cylinders meet at right angle to each other? 4. Can the student draw the intersection of two similar and dissimilar diameters of cylinders intersecting at right angle to each other?	

AUTOMOTIVE ENGINEERING

FORM III

CLASS LEVEL COMPETENCIES

By the end of Form III, the student should have ability to:

a) trouble shoots different faults and analyse automotive system;
b) demonstrate the use of pneumatic and hydraulic system in automotive engineering;
c) trouble shoots different faults and repair refrigeration and air conditioning systems;
d) draw sketches using technical drawing knowledge and skills; and
e) draw automotive sketches using computer software and other modern technologies.

CLASS LEVEL OBJECTIVES

By the end of Form III, the student should be able to:

a) explain functions of various components of motor vehicle and automotive system;
b) explain the applications of pneumatic and Hydraulic system;
c) perform maintenance and repair of refrigeration and air conditioning systems;
d) use technical drawing knowledge and skills to draw sketches, different automotive engineering parts; and
e) use computer software to draw automotive sketches.

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
1.0 AUTOMOTIVE ENGINEERING	Introduction to Automotive Engineering	The student should be able to: a) Explain the term Automotive engineering. b) Explain importance of Automotive engineering field in society. c) Differentiate Automotive engineering from other fields of engineering. d) Identify opportunities obtained in the field of Automotive engineering. e) Explain the essence of studying Automotive engineering.	i) The teacher to use questions to guide students to: – Explain the meaning of Automotive engineering. – Explain importance of Automotive engineering field in society ii) The teacher to organise group discussions for students to: – Differentiate Automotive engineering from other fields of engineering. – Identify opportunities obtained in the field of Automotive engineering. iii) The teacher to use questioning strategies to guide students to explain the essence of studying Automotive engineering. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).	• Multimedia, TV, Computer • Reading texts on the topic	1. Is the student able to explain the meaning of the term Automotive engineering? 2. Is the student able to explain importance of Automotive engineering field in society? 3. Is the student able to differentiate Automotive engineering from other fields of engineering? 4. Is the student able to identify opportunities obtained in the field of Automotive engineering?	5

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
					5. Is the student able to explain the essence of studying Automotive engineering?	
2.0 AUTOMOBILE ENGINE TECHNOLOGY	2.1 Engine Main Parts	The student should able to: a) Describe different parts of engine. b) Differentiate parts of engine. c) Demonstrate different parts of engine. d) Describe the functions of different parts of engine.	i) The teacher to use questions to guide students to describe different parts of engine such as: – Engine Block. – Cylinder Head. – Camshaft. – Flywheel. – Connecting roads. – Piston rings. – Crankshaft – Valve train. ii) The teacher to use questioning strategies (why and who question) to guide students to differentiate parts of Engine. iii) The teacher to create activities for students to demonstrate parts of engine such as: – Engine Block	• Chalkboard • Motor vehicle textbooks • Engine parts model • Posters showing engine parts • Engine model	1. Is the student able to describe different parts of engine? 2. Can the student differentiate parts of engine? 3. Is the student able to differentiate parts of engine? 4. Describe the functions of different parts of engine?	3

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
			– Cylinder Head. – Crankshaft. – Flywheel. – Connecting roads – Piston rings. – Camshaft. – Valve train. iv) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii). v) The teacher to arrange students in groups and guide them to describe the functions of different parts of engine. vi) Students to present their responses for sharing and discussion. vii)The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-v).			

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	2.2 Engines and Characte-ristics	The student should be able to: a) Describe the characteristics of petrol engine b) Describe the characteristics of diesel engine. c) Explain the advantages and disadvantages of petrol/gas and diesel engines. d) Explain basic operating principles of petrol/gas and diesel engines. e) Explain valve arrangement and combustion chambers of petrol/gas/diesel engine.	i) The teacher to use questions to guide students to: – Describe the characteristics of petrol engine – Describe the characteristics of diesel engine ii) The teacher to arrange the students in groups and guide them to: – Explain the advantages and disadvantages of petrol/gas and diesel engines. – Explain basic operating principles of petrol/ gas and diesel engines. – Distinguish petrol/gas engine from diesel engines. – Explain valve arrangement and combustion chambers of petrol/diesel/gas engine.	• Chalkboard • Motor vehicle textbooks • Four-stroke engine model • Posters with pictures of four stroke engines petrol/gas and diesel • Two stroke Engine model • Rotary Engine Model	1. Is the student able to describe the characteristics of petrol engine? 2. Can the student describe the characteristics of diesel engine? 3. Is the student able to explain the advantages and disadvantages of petrol/ gas and diesel engines? 4. Is the student able to explain the basic operating principles of petrol/gas and diesel engines?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		f) Distinguish petrol/gas engine from diesel engines.	iii) Students to present their responses for sharing and discussion. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii)		5. Is the student able to explain valve arrangement and combustion chambers of petrol/diesel engine? 6. Can the student distinguish petrol engine from diesel engines?	
	2.3 Two-stroke Engine (Spark Ignition and Compression Ignition)	The students should be able to: a) Explain valve arrangement and combustion chamber of the two-stroke engine. b) Describe the characteristics of two stroke engine.	i) The teacher to use questions to guide students to explain valve arrangement and combustion chamber of the two-stroke engine. ii) The teacher to arrange the students in groups and guide them to: – Describe the characteristics of two stroke engine. – State the advantages and disadvantages of two-stroke engine.	• Chalkboard • Motor vehicle textbooks • Four-stroke engine model • Posters with pictures of four/ two stroke engines petrol and diesel	1. Is the student able to explain valve arrangement and combustion chamber of the two-stroke engine? 2. Is the student able to describe the characteristics of two stroke engine?	5

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		c) Explain the basic operating principles of two- stroke engines (in- take, compression, ignition and exhaust strokes). d) State the advantages and disadvantages of two-stroke engine. e) Draw timing diagrams for two- stroke engines	iii) The teacher to use questioning strategies (what, why and how) to guide the students to explain the basic operating principles of two-stroke engines (in- take, compression, ignition and exhaust strokes). iv) The teacher to create activities for students to draw timing diagrams for two-stroke engines. v) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iv). vi) Students to present their responses for sharing and discussion. vii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-v)	• Two stroke Engine model • Rotary Engine Model	3. Is the student able to explain the basic operating principles of two- stroke engines? 4. Is the student able to state the advantages and disadvantages of two-stroke engine? 5. Can the student draw timing diagrams for two- stroke engines?	5

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	2.4 Four-stroke Engine (Spark Ignition and Compression Ignition)	The students should be able to: a) Explain valve arrangement and combustion chamber of the four-stroke engine. b) Describe the characteristics of four-stroke engine. c) Explain the basic operating principles of four- stroke engines (in- take, compression, ignition and exhaust strokes).	i) The teacher to use questions to guide students to explain valve arrangement and combustion chamber of the four-stroke engine. ii) The teacher to arrange the students in groups and guide them to: – Describe the characteristics of four stroke engine. – State the advantages and disadvantages of four-stroke engine. iii) The teacher to use questioning strategies (what, why and how) to guide the students to: – Explain the basic operating principles of four- stroke engines (in- take, compression, ignition and exhaust strokes). – Differentiate multi-cylinder from single cylinder. iv) The teacher to create activities for students to draw timing diagrams for four- stroke engines.	• Chalkboard • Motor vehicle textbooks • Four-stroke engine model • Posters with pictures of four stroke engines petrol and diesel • Two stroke Engine model • Rotary Engine Model	1. Is the student able to explain valve arrangement and combustion chamber of the four-stroke engine? 2. Is the student able to describe the characteristics of four stroke engine? 3. Is the student able to explain the basic operating principles of four- stroke engines?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		d) State the advantages and disadvantages of four-stroke engine. e) Differentiate multi-cylinder from single cylinder. f) Draw timing diagrams for four- stroke engines.	v) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iv). vi) Students to present their responses for sharing and discussion. vii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-v)		4. Is the student able to state the advantages and disadvantages of four-stroke engine? 5. Can the student differentiate multi-cylinder from single cylinder? 6. Can the student draw timing diagrams for four- stroke engines?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	2.5 Rotary Engine (Introduction)	The student should be able to: a) Describe the characteristics of rotary engine. b) State the advantages and disadvantages of rotary engine. c) Differentiate rotary engine from two-stroke and four-stroke engines.	i) The teacher to arrange students in groups and guide them to: – Describe the characteristics of rotary engine. – State the advantages and disadvantages of rotary engine. ii) The teacher to use questioning strategies (what, why and how) to guide the students to differentiate rotary engine from two-stroke and four-stroke engines. iii) Students to present their responses for sharing and discussion. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-v).	• Chalkboard • Motor vehicle textbooks • Rotary engine model • Four-stroke engine model • Two-stroke engine model	1. Is the student able to describe the characteristics of rotary engine? 2. Is the student able to state the advantages and disadvantages of rotary engine? 3. Can the student differentiate rotary engine from two stroke and four stroke engines?	3
3.0 AUTOMOTIVE SYSTEMS I	3.1 Safety and Warning Devices	The student should be able to: a) Identify types of warning devices. b) Explain the purpose of warning devices.	i) The teacher to use questioning strategies (what, how and why questions) to guide students to: – Identify types of warning devices. – Explain the purpose of warning devices.	• Motor vehicle Text book • Warning device models • Posters, Flip chart	1. Is the student able to identify types of warning devices?	2

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
			i) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i).	• Marker pen • Black board/ chalk	2. Is the student able to explain the purpose of warning devices?	
	3.2 The Clutch	The student should be able to: a) Explain the term clutch. b) Analyse types of clutches and their applications. c) Describe the important of clutches in a vehicle.	i) The teacher to use questions to guide students to explain the term clutch. ii) The teacher to arrange students in groups and guide them to: – Analyse types of clutches and their applications.. – Describe the important of clutches in vehicle. iii) Students to present their responses for sharing and discussion. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i).	• Motor vehicle Text book • Clutches models • Posters, Flip chart • Marker pen • DVD/VCD/VHS • Computers and TV	1. Is the student able to explain the term clutch? 2. Can the student analyse types of clutches and their applications? 3. Can the students describe the important of clutches in a vehicle?	2

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	3.3 The Gear Box	The student should be able to: a) Explain the term gearbox. b) List different types of gearboxes. c) Explain the applications of different types of gearboxes. d) Make a simple sketch of the gearbox	i) The teacher to use questions to guide students to: – Explain the term gearbox. – List different types of gearboxes (i.e., manual, automatic, CVT, Semi-automatic) – Explain the applications of different types of gearbox. ii) The teacher to create activities for the students to make a simple sketch of a gearbox. iii) Students to present their work for sharing and discussion. iv) With the aid of assessment guideline, the teacher should guide students to assess the activities performed in part (ii). v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iv).	• Charts, Posters • Gear box model • Gear box • Flip chart, Marker pen • DVD/VCD/VHS • Computer	1. Is the student able to explain the term gearbox? 2. Can the student list different types of gearboxes? 3. Can the student explain the applications of different types of gearbox? 4. Can the student make a simple sketch of the gearbox?	8

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	3.4 Fluid flywheel and Torque Converters	The student should be able to: a) Identify fluid flywheel and torque converter. b) Identify the main parts of fluid flywheel and torque converter. c) Explain the advantages and disadvantages of fluid flywheel and torque converter. d) Describe purpose of fluid flywheel and torque converter.	i) The teacher to use questioning strategies (what, how and why questions) to guide students to: – Identify fluid flywheel and torque converter. – Identify the main parts of fluid flywheel and torque converter. ii) The teacher to arrange students in groups and guide them to: – Explain the advantages and disadvantages of fluid flywheel and torque converter. – Describe purpose of fluid flywheel and torque converter. iii) Students to present their responses for sharing and discussion. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).	• Motor vehicle Text book • Fluid flywheel and torque converter models • Posters, Flip chart • Marker pen	1. Is the student able to identify fluid flywheel and torque converter? 2. Is the student able to identify the main parts of fluid flywheel and torque converter? 3. Is the student able to state advantages and disadvantages of fluid flywheel and torque converter? 4. Is the student able to describe purpose of fluid flywheel and torque converter?	2

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	3.5 Automotive Body and Chassis	The student should be able to: a) Define the terms automotive body and chassis. b) Differentiate types of automotive body and chassis. c) Describe types of chassis for small vehicles and trucks.	i) The teacher to use questions to guide the students to define the terms automotive body and chassis. ii) The teacher to arrange students in groups and guide them to: – Differentiate types of automotive body and chassis. – Describe types of chassis for small vehicles and trucks iii) Students to present their responses for sharing and discussion. iv) The teacher to give feedback and use the students' responses as feedback to support the students to perform the tasks done in part (i-iii).	• Motor vehicle Text book • Automotive body and chassis models • Posters, Flip chart • Marker pen	1. Is the student able to define the terms automotive body and chassis? 2. Is the student able to differentiate types of automotive body and chassis? 3. Is the student able to describe types of chassis for small vehicles and trucks?	2

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	3.6 Power Train Arrangements	The student should be able to: a) Identify front and rear wheel drive. b) Draw front and rear wheel drive. c) Arrange all wheel drive.	i) The teacher to create activities for the students to: – Identify front and rear wheel drive. – Draw front and rear wheel drive. – Arrange all wheel drive. ii) With the aid of assessment guideline, the teacher should guide students to assess the activities performed in part (i). iii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i) and (ii).	• Motor vehicle Text book • Front and rear wheel drive models • Posters, Flip chart • Marker pen	1. Is the student able to identify front and rear wheel drive? 2. Is the student able to draw front and rear wheel drive? 3. Is the student able to arrange all wheel drive?	2
	3.7 The Propeller/ drive Shaft and Joints	The student should be able to: a) Define the term propeller shaft/ drive shaft. b) Identify types of propeller shafs/ drive shaft.	i) The teacher to use questions to guide the students to: – Define the term propeller shaft. – Identify types of propeller shafts. ii) The teacher to arrange students in groups and guide them to: – Describe types of joints used to connect propeller shaft with other members.	• Charts • Propeller shaft model • Propeller shaft • Posters, Flip chart • Marker pen • Drive shaft	1. Is the student able to define the term propeller shaft? 2. Is the student able to identify types of propeller shafts?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		c) Explain the functions of propeller shaft. d) Describe types of joints used to connect propeller shaft. e) Explain the functions of joints used to connect propeller shaft/ drive shaft.	– Explain the functions of joints used to connect propeller shaft – Explain the functions of propeller shaft. iii) Students to present their responses for sharing and discussion. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).	• DVD/VCD/VHS • Computer • Cross joint • CV joint	3. Is the student able to explain the functions of propeller shaft? 4. Is the student able to describe types of joints used to connect propeller shaft with other members? 5. Is the student able to explain the functions of joints used to connect propeller shaft?	
	3.8 The Final Drive	The student should be able to: a) Define the term final drive. b) Describe differential gears and their application. c) Describe the axle casing and axle shaft.	i) The teacher to use questions to guide students in groups to: – Define the term final drive. – Describe axle casing and axle shaft. ii) The teacher to arrange students in groups and guide them to: – Describe differential gears and their applications. – Analyse the functions of axle casing and axle shaft.	• Motor vehicle text book • Charts • Differential gears models • Final drive • DVD/VCD/VHS	1. Is the student able to define final drive? 2. Is the student able to describe differential gears and their applications? 3. Is the student able to describe axle casing and axle shaft?	3

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		d) Analyse the functions of axle casing and axle shaft.	iii) Students to present their responses for sharing and discussion. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii)		4. Is the student able to analyse the functions of axle casing and axle shaft?	
4.0 TOOLS AND EQUIPMENT	4.1 Tightening Tools	The student should be able to: a) Explain the meaning of tightening tools. b) Select different types of tightening tools. c) Use tightening tools.	i) The teacher to use questions to guide students to brainstorm the concept of tightening tools. ii) The teacher to create activities for students to: – Select different types of tightening tools. – Use tightening tools. iii) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).	• Tool box • Bench work • Posters • Flip charts • Marker pen • Safety gears	1. Is the student able to explain the meaning of tightening tools? 2. Can the student select different types of tightening tools? 3. Can the student use tightening tools?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	4.2 Removing and Refitting Tools	The student should be able to: a) Identify removing and refitting tools. b) Demonstrate application of removing and refitting tools. c) Use the removing and refitting tools.	i) The teacher to create activities for students to: – Identify removing and refitting tools. – Demonstrate application of removing and refitting tools. – Demonstrate how to use removing and refitting tools. – Use the removing and refitting tools (i.e., machine stands, presses, fixtures, etc). ii) With the aid of assessment guideline, the teacher should guide students to assess the activities performed in part (i). iii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i) and (ii).	• Tool box • Bench work • Posters • Flip charts • Marker pen • Safety gears	1. Is the student able to identify removing and refitting tools? 2. Can the student demonstrate application of removing and refitting tools? 3. Can the student use the removing and refitting tools?	3
	4.3 Testing and diagnostic Tools	The student should be able to: a) Define the term testing and diagnostic tools.	i) The teacher to use questions to guide students to: – Define the term testing and diagnostic tools.	• Tool box • Bench work • Posters • Flip charts	1. Can the student define the term testing and diagnostic tools?	3

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		b) Identify different types of testing and diagnosis tools. c) Select testing and diagnostic tools. d) Use testing and diagnostic tools.	– Identify different types of testing and diagnosis tools. ii) The teacher to create activities for students to: – Select testing and diagnostic tools. – Use testing and diagnostic tools. iii) The teacher should monitor and facilitate students in performing the tasks given in part (ii). iv) With the aid of assessment guideline, the teacher should guide students to assess the activities performed in part (ii). v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).	• Marker pen • DVD/VCD/ VHC • Computer • Diagnostic kits • Testing kits	2. Is the student able to identify different types of testing and diagnosis tools? 3. Can the student select testing and diagnostic tools? 4. Can the student use testing and diagnostic tools?	3

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	4.4 Lifting Equipment	The student should be able to: a) Define the term lifting mechanisms. b) Identify different types of lifting equipment (i.e., overhead cranes, mobile cranes, chain block) c) Select lifting equipment d) Use lifting equipment	i) The teacher to guide students through questions and answers and demonstration to: – Define the term lifting mechanisms. – Identify different types of lifting equipment (i.e., overhead cranes, mobile cranes, chain block) ii) The teacher should create activities and guide students to: – Select lifting equipment. – Use lifting equipment. iii) The teacher should monitor and facilitate students in performing the tasks given in part (ii). iv) With the aid of assessment guideline, the teacher should guide students to assess the activities performed in part (ii) v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i) and (ii).	• Chain block • Posters with lifting equipment	1. Is the student able to define the term lifting mechanisms? 2. Is the student able to identify different types of lifting equipment? 3. Is the student able to select lifting equipment? 4. Is the student able to use lifting equipment?	2

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
5.0 PNEUMATIC AND HYDRAULIC PRINCIPLES	5.1 Pneumatic principles	The student should be able to: a) Define the term pneumatics. b) Explain the applications of pneumatic systems. c) Analyse the working principles of pneumatics.	i) The teacher to use brainstorming questions to guide students to define the term pneumatics. ii) The teacher to arrange students in groups and guide them to: – Define the term pneumatics. – Explain applications of pneumatic systems (i.e., visiting plants with pneumatic systems). – Analyse the working principles of pneumatics. iii) Students to present their responses for sharing and discussion. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).	• Hydraulic and pneumatic text books • Charts • Pneumatic training kit • Pneumatic machine/ equipment • Pneumatic power supply • Hydraulic training kit • Board with pneumatic circuits	1. Is the student able to define the term pneumatics? 2. Can the student explain application of pneumatic systems? 3. Can the student analyse the working principles of pneumatics?	3
	5.2 Hydraulic principles	The student should be able to: a) Define the term hydraulic. b) Explain concept of fluid power.	i) The teacher to use brainstorming questions to guide students to: – Define the term hydraulics. – Explain concept of fluid power.	• Hydraulic and pneumatic text books • Charts • Hydraulic training kit	1. Is the student able to define the term hydraulics?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		b) Explain application of hydraulic systems d) Explain how hydraulic systems function. e) Explain the advantages of hydraulics over pneumatics. f) Explain working principles of hydraulics.	ii) The teacher to arrange student in groups and guide them to: – Explain how hydraulic systems function. – Explain working principles of hydraulic (i.e., Pascal's law and Bernoulli's concepts). – Explain the applications of hydraulic systems (visiting plants with hydraulic systems). iii) The teacher to use questioning strategies (i.e. what, why and how questions) to guide students to identify the advantages of hydraulics with pneumatics. iv) Students to present their responses for sharing and discussion. v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iv).	• Hydraulic machine/ equipment • Hydraulic power supply • Apply various hydraulic test/ applications	2. Is the student able to explain concept of fluid power? 3. Is the student able to explain application of hydraulic systems? 4. Can the student explain how hydraulic systems function? 5. Can student identify advantages of hydraulics compared with pneumatics? 6. Is the student able to explain working principles of hydraulics (Pascal's law and Bernoulli's concepts)?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	5.3 Hydraulic and Pneumatic Symbols	The students should be able to: a) Define the terms hydraulic and pneumatic symbols. b) Identify hydraulic and pneumatic symbols. c) Differentiate pneumatic and hydraulic symbols.	i) The teacher to use questions to guide students to: – Define the terms hydraulic and pneumatic symbols – Identify hydraulic and pneumatic symbols. ii) The teacher to use questioning strategies (what, why and how questions) to guide students to differentiate pneumatic and hydraulic symbols. iii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i) and (ii).	• Multi media • Posters with symbols	1. Can the student define the terms hydraulic and pneumatic symbols? 2. Can the student identify pneumatic and hydraulic symbols? 3. Is the student able to differentiate pneumatic and hydraulic symbols?	2
	5.4 Hydraulic and Pneumatic Circuits	The students should be able to: a) Identify hydraulic and pneumatic circuits b) Differentiate pneumatic and hydraulic circuit.	i) The teacher to organise a visit to various work places and guide to identify hydraulic and pneumatic circuits. ii) The teacher to use questioning strategies (what, why and how questions) to guide students to differentiate pneumatic and hydraulic circuit.	• Hydraulic and pneumatic circuit boards • Multi media • Posters	1. Is the student able to identify hydraulic and pneumatic circuits? 2. Can the student differentiate pneumatic and hydraulic circuit?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		c) Prepare different pneumatic and hydraulic circuits.	iii) The teacher to create activities for students to prepare pneumatic and hydraulic circuits. iv) The teacher should monitor and facilitate students in performing the tasks given in part v) With the aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii). vi) The teacher to give feedback and use the students' responses as feedback to support the students to perform the tasks done in part (i), (ii) and (iii).		3. Can the student prepare pneumatic and hydraulic circuits?	
6.0 REFRIGERATION AND AIR CONDITIONING	6.1 Principles of Refrigeration	The student should be able to: a) Define the basic concepts of refrigeration. b) Identify types of refrigerators.	i) The teacher to organise students in groups and guide them to: – Define the basic concepts of refrigeration. – Identify types of refrigerators.	• Refrigeration text books • Charts • Refrigerator • Flip chart • Marker pen • DVD/VCD/VHS	1. Is the student able to define the basic concept of refrigerator? 2. Is the student able to identify types of refrigerators?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		c) Explain the importance of refrigeration. d) Differentiate vapour compression and vapour absorption systems. e) Read mollies diagrams/ charts.	– Explain the importance of refrigeration. ii) Students to present their responses for sharing and discussion. iii) The teacher to use questioning strategies (what, how and why questions) to guide students to differentiate vapour compression and vapour absorption system. iv) The teacher to create activities for students to read mollies diagram/ charts. v) With the aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iv). vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-v).	• Computer • Enthalpy-entropy chart	3. Is the student able to explain the importance of refrigeration? 4. Is the student able to differentiate vapour compression and vapour absorption systems? 5. Can the student read mollies charts?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	6.2 Introduction to Air Condition	The student should be able to: a) Explain the meaning of air condition. b) List types of air conditioning systems. c) Explain the importance of air conditioning system.	i) The teacher to use questions to: – Explain the meaning of air condition. – List types of air conditioning systems. ii) The teacher to arrange students in groups and guide them to explain the importance of air conditioning. iii) Students to present their responses for sharing and discussion. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).	• Air conditioning text books • Charts • Air condition	1. Is the student able to explain the meaning of air condition? 2. Can the student list types of air conditioning systems? 3. Is the student able to explain the importance of air conditioning?	2
	6.3 Compressor	The student should be able to: a) Define the term compressor b) Identify types of compressors. c) Describe stages of compressors.	i) The teacher to use questions to guide students to: – Define the term compressor. – Identify types of compressors. – Describe stages of compressors. ii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i).	• Compressors text books • Charts • Compressors models • Posters	1. Is the student able to define the term compressor? 2. Is the student able to identify types of compressors? 3. Is the student able to describe stages of compressors?	2

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	6.4 Evaporator and Coolers	The student should be able to: a) Identify types of evaporators. b) Identify types of coolers. c) Explain de-frosting methods.	i) The teacher to use questions to guide students to: – Identify types of evaporators. – Identify types of coolers. – Explain de-frosting methods. ii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i).	• Evaporators and coolers models • Evaporators and coolers text book • Charts	1. Is the students able to identify types of evaporators? 2. Is the students able to identify types of coolers? 3. Is the students able to explain de-frosting methods?	2

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	6.5 Condensers	The student should be able to: a) Explain the term air-cooler condensers. b) Explain the term water- cooler condensers. c) Explain the term evaporative condensers. d) Select condensers.	i) The teacher to use questions to guide students to explain the term: – Air-cooler condensers. – Water- cooler condensers. – Evaporative condensers.. ii) The teacher to create activities for students to select different types of condensers. iii) Students to present their responses for sharing and discussion. iv) With the aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii).	• Condensers model • Condensers text book • Charts • Posters	1. Is the student able to explain the term air-cooler condensers? 2. Is the student able to explain the term water- cooler condensers? 3. Is the student able to explain the term evaporative condensers? 4. Is the student able to select condensers?	2
			v) The teacher to give feedback and use the students' responses as feedback to support the students to perform the tasks done in part (i-v).			

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	6.6 Refrigerants and Controls	The student should be able to: a) Identify types of refrigerants. b) Identify types of expansion devices and filters. c) Analyse the importance of expansion devices and filters.	i) The teacher to use questions to guide students to: – Identify types of refrigerants. – Explain types of expansion devices and filters. ii) The teacher to organise students in groups and guide them to analyse the importance of expansion devices and filters. iii) Students to present their responses for sharing and discussion. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).	• Refrigerant bottles • Expansion devices • Filters	1. Is the students able to identify types of refrigerants? 2. Is the students able to explain types of expansion devices and filters? 3. Is the student able to analyse the importance of expansion devices and filters?	2

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	6.7 Piping and Oil Management	The student should be able to: a) Identify types of chilled water piping. b) Differentiate liquid lines from suction line c) Control oil in the compressor. d) Change oil in the compressor.	i) The teacher to use questions to guide students to identify types of chilled water piping. ii) The teacher to use questioning strategies (why and how questions) to guide students to differentiate liquid lines from suction line iii) The teacher to create activities for students to: – Control oil in the compressor. – Change oil in the compressor. iv) With the aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii). v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-v).	• Tool box • Charts • Refrigerator • Air condition • Compressor oil • PPE	1. Is the student able to identify types of chilled water piping? 2. Is the student able to differentiate liquid line from suction line? 3. Can the student control oil in the compressor. 4. Can the student change oil in the compressor.	2

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	6.8 Ducting and Insulation	The student should be able to: a) Identify types of ducting and Insulators. b) Explain uses of ducting and insulators. c) Identify the common materials used for insulation in the refrigeration system. d) Explain why insulation is applied to ductwork. e) Draw schematic diagram of refrigeration and show ductwork and insulation.	i) The teacher to use questions to guide students to: – Identify types of ducting and insulators. – Explain uses of ducting and insulators. ii) The teacher to organise students in groups and guide them to: – Identify the common materials used for insulation in the refrigeration. – Explain why insulation is applied to ductwork. iii) The teacher to create activities for students to draw schematic diagram of refrigeration and show ductwork and insulation. iii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iv).	• Ducting and insulation model • Ducting and insulation text book • Charts	1. Is the student able to identify types of ducting and insulators? 2. Is the student able to explain uses of ducting and insulators? 3. Is the student able to identify the common materials used for insulation in the refrigeration system? 4. Is the student able to explain why insulation is applied to ductwork? 5. Is the student able to draw schematic diagram of refrigeration and show ductwork and insulation?	2

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	6.9 Tools and Equipment for Refrigeration and Air Conditioning	The student should be able to: a) Explain the meaning of the terms soft brazing, hard brazing and brazing rods. b) Identify different tools used in refrigeration and air conditioning. c) Perform cutting, flaring, bending and joining of tubes by using tools and equipment.	i) The teacher to use questions to guide students to: – Explain the meaning of the terms soft brazing, hard brazing and brazing rods. – Identify different tools used in refrigeration and air conditioning. ii) The teacher to create activities for students to cut, flare, bend and join tube by using tools and equipment. iii) The teacher should monitor and facilitate students in performing the tasks given in part (ii). iv) With the aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).	• Tool box • Charts • Refrigerator • Air condition • Welding machines (gas welding and brazing) • Cutting machine (e.g. flame cutting machine)	1. Is the student able to explain the terms soft brazing and brazing rods? 2. Is the student able to identify different tools used in refrigeration and air conditioning? 3. Can the student cut, bend and join tubes by using tools and equipment?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	6.10 Refrigerants	The student should be able to: a) Define the term refrigerant. b) Mention common refrigerants. c) Explain the properties of refrigerants.	i) The teacher to use questions to guide students to: – Define the term refrigerant. – Mention common refrigerants. ii) The teacher to organise students in groups and guide them to describe the properties of refrigerants. iii) Students to present their responses for sharing and discussion. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i) and (ii).	• Chalkboard • Charts • Refrigerants • Refrigerator • Text books	1. Is the student able to define the term refrigerant? 2. Can the student mention common refrigerants? 3. Is the student able to explain properties of refrigerants?	3

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	6.11 Refrigeration Cycles	The student should be able to: a) Identify types of refrigeration cycles. b) Describe heat loss and heat gain in evaporator and condenser. c) Use diagram to describe reversed carnot cycle. d) Explain various changes which take place on the refrigerant when it circulates in the system.	i) The teacher to organise students in groups and guide them to: – Identify types of refrigeration cycles. – Describe heat loss and heat gain in evaporator and condenser. – Use diagram to describe reversed carnot cycle – Explain various changes which take place on the refrigerant when it circulates in the system. ii) Students to present their responses for sharing and discussion. iii) The teacher to give feedback and use the students' responses as feedback to support the students to perform the tasks done in part (i) and (ii).	• Refrigeration text books • Charts • Refrigerator • Displays	1. Is the student able to identify types of refrigeration cycles? 2. Can the student describe heat loses and heat gain in evaporator and condenser? 3. Is the student able to describe reversed carnot cycle with the aid of diagram? 4. Can a student explain various changes which take place on the refrigerant when it circulates in the system?	3

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	6.12 Principle of Air Conditioning	The student should be able to: a) Define basic air conditioning terms. b) Explain the meaning of psychometrics. c) Describe different processes in air conditioning. d) Carry out different processes in air conditioning.	i) The teacher to use questions to guide students to: – Define basic air conditioning terms. – Explain the meaning of psychometrics. ii) The teacher to organise students in groups and guide them to describe different processes in air conditioning. iii) The teacher to create activities for students to perform different processes in air conditioning. iv) Students to present their responses for sharing and discussion. v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iv).	• Air condition text books • Charts • Air condition • Displays • Air condition model • Posters	1. Is the student able to define basic air condition terms? 2. Is the student able to explain psychometrics? 3. Can the student describe different processes in air conditioning? 4. Can the student perform different processes in air conditioning?	3

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
7.0 ENGINEERING DRAWING III	7.1 Orthographic Projection	The student should be able to: a) Explain the term orthographic projection. b) Identify drawing symbols for first and third angle. c) Project views on vertical and horizontal principle plane. d) Explain the importance of drawing symbols in orthographic. e) Construct orthographic drawing in first and third angle projection.	i) The teacher to arrange students in groups and guide them to: – Explain the term orthographic projection. – Identify drawing symbols for first and third angle. ii) The teacher to create activities for students to: – Draw views on vertical and horizontal principle plane (Front, end elevation and plan). – Draw object in first and third angle projections. iii) Students to present their work for sharing and discussion. iv) With the aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii).	• Drawing board • Drawing Instrument/ equipments • VCD/DVD showing Orthographic Projection • Multimedia projection • Poster showing orthographic projection • ISO drawing paper	1. Is the student able to explain the term orthographic projection? 2. Can the student identify drawing symbols for first and third angle? 3. Can the student project views on vertical and horizontal principle plane (front, end elevation and plan)? 4. Can the student explain the importance of drawing symbols in orthographic?	10

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		f) Draw views on vertical and horizontal principle plane (Front, end elevation and plan). g) Draw object in first and third angle projections	v) The teacher to use questioning strategies (what, how, and why questions) to guide students to explain the importance of drawing symbols in orthographic. vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-v).		5. Can the student construct orthographic drawing in first angle and third angle projection? 6. Can the student draw views on vertical and horizontal principle plane (Front, end elevation and plan)? 7. Can the student draw object in first and third angle projections?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	7.2 LOCI (Mechanisms)	The Student should be able to: a) Define the term locus of a point. b) Can the student plot the locus point of a ladder movement of a crank and slider for single point coil springs? c) Construct locus of ladder movement crank and slides single point links with multiple point and helix and coil springs.	i) The teacher to use brainstorming questions to guide students define the term locus of a point. ii) The teacher to create activities for students to: – Plot the locus of points of a ladder movement of a crank and slider single point coil springs. – Construct locus of ladder movement crank and slides single point links with multiple point and helix and coil springs. iii) The teacher should monitor and facilitate students in performing the tasks given in part (ii). iv) Students to present their work for sharing and discussion. v) With the aid of assessment guideline, the teacher should guide students to assess the activities performed in part (ii). vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iv).	• Posters with picture showing different meshes of locus • Drawing set • Drawing board/ table • ISO drawing paper • Video animation of LOCI • Multimedia project	1. Is the student able to define the term locus of a point? 2. Can the student plot the locus point of a ladder movement of a crank and slider for single point coil springs? 3. Can the student construct locus of ladder movement crank and slides single point links with multiple point and helix and coil springs?	6

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	7.3 Auxiliary Views	The student should be able to: a) Explain the meaning of auxiliary views. b) Explain the importance of auxiliary views in engineering. c) Differentiate types of auxiliary elevation. d) Identify need and use of points, lines, and planes in space.	i) The teacher to use questions to guide students to explain the meaning of auxiliary views. ii) The teacher to guide students in groups to: – Explain the importance of auxiliary views in engineering. – Differentiate types of auxiliary elevation. – Identify need and use of points, lines, and planes in space. iii) Students to present their responses for sharing and discussion. iv) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii). v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iv)	• Scale rule • Drawing board • Drawing paper • Drawing kit	1. Is the student able to explain the meaning of auxiliary views? 2. Is the student able to explain the importance of auxiliary views in engineering? 3. Can the student differentiate types of auxiliary elevation? 4. Can the student identify need and use of points, lines, and planes in space?	3

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	7.4 Developments of Mechanical Components	The student should be able to: a) Explain development of objects in engineering drawing. b) Describe the purpose and use of development drawings. c) Draw development of mechanical components. d) Develop two cylinders that intersect at right angles.	i) The teacher to guide students in groups to: – Explain development of an object in engineering drawing. – Describe the purpose and use of development drawings. ii) The teacher to create activities for students to: – Draw developments of mechanical components. – Develop two cylinders that intersect at right angles. iii) The teacher should monitor and facilitate students in performing the tasks given in part (ii). iv) Students to present their responses for sharing and discussion. v) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii) . vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iv).	• Poster with pictures showing different types of developments of machine components • Drawing set • Model with various intersections of components	1. Is the student able to explain development of objects in engineering drawing? 2. Can the student describe the purpose and use of development fields? 3. Can the student draw development of mechanical components? 4. Can the student develop two cylinders that intersect at right angles?	6

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	7.5 Section	The student should be able to: a) Identify different types of sections. b) Identify applications of sections in mechanical engineering. c) Apply sections in various mechanical engineering drawings. d) Draw section lines. e) Draw hatching lines. f) Apply hatching lines in section drawing.	i) The teacher to use questions to guide students to: – Identify different types of sections. – Identify different application of sections in mechanical engineering. ii) The teacher to create activities for students to: – Draw section lines – Draw hatching lines. – Apply sections in various mechanical engineering drawings. – Apply hatching lines in section drawing. iii) The teacher should monitor and facilitate students in performing the tasks given in part (ii). iv) Students to present their responses for sharing and discussion. v) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii).	• Drawing kit • Drawing template • Drawing sheet • Drawing board	1. Can the student identify different types of sections. 2. Can the student identify applications of sections in mechanical engineering? 3. Can the student apply sections in various mechanical engineering drawings? 4. Can the student draw section lines? 5. Can the student draw hatching lines? 6. Can the student apply hatching lines in section drawing?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
			vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i), (ii) and (iv).			
	7.6 Limits and Fits	The student should be able to a) Define the term limits as applied to engineering process. b) Identify different types of limits and fits and their applications in automotive engineering. c) Identify unilateral and bilateral tolerances as specified in the dimensioning of drawing.	i) The teacher to use questions to guide students to: – Define the term limits and fits as applied to the engineering process. – Identify different types of limits and fits. – Identify unilateral and bilateral tolerances as special in the dimension of drawing. ii) The teacher to organise students in groups and guide them to analyse the term application limits and fits in automotive engineering.	• Posters showing different tolerances and limits • Manila sheet • Marker pen	1. Is the student able to define the term limits as applied to engineering process? 2. Can the student identify different types of fits and their applications in automotive engineering? 3. Can the student identify unilateral and bilateral tolerances as specified in the dimensioning of drawing?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		e) Analyse the application of limits and fits in automotive engineering. f) Solve various problems relating to limits and fits as applied in engineering process. g) Read from table of fits and tolerances in order to determine the required size of the hole and shaft with reference to 1S0 standard.	iii) The teacher to create activities for students to: – Solve various problems relating to limits and fits as applied in engineering process. – Read from table of fits and tolerances in order to determine the required size of the hole and shaft with reference to 1S0 standard. iv) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii). v) Students to present their responses for sharing and discussion, vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iii).		4. Can the student analyse the application of limits and fits in automotive engineering? 5. Can the student solve various problems relating to limits and fits as applied in engineering process? 6. Can the student read from table of fits and tolerances in order to determine the required size of the hole and shaft with reference to 1S0 standard?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
8.0 INTRODUCTION TO CAD I	8.1 Introduction to CAD I	The student should be able to: a) Define the term Computer Aided Drafting (CAD). b) Explain the importance of CAD in automotive engineering. c) Describe the applications of CAD in mechanical engineering. d) Explain the advantages and disadvantages of using CAD in automotive engineering.	i) The teacher to use brainstorming questions to guide students to define the term Computer Aided Drafting (CAD). ii) The teacher to arrange students in groups and guide them to: – Explain the importance of CAD in mechanical engineering. – Describe the applications of CAD in mechanical engineering. – Explain the advantages and disadvantages of using CAD in automotive engineering. iii) Students to present their responses for sharing and discussion. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iii).	• Posters with pictures of objects drawn using CAD • Posters with pictures of computer inputs and output devices • CAD package • CAD software (CorelDraw, Page Maker, Microsoft Office, Auto CAD, Paint, Corel CAD etc) • Computer loaded with CAD software	1. Is the student able to define the term Computer Aided Drafting (CAD)? 2. Is the student able to explain the importance of CAD in automotive engineering? 3. Is the student able to describe the applications of CAD in automotive engineering? 4. Is the student able to explain the advantages and disadvantages of using CAD in automotive engineering?	8

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	8.2 CAD Software and Hardware	The student should be able to: a) List different types of computer hardware. b) Explain the term Auto CAD. c) Identify CAD hardware and software. d) Describe CAD system hardware e) Describe the elements of drawing in CAD. f) Explain the importance of CAD and its applications in engineering.	i) The teacher to use questions to guide students to: – List different types of computer hardware. – Explain the term Auto CAD. ii) The teacher to arrange students in groups and guide them to: – Identify CAD hardware and software. – Describe CAD system hardware (CPU, Secondary Memory, and Workstation). – Describe elements of drawing in CAD. iii) Students to present their responses for sharing and discussion. iv) The teacher to use questioning strategies (what, how, and what questions) to guide students to explain the importance of CAD and its applications in engineering.	• Posters with pictures of objects drawn using CAD • Posters with pictures of computer inputs and output devices • AutoCAD package • CAD software (CorelDraw, Page Maker, Microsoft Office, Auto CAD, Paint, Corel CAD etc) • Computer installed with CAD software	1. Can the student list different types of computer hardware? 2. Can the student explain the term Auto CAD. 3. Can the student Identify CAD hardware and software? 4. Can the student describe CAD system hardware? 5. Can the student describe the elements of drawing in CAD?	6

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
			v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iii).		6. Can the student explain the importance of CAD and its applications in engineering?	
	8.3 CAD Application	The student should be able to: a) Describe elements of CAD used for drawing automobile objects. b) Identify types of projections and geometrical modeling. c) Use elements of CAD drawing to draw automobile objects. d) Make automobile layout and sketch using CAD.	i) The teacher to arrange students in groups and guide them to: – Describe elements of CAD used for drawing automobile objects. – Identify types of projections and geometrical modeling. ii) Students to present their responses for sharing and discussion. iii) The teacher to create activities for students to: – Use elements of CAD drawing to draw automobile objects, – Make automobile layout and sketches using CAD. iv) The teacher should monitor and facilitate students in performing the tasks given in part (iii).	• Posters with pictures of objects drawn using CAD • Posters with pictures of computer inputs and output devices • CAD package • CAD software (CorelDraw, Page Maker, Microsoft Office, Auto CAD, Paint, Corel CAD etc)	1. Can the student describe elements of CAD used for drawing automobile objects? 2. Can the student identify types of projections and geometrical modeling? 3. Can the student use elements of CAD drawing to draw automobile objects?	6

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
			v) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii). vi) The teacher should give feedback and use the students' responses as feedback in supporting students to use the component of CAD in engineering drawing.	• Computer loaded with CAD software	4. Can the student make automobile layout and sketch using CAD?	

FORM IV

COMPETENCIES

By the end of form IV, the student should have ability to:

a) trouble shoots different faults and analyse auto-electric system in a motor vehicle;
b) recognize malfunctions in engine systems;
c) trouble shoots different faults on motor vehicles and assemble automotive system;
d) conduct different maintenance practice and repair of automotive system;
e) applying technical drawing knowledge and skills in drawing automotive layout and sketches; and
f) apply CAD technology to draw machine components.

OBJECTIVES

By the end of form IV, the student should be able to:

a) identify malfunctions in engine systems;
b) describe and assemble automotive system;
c) use the knowledge and skill learnt to conduct different maintenance practice and repair of automotive system;
d) use technical drawing knowledge and skills to draw different machinery components; and
e) use CAD technology to draw machine/automotive components.

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
1.0 ENGINE SYSTEMS	1.1 Lubrication System	The student should be able to: a) Identify types of lubrication systems. b) Identify various types of oil pumps and pressure gauges. c) Explain the purpose of automotove lubrication systems. d) Classify different types of oil and pressure gauges. e) Explain uses of oil pumps and gauges in a vehicle. f) Explain the functions of oil pumps.	i) The teacher to use questions to guide the students to: – Identify types of lubrication systems. – Identify various types of oil pumps and pressure gauges. ii) The teacher to arrange students in groups and guide them to: – Explain the purpose of automotive lubrication systems. – Classify different types of oil and pressure gauges. – Explain uses of oil pumps and gauges in a vehicle. – Explain the functions of oil pumps. – Explain the operations principle of oil pumps and gauges in a vehicle. – Explain the use of oil filter in the engine. iii) The teacher to use questioning strategies (what, how, and what questions) to guide students to explain the operations principle of oil pumps and gauges in a vehicle.	• Various oil pumps. • Different types of oil e.g. SAE 40, etc • Pictures and Drawings of different types of oil Pumps • Multimedia Projector • Video (CD/ DVD) showing lubrication system animation (simulation) • Lubrication System model • Real vehicles with working engine • Different types of oil filters	1. Is the student able to identify types of lubrication systems? 2. Is the student able to identify various types of oil pumps and pressure gauges? 3. Is the student able to explain the purpose of automotive lubrication systems? 4. Is the student able to classify different types of oil and pressure gauges? 5. Is the student able to explain uses of oil pumps and gauges in a vehicle?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		g) Explain the operations principle of oil pumps and gauges in a vehicle. h) Explain the use of oil filter in the engine.	iii) Students to present their responses and sharing. iv) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-vi).		6. Is the student able to explain the functions of oil pumps? 7. Is the student able to explain the operations principle of oil pumps and gauges in a vehicle? 8. Is the student able to explain the use of oil filter in the engine?	
	1.2 Fuel Air and Exhaust System for Compression Ignition Engines (CI) and Spark Ignition Engines (SI)	The student should be able to: a) Explain the fuel systems and their components. b) Identify types of fuel metering system for S1 and CI.	i) The teacher to use questions to guide students to: – Explain the fuel systems and their components. – Identify types of fuel metering system for S1 and CI.. – Describe the emission control system. – Describe the exhaust system and noise silencing. ii) The teacher to arrange students in groups and guide them to: – Explain the main purpose of fuel system.	• Multimedia Projector • Video (CD/ DVD) showing fuel system animation (simulation) • Fuel System layout model • Real vehicles • Heater plugs • Injectors • Electronic fuel injector (EFI) system model/ animation (simulation)	1. Is the student able to explain the fuel systems and their components? 2. Is the student able to Identify types of fuel metering system for S1 and CI? 3. Is the student able to describe the emission control system?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		c) Describe the emission control system. d) Describe the exhaust system and noise silencing. e) Explain the main purpose of fuel system. f) Describe the functions of the exhaust system and noise silencing. g) Control A/F ratio in S1 engines.	– Describe the functions of the exhaust system and noise silencing. iii) The teacher to create activities for students to control of A/F ratio in S1 engines. iv) The teacher should monitor and facilitate students in performing the tasks given in part (iii). v) Students to present their responses and sharing. iv) With the aid of prepared assessment guideline, the teacher should guide the students to assess the activities performed in part (iii). v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-v).		4. Is the student able to describe the exhaust system and noise silencing? 5. Is the student able to explain the main purpose of fuel system? 6. Is the student able to describe the functions of the exhaust system and noise silencing? 7. Can the student control A/F ratio in S1 engines? 8. Can the student control A/F ratio in S1 engines?	
		1.3 Fuel System (Feed Pumps)	i) The teacher to use questions to guide students to identify types of lift pumps. ii) The teacher to arrange students in groups and use questions to guide them to:	• Multimedia Projector • Video (CD/ DVD) showing fuel system Animation (simulation)	1. Is the student able to identify types of lift pumps?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		The student should be able to: a) Identify types of lift pumps. b) Explain the purpose of feed pump in an engine. c) Explain the functions of the feed pump in CI engines and its operation. d) Sketch feed pumps. e) Assemble feed pumps. f) Disassemble feed pumps.	– Explain the purpose of feed pump in an engine. – Explain the functions of the feed pump in CI engines and its operation. iii) The teacher to create activities for students to: – Sketch feed pumps, – Assemble feed pumps. – Disassemble feed pumps. iv) Students to present their responses and sharing. v) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii). vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-v).	• Fuel System layout model • Real vehicles • Heater plugs • Injectors • Tools	2. Is the student able to explain the purpose of feed pump in an engine? 3. Is the student able to explain the functions of the feed pump in CI engines and its operation? 4. Can the student sketch feed pumps? 5. Can the student assemble feed pumps? 6. Can the student disassemble feed pumps?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	1.4 Fuel System (Injectors)	The student should be able to: a) Explain the concept of injectors. b) Identify types of injectors. c) Explain the concept of heater plugs in CI engines d) Identify the purpose of mixing air and fuel by fine spray of fuel into air. e) Describe electronic Fuel Injection (EFI) system. f) Explain the functions of the fuel injection pump in CI engines and its operation.	i) The teacher to use questions to guide students to: – Explain the concept of injectors. – Identify types of injectors. – Explain the concept of heater plugs in CI engine. ii) The teacher to arrange students in groups and guide them to: – Identify the purpose of mixing air and fuel by fine spray of fuel into air. – Describe electronic Fuel Injector (EFI) system. – Explain the functions of the fuel injection pump in CI engines and its operation. iii) The teacher to create activities for students to: – Sketch fuel injector pump. – Conduct sectional views of different types of injectors. iv) Students to present their responses and sharing.	• Electronic Fuel Injection (EFI) system model/ Animation (simulation) • Common rail Injection System model	1. Is the student able to explain the concept of injectors. 2. Is the student able to Identify types of injectors? 3. Is the student able to explain the concept of heater plugs in CI engines? 4. Is the student able to identify the purpose of mixing air and fuel by fine spray of fuel into air? 5. Is the student able to describe electronic Fuel Injector (EFI) system?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		g) Sketch fuel injector pump. h) Conduct sectional views of different types of injectors i) Differentiate between Electronic Fuel Injection and Conventional/ Mechanical Fuel Injection j) Describe common rail fuel injection system	v) With the aid of prepared assessment guideline, the teacher should guide the students to assess the activities performed in part (iii). vi) The teacher to give feedback and use the students' responses as feedback to support students to perform the tasks mentioned in part (i-v).		6. Is the student able to explain the functions of the fuel injection pump in CI engines and its operation.? 7. Is the student able to sketch fuel injector pump? 8. Is the student able to conduct sectional views of different types of injectors? 9. Is the student able to differentiate EFI from Conventional fuel Injection system 10. Is the student able to describe common rail injection system?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	1.5 Ignition system for SI engines	The student should be able to: a) Describe a simple ignition system. b) Identify a simple coil ignition system and other types of ignition system. c) Describe a simple coil ignition system, magneto, electronic (transistor/ capacitor) and computerized ignition systems and other various ignition systems components. d) Sketch simple ignition circuit diagrams.	i) The teacher to arrange students in groups and guide them to: – Describe ignition system and system functions. – Identify principle operation, trouble shooting and services. – Describe a simple coil ignition system, magneto, electronic (transistor/ capacitor) and computerized ignition systems and other various ignition systems components. ii) The teacher to create activities for students to sketch simple ignition circuit diagrams. – With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). iii) Students to present their responses and sharing. iv) The teacher to give feedback and use the students' responses as feedback to support students to perform the tasks mentioned in part (i-iii).	• Various types of engine ignition systems layout model • Pictures/ Drawings of different types of ignition systems • Pictures/ Drawings of different types of ignition systems • Multimedia Projector • Video (CD/ DVD) showing ignition system Animation (simulation). • Real vehicles. • Various parts of ignition systems.	1. Is the student able to describe a simple ignition system? 2. Can the student identify a simple coil ignition system and other types of ignition system? 3. Can the student describe a simple coil ignition system, magneto, electronic (transistor/ capacitor) and computerized ignition systems and other various ignition systems components? 4. Is the student able to sketch simple ignition circuit diagrams?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	1.6 Charging System	The student should be able to: a) Identify charging system components. b) Describe charging system components. c) Use charging system components.	i) The teacher to use questions to guide students to: – Identify charging system components. – Describe charging system components. ii) The teacher to create activities for students to demonstrate the use of charging system components. iii) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iii).	• Pictures/ Drawings of different types charging system • Video (CD/ DVD) showing charging system animation (simulation). • Real vehicles. • Various parts of charging system	1. Is the student able to identify charging system components? 2. Is the student able to describe charging system components? 3. Is the student able to use charging system components?	2
	1.7 Engine Cooling System	The student should be able to: a) Explain the concepts of heat transfer.	i) The teacher to use questions to guide students to: – Explain the concept of heat transfer. – Identify types of cooling system (i.e., air cooling and water cooling).	• Various types of cooling systems • Pictures/ Drawings of different types of engine cooling systems	1. Is the student able to explain the concepts of heat transfer. 2. Is the student able to identify types of cooling system?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		b) Identify types of cooling system c) Explain different components of engine cooling systems. d) Identify different methods of engine cooling system. e) Explain the functions of engine cooling system. f) Explain the importance of engine cooling system. g) Explain advantages and disadvantages of each engine cooling system. h) Describe trouble shooting and service i) Describe the engine-cooling system with well- labeled diagrams.	– Explain different components of engine cooling systems. º Radiators º Water pump º Fans º Thermostat º Coolant additives. ii) The teacher to use questioning strategies (what, why and how questions) to guide students to: – Explain different methods of cooling engine system? – Explain functions of engine cooling system. – Explain the importance of engine cooling system. iii) The teacher to arrange students in groups and guide them to: – Explain advantages and disadvantages of each engine cooling system – Describe concept of trouble shooting and service. iv) The teacher to create activities for students to describe the engine-cooling system with well- labeled diagrams.	• Multimedia Projector • Video (CD/ DVD) showing engine cooling system Animation (simulation) • Real vehicles • Various parts of engine cooling systems e.g. hose pipes, pumps etc	3. Is the student able to explain different components of engine cooling systems? 4. Is the student able to explain different methods of engine cooling system? 5. Is the student able to explain the functions of engine cooling system? 6. Is the student able to explain the importance of engine cooling system? 7. Is the student able to explain advantages and disadvantages of each engine cooling system? 8. Is the students able to describe trouble shooting and service?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
			v) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iv). vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iv).		9. Is the students able to describe the engine-cooling system with well-labeled diagrams?	
	1.8 Engine Sensors and Computer Control Modules	The student should be able to: a) Identify types of engine sensors. b) Explain the link between sensors and computers. c) Explain the functions of engine sensors and computer control modules.	i) The teacher to use questions to guide students to identify types of engine sensors ii) Students in groups to explain the: – Link between sensors and computers. – Functions of engine sensors and computer control modules. iii) Students to present their responses for sharing and discussion. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iii).	• Various types of engine sensors and computer control modules • Pictures/ Drawings of different types of engine sensors and computer control modules • Multimedia Projector • Video (CD/ DVD) showing engine sensors and computer control modules animation (simulation).	1. Is the student able to identify types of engine sensors? 2. Is the student able to explain the link between sensors and computer? 3. Is the student able to explain functions of engine sensors and computer control modules?	2

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
				• Real vehicles • Various parts of engine sensors and computer control modules		
	1.9 Alternative Fuels	The student should be able to: a) Identify the alternative fuels for S1(CNG ethanol, LPG) b) Identify the alternative fuels for C1(Biodisel).	i) The teacher to use questions to guide students to: – Explain alternative fuels for S1(CNG ethanol, LPG). – Identify alternative fuels for C1(Biodisel). ii) The teacher to give feedback and use students' responses as feedback to support students to perform the tasks given in part (i).	• Various types of fuels • Multimedia Projector • Video (CD/ DVD) showing various types of fuels • Real vehicles	1. Is the student able to explain alternative fuels for S1(CNG ethanol, LPG)? 2. Is the student able to identify alternative fuels for C1(Biodisel)?	1
2.0 AUTOMOTIVE SYSTEMS II	2.1 Suspension Systems	The student should be able to: a) List different types of suspension system. b) Describe different types of suspension system.	i) The teacher to use questions to guide students to: – List different types of suspension system. – Identify different suspension material properties. ii) The teacher to guide students in groups to: – Describe different types of suspension system – Describe suspension system trouble shooting.	• Various types of suspension systems layout model • Pictures/ Drawings of different types of suspension systems • Multimedia Projector	1. Is the student able to list different types of suspension system? 2. Is the student able to describe different types of suspension system?	8

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		c) Describe suspension system trouble shooting. d) Identify the components of suspension system. e) Identify different suspension material properties. f) Explain the purpose of suspension system. g) Identify different types of steel suspension system. h) Assemble and disassemble suspension system.	– Identify the components of suspension system. – Describe different types of suspension system e.g. steel, hydro-elastic, rubber, pneumatic and dumpers suspension system. – Explain the purpose of suspension system. – Identify different types of steel suspension system (laminated leaf spring, coil (helical) spring, torsion bar, wishbones and stabilizers). iii) The teacher to create activities for students to assemble and disassemble suspension system. iv) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii). v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iv).	• Video (CD/ DVD) showing suspension system animation • Real vehicles • Various parts of suspension systems. • Coil springs, leaf spring, shock absorber etc.	3. Is the student able to describe suspension system trouble shooting? 4. Is the student able to identify the components of suspension system? 5. Is the student able to identify different suspension material properties? 6. Is the student able to explain the purpose of suspension system? 7. Is the student able to identify different types of steel suspension system? 8. Is the student able to assemble and disassemble suspension system?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	2.2 Braking Systems	The student should be able to: a) Explain the types and purpose of brakes. b) Identify air and hydraulic brakes. c) Identify the layout and operation of a hand brake mechanism together with its means of compensation. d) Explain the reasons for the use of hydraulically operated brakes on vehicles e) List the safety precautions related to a hydraulic brake system.	i) The teacher to use questions to guide students to: – Explain the types and purpose of brakes. – Identify air and hydraulic brakes. ii) The teacher to arrange students in groups to: – Identify the layout and operation of a hand brake mechanism together with its means of compensation – Explain the reasons for the use of hydraulically operated brakes on vehicles. – List the safety precautions related to a hydraulic brake system. – Identify vehicles (2-wheel / 4-wheel drive) brake system features. – Describe ABS system. – Identify air and hydraulic brake. iii) The teacher to use questioning strategies (what, why and how questions) to guide students to explain the reasons for the use of hydraulically operated brakes on vehicles.	• Various types of brake systems layout model • Pictures/ Drawings of different types of brake systems • Multimedia Projector • Video (CD/ DVD) showing brake system animation • Real vehicles. • Various parts of brake systems parts including master cylinder, slave cylinder, wheel cylinder, brake drum and shoe, etc. • Tools	1. Is the student able to describe the types and purpose of brakes? 2. Can the student identify air and hydraulic brakes? 3. Can the student identify the layout and operation of a hand brake mechanism together with its means of compensation? 4. Can the student explain the reasons for the use of hydraulically operated brakes on vehicles? 5. Is the student able to list safety precautions related to a hydraulic brake system?	6

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		f) Identify vehicles (2-wheel / 4-wheel drive) brake system features. g) Describe ABS system. h) Carry out maintenance on brake system. i) Prepare sketches showing the layout of a single line hydraulic braking system. j) Dismantle components of the brake system and assemble them.	iv) The teacher to create activities for students to: – Prepare sketches showing the layout of a single line hydraulic braking system. – Carry out maintenance on brake system. – Dismantle components of the brake system and assemble them. v) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iv). vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-v).		6. Can the student identify 2 wheel drive and 4 wheel drive brake systems features? 7. Can the student describe ABS system? 8. Can the student carry out maintenance on brake system? 9. Can the student prepare sketches showing the layout of a single line hydraulic braking system? 10. Can the student dismantle components of the brake system and assemble them?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
					11. Can the student dismantle components of brake system and assemble them?	
	2.3 Steering System	The student should be able to: a) Define Ackerman principles as applied to steering linkage. b) Explain the purpose of steering system. c) Describe steering geometries. d) Describe the purpose of power assisted steering. e) Explain the principles underlying caster and camber angles and kingpin inclination.	i) The teacher to use questions to guide students to: – Define Ackerman principles as applied to steering linkage. – Explain the purpose of steering system. – Describe the purpose of power assisted steering. ii) The teacher to guide students in groups to: – Describe steering geometry including and not limited to toe in, toe out. – Explain the principles underlying caster and camber angles and kingpin inclination. – Explain the principle of operating different power assisted steering.	• Different types of steering geometry sketches • Various types of steering systems layout teaching model • Pictures/ Drawings of different types of steering systems • Multimedia Projector • Video (CD/ DVD) showing steering system Animation. • Real vehicles. • Various parts of steering systems parts including steering boxes, steering joints etc. • Tool box	1. Can the student define Ackerman principles as applied to steering linkage. 2. Is the student able to explain the purpose of steering system? 3. Is the student able to describe steering geometries? 4. Is the student able to describe the purpose of power assisted steering? 5. Is the student able to explain the principles underlying caster and camber angles and kingpin inclination?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		g) Explain principles of operating different power assisted steering. h) Draw steering geometry. i) Carry out fault checking and maintenance.	iii) The teacher to create activities for students to: – Draw steering geometry. – Carry out fault checking and maintenance in power assisted steering; iv) Students to present their responses for sharing and discussion. v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iv).		6. Is a student able to explain principles of operating different power assisted steering? 7. Is a student able to draw steering geometry? 8. Can the student carry out fault checking and maintenance?	
	2.4 Steering Joints	The student should be able to: a) Identify types of steering joints; b) Distinguish fault finding and rectification of steering joints. c) Explain the purpose of steering joints.	i) The teacher to use questions to guide students to: – Identify types of steering joints; – Distinguish fault finding and rectification of steering joints ii) The teacher to arrange students in groups and guide them to: – Distinguish fault finding and rectification of steering joints.	• Different types of steering geometry sketches • Various types of steering systems layout teaching model • Pictures/ Drawings of different types of steering systems	1. Is the student able to identify types of steering joints? 2. Is the student able to distinguish fault finding and rectification of steering joints? 3. Is the student able to distinguish fault finding and rectification of steering joints?	2

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		c) Dismantle and assemble steering system	– Explain the purpose of steering joints; – The teacher to create activities and guide students to dismantle and assemble steering system iv) Students to present their responses/work for sharing and discussion v) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii). vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iv).	• Multimedia Projector • Video (CD/ DVD) showing steering system Animation • Real vehicles. • Tool box • Steering joints • Various parts of steering systems parts including steering boxes, steering joints etc.	4. Is the student able to dismantle and assemble steering system? 5. Is the student able to explain the purpose of steering joints? 6. Can the student dismantle and assemble steering system?	
	2.5 Steering box	The student should be able to: a) Identify types of steering boxes. b) Describe construction of steering boxes.	The teacher to guide students through group discussions to: – Identify types of steering boxes – Describe construction of steering boxes	• Different types of steering boxes • Picture/drawings of steering boxes	1. Is the student able to identify types of steering boxes? 2. Is the student able to describe construction of steering boxes?	2

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	2.6 Tyres	The student should be able to: a) Identify types of tyres. b) Describe tyre information. c) Identify different parts of tyres. d) Explain the purpose of tyres. e) Describe tyre air pressures. f) Distinguish different types of tyres, whether cross-ply or radial ply.	i) The teacher to use questions to guide students to: – Identify types of tyres. – Describe tyre information. – Identify different parts of tyres. ii) The teacher to arrange students in groups and use questions to guide them to: – Explain the purpose of tyres. – Describe tyre air pressures. iii) The teacher to use questioning strategies (why and how questions) to guide students to distinguish different types of tyres, whether cross-ply or radial ply. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i) and (ii).	• Different types of wheel and tyres • Various types of wheel and tyres layout teaching model • Pictures/ Drawings of different types of wheel and tyres • Multimedia Projector • Video (CD/ DVD) showing wheel and tyres animation (simulation) • Real vehicles	1. Is the student able to identify types of tyres? 2. Is the student able to describe tyre information? 3. Is the student able to identify different parts of tyres? 4. Is the student able to explain the purpose of tyres? 5. Is the student able to describe tyre air pressures? 6. Is the student able to distinguish different types of tyres, whether cross-ply or radial ply?	6

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	2.7 Wheel	The student should be able to: a) Identify types of wheel balancing. b) Explain wheel offsets and geometry. c) Explain the purposes of wheel alignment. d) Explain the importance of wheel balancing. e) Explain the effect of unbalanced wheel to steering and braking systems. f) Describe effect of front wheel on tyre wear, toe in or toe out. g) Carry out wheel alignment and balancing.	i) The teacher to use questions to guide students to: – Identify types of wheel balancing. – Explain wheel offsets and geometry. ii) The teacher to arrange students in groups and use questions to guide them to: – Explain the purposes of wheel alignment. – Explain the importance of wheel balancing. – Explain the effect of unbalanced wheel to steering and braking systems. – Describe effect of front wheel on tyre wear, toe in or toe out. iii) The teacher to create activities and guide students to carry out wheel alignment and balancing. iv) The teacher should monitor and facilitate students to perform the task given in part (iii).	• Different types of wheel and tyres • Various types of wheel and tyres layout teaching model • Pictures/ Drawings of different types of wheel and tyres • Multimedia Projector • Video (CD/ DVD) showing wheel and tyres animation (simulation) • Real vehicles • Various parts of wheel and tyres including rims, tyre, wheel • Cap, balancing weights, etc • Wheel balancing machine • Wheel alignment machine • Tools	1. Is the student able to identify types of wheel balancing? 2. Is the student able to explain wheel offsets and geometry? 3. Is the student able to explain the purposes of wheel alignment? 4. Is the student able to explain the importance of wheel balancing? 5. Is the student able to explain the effect of unbalanced wheel to steering and braking systems? 6. Is the student able to describe effect of front wheel on tyre wear, toe in or toe out.	6

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
			v) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii). vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iv).		7. Can the student carry out wheel alignment and balancing?	
	2.8 Vehicle Safety System and Accidents	The student should be able to: a) Identify Vehicle Safety System. a) Explain the importance of seat belts, air bags, ABS and laminated wind screen. b) Explain road sign and their interpretation. c) State advantages of vehicle safety systems.	i) The teacher to use questioning strategies (what, how and why questions) to guide students to: – Identify vehicle safety system. – Explain the importance of seat belts, air bags, ABS and laminated wind screen in preventing vehicle accidents. ii) The teacher to arrange students in groups and use questions to guide them to: – Explain road sign and their interpretation. – State advantages of vehicle safety systems. iii) The teacher should give feedback and use students' responses as feedback to support students to state importance and advantages of vehicle safety:	• Pictures/ Drawings of different types of vehicle safety system • Multimedia Projector • Video (CD/ DVD) showing vehicle safety system • Real vehicles • Posters with road signs	1. Is the student able to identify vehicle safety system. 2. Is the student able to explain the importance of seat belts, air bags, ABS and laminated wind screen? 3. Is the student able to explain road sign and their interpretation? 4. Is the student able to state advantages of vehicle safety systems?	2

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
3.0 POWER AND ENERGY	3.1 Sources of Energy	The student should be able to: a) Explain the term energy system. b) Identify different types of energy. c) Identify different types of energy sources. d) Differentiate different types of energy.	i) The teacher to use question to guide students to: – Explain the term energy system – Identify different types of energy. – Identify different types of energy sources. ii) The teacher to use questioning strategies (what, how and why questions) to guide students to differentiate different types of energy. iii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i) and (ii).	• Posters • Solar panel • Wind turbine • CD/DVD • Small hydro-power plant model • Biomass plant model • Geothermal plant/ poster • Nuclear power plant/poster • Kinetic energy (Tidal) plan model	1. Is the student able to explain the term energy system? 2. Is the student able to identify different types of energy? 3. Is the student able to identify different types of energy sources? 4. Is the student able to differentiate different types of energy?	8
	3.2 Energy Harnessing Technology	The student should be able to : a) Identify types of harnessing technologies. b) Distinguish different types of harnessing technologies.	i) The teacher to use questions to guide students to identify different harnessing technology such as for hydro-power, thermal engine (internal and external combustion), wave, tidal, nuclear and geothermal.	• Posters • CD/DVD • Power plant model/poster • Solar power plant	1. Is the student able to identify types of harnessing technologies? 2. Is the student able to distinguish different types of harnessing technologies?	8

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		c) Explain the advantages and disadvantages of different types of harnessing technologies	ii) The teacher to arrange students in groups and use questions to guide them to: – Distinguish different types of harnessing technologies. – Explain the advantages and disadvantages of different types of harnessing technologies. iii) Students to present their responses for sharing and discussion. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i) and (ii).		3. Is the student able to explain the advantages and disadvantages of different types of harnessing technologies?	
4.0 AUTOMOTIVE ELECTRIC SYSTEM	4.1 Auto electric system	The student should be able to: a) Describe the electrical system in a vehicle b) Explain the core function of electricity in vehicles.	i) The teacher to arrange students in groups and use questions to guide them to: – Describe the electrical system in a vehicle – Explain the core function of electricity in vehicles. – Explain the purpose of electrical system in a vehicle.	• Pictures/ Drawings / sketches of vehicle electrical system. • Auto-electrical textbooks. • Posters • Board • Marker pens	1. Is the student able to describe the electrical system in a vehicle? 2. Is the student able to explain the core function of electricity in vehicles?	6

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		c) Explain the purpose of electrical system in a vehicle.	ii) Students to present their responses for sharing and discussion. iii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i).		3. Is the student able to explain the purpose of electrical system in a vehicle?	
	4.2 Auto-electric Symbols	The student should be able to: a) Identify different types of auto-electric symbols. b) Draw auto-electric symbols.	i) The teacher to guide students in groups to identify the various types of auto-electric symbols. ii) The teacher to create activities for students to draw auto-electric symbols. iii) Students to present their responses for sharing and discussion. iv) With the aid of assessment guideline, the teacher should guide students to assess the activities performed in part (ii). v) The teacher should give feedback and use students' responses as feedback to support students to identify different types of auto-electric symbols.	• Marker pen • Computer • Auto-electric text book • Charts • Electrical symbols • DVD/VCD/VHS	1. Is the student able to identify different types of auto-electric symbols? 2. Can the student draw auto-electric symbols?	4

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	4.3 Fundamentals of electronics	The student should be able to: a) Identify electronic components (e.g. diodes, transistors, capacitors, transduces, LED etc) b) Explain the principles of operation of electronic components. c) Draw electronic and electric components.	i) The teacher to use questions to guide students to: – Identify electronic components. – Explain principles of operation of electronic components. ii) The teacher to create activities for students to: – Draw electronic components. – Draw electric components. iii) With the aid of assessment guideline, the teacher should guide students to assess the activities performed in part (ii). iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).	• Marker pen • Computer • Auto-electric text book • Charts • Electrical symbols • DVD/VCD/VHS • Electronics symbols • Board with electrical and electronic circuits	1. Is the student able to identify electronic components? 2. Is the student able to explain principles of operation of electronic components? 3. Can the student draw electronic and electric components?	4
	4.4 Auto-Electric Circuits	The student should be able to : a) Identify different types of auto-electric circuits in a motor-vehicle system.	i) The teacher to arrange students in groups and use questions to guide them: – Identify different types of auto- electric circuits in a motor-vehicle system.	• Various types of Auto- Electric circuits layout teaching model. • Pictures/ Drawings of different types of Auto-Electric circuits. • Multimedia Projector	1. Is the student able to identify different types of auto-electric circuits in a motor-vehicle system? 2. Is the student able to explain the purpose of different types of Auto-Electric circuits in a motor-vehicle system?	3

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		b) Explain the purpose of different types of Auto-Electric circuits in a motor-vehicle system c) Identify components/ parts of Auto-Electric circuits. d) Tracing faults in the lighting, starting, ignition and braking systems. e) Sketch different types of auto-electric circuits in a motor-vehicle system.	– Explain the purpose of different types of Auto-Electric circuits in a motor-vehicle system (i.e., Starting system, Ignition system, lighting system, braking system etc.) – Identify components/parts of Auto-Electric circuits. ii) Students to share their responses for sharing and discussion. iii) The teacher to create activities for students to: – Sketch different types of Auto- Electric circuits. – Trace faults in the lighting, starting, ignition and braking systems. iv) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii). v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iv).	• Video (CD/ DVD) showing Auto-Electric circuits animation (simulation) • Real vehicles • Various components of Auto- Electric circuits including fuses, switches, fuse box, lights, etc • Testing kit • Related tools	3. Is the student able to identify components/parts of Auto-Electric circuits? 4. Is the student able to trace faults in the lighting, starting, ignition and braking systems.? 5. Can the student sketch different types of Auto-Electric circuits in a motor-vehicle system.?	

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	4.5 Printed Circuits Board PCB	The student should be able to: a) Identify parts of printed circuits board. b) Identify the purposes of printed circuits board. c) Explain the main functions of printed circuits board.	i) The teacher to arrange students in groups and use questions to guide them: – Identify parts of printed circuits board. – Identify the purposes of printed circuits board, – Explain the main functions of printed circuits board. ii) Students to share their responses for sharing and discussion. iii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i).	• Printed circuits board • Pictures/ drawings of sample PCB • Video (CD/ DVD showing PCB • Components of PCB	1. Is the student able to identify parts of printed circuits board? 2. Is the student able to identify the purposes of printed circuits board? 3. Is the student able to explain the main functions of printed circuits board.?	2
	4.6 Faults in Auto-Electrics System	The student should be able to: a) Detect open circuit problems. b) Investigate relay and overload problems. c) Use fault finding techniques in auto system d) Rectify open circuit problems.	i) The teacher to create activities for students to: – Trace open circuit problems. – Check for relays and overload problems. – Practice fault diagnosis. – Use fault finding techniques on auto- electric system. – Carry out simple rectification of auto-electric system.	• Testing kits • Measurement kits • Diagnostic kits • Motor vehicle	1. Can the student trace open circuit problems? 2. Can the student check relays and overload problems? 3. Can the student use fault finding techniques in auto system?	6

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		e) Rectify overloading problems by adjustment and replacements. f) Perform adjustments and replacements g) Carry out simple rectification of auto-electric system.	– Demonstrate how to perform adjustments and replacements. – Rectify overloading problems by adjustment and replacements. – Identify remedy auto-electric problems. ii) Students to present their work for sharing and discussion. iii) With the aid of assessment guideline, the teacher should guide students to assess the activities performed in part (i). v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).		4. Can the student rectify open circuit problems? 5. Can the student rectify overloading problems by adjustment and replacements? 6. Can the student perform adjustments and replacements? 7. Can the student carry out simple rectification of auto-electric system?	
	4.7 Repair and Maintenance of Auto-Electric System	The student should be able to: a) Check the battery state of charge using hydrometer.	i) The teacher to create activities for students to: – Check battery state of charge using hydrometer. – Clean and replace battery terminals.	• Test kits for electrical components • Related tools • Carbon/bronze brushes	1. Can the student check battery state of charge using hydrometer? 2. Can the student clean and replace battery terminal?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		b) Clean and replace battery terminal. c) Charge battery. d) Remove and replace alternator assembly. e) Clean and set contact breaker point. f) Remove wiper motor, starter motor and replace brushes. g) Replace fuses in electrical system. h) Set spark plug with feeler gauge. i) Set and adjust ignition timing.	– Charge battery. – Remove and replace alternator assembly. – Clean and set contact breaker point – Set and adjust ignition timing. – Remove wiper and stater motor and replace brushes. – Replace fuses in electrical system. – Set spark plug with feeler gauge. – Set and adjust ignition timing. ii) Students to present their work for sharing and discussion. iii) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (i). iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i).	• Park plug • Feeler gauge • Starter motor • Alternator • Battery • Fuses	3. Can the student charge battery? 4. Can the student remove and replace alternator assembly? 5. Can the student clean and set contact breaker point? 6. Can the student remove wiper and starter motor and replace brushes? 7. Is the student able to replace fuses in electrical system? 8. Can the student set spark plug with feeler gauge? 9. Can the student able to set and adjust ignition timing?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
5.0 AUTOMOTIVE AUXILIARY SYSTEM	5.1 Overview of Auto-electric Auxiliary parts	The student should be able to: a) Identify automotive auxiliary system parts. b) Explain the purposes of auxiliary systems. c) Describe the importance of auxiliary systems.	i) The teacher to use questions to guide students to identify automotive auxiliary system parts. ii) The teacher to use questioning strategies to guide students to: – Explain the purposes of auxiliary systems. – Describe the importance of auxiliary systems. iii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i) and (ii).	• Various types of Auxiliary systems layout teaching model • Pictures/ Drawings of different types of Auxiliary systems • Multimedia Projector • Video (CD/ DVD) showing Auxiliary systems animation (simulation) • Real vehicles • Various components of Auxiliary systems including fuses, switches, fuse box, lights, etc	1. Is the student able to identify automotive auxiliary system parts? 2. Is the student able to explain the purposes of auxiliary systems? 3. Is the student able to describe the importance of auxiliary systems?	2
	5.2 Auxiliary Systems (Gauges and Meters)	The student should be able to: a) Identify different types of gauges in a motor vehicle.	i) The teacher to use questions to guide students to: – Identifies different types of gauges and meters in a motor vehicle. – Explain uses of gauge and meter in a motor vehicles.	• Various types of Auxiliary systems layout teaching model	1. Is the student able to identify different types of gauges in a motor vehicle?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		b) Explain the purpose of gauges and meters in a vehicle. c) Explain the importance of gauges and meters in motor vehicle. d) Identify faults in meters. e) Locate and read different gauges. f) Read different motor vehicles meters e.g. speedometer, etc. g) Dismantle and check faulty in meters. h) Replace and repair faulty in meters.	ii) The teacher to arrange students in groups and use questions to guide them: – Explain the importance of gauges and meters in motor vehicle. – Identify faults in meters. iii) Students to share their responses for sharing and discussion. iv) The teacher to create activities for students to: – Locate and read different gauges. – Read different motor vehicles meters e.g. speedometer, etc – Dismantle and check, faulty in meters. – Replace and repair and check faulty in meters. v) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iv). vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-v).	• Pictures/ Drawings of different types of Auxiliary systems • Multimedia Projector • Video (CD/ DVD) showing Auxiliary systems animation (simulation) • Real vehicles • Various components of Auxiliary systems including fuses, switches, fuse box, lights, etc • Related tools • Various vehicle meters	2. Is the student able to explain uses of gauge and meters in a motor vehicles? 3. Is the student able to explain the importance of gauges and meters in motor vehicle? 4. Is the student able to identify faults in meters? 5. Is the student able to locate and read different gauges? 6. Is the student able to read different motor vehicles meters? Speedometer, etc. 7. Can the student dismantle and check faulty in meters? 8. Can the student replace and repair faulty in meters?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	5.3 Alarms and Horns	The student should be able to: a) Explain the purpose of alarms and horns in a vehicle. b) Explain the importance and operating principle of horns used in motor vehicles system. c) Dismantle and check faulty in horn and alarms. d) Replace and repair faulty in alarms and horns in a vehicle. e) Trace various wiring systems connect alarm and horns.	i) The teacher to arrange students in groups and guide them to explain the purpose of alarms and horns in a vehicle. ii) Students to share their responses for sharing and discussion. iii) The teacher to use questioning strategies to guide students to explain the importance and operating principle of horns used in motor vehicles system. iv) The teacher to create activities for students to: – Dismantle and check faulty in horn and alarms. – Replace and repair faulty in alarms and horns in a vehicle. – Trace various wiring systems connect alarm and horns. v) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iv). vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-v).	• Various types of Auxiliary systems layout teaching model • Pictures/ Drawings of different types of Auxiliary systems • Multimedia Projector • Video (CD/ DVD) showing Auxiliary systems animation (simulation) • Real vehicles • Various components of Auxiliary systems including fuses, switches, fuse box, lights, etc • Related tools	1. Is the student able to explain the purpose of alarms and horns in a vehicle? 2. Can the student explain the importance and operating principle of horns used in motor vehicles system.? 3. Is the student able to dismantle and check faulty in horn and alarms? 4. Is the student able to replace and repair faulty in alarms and horns in a vehicle? 5. Can the student trace various wiring systems connect alarm and horns?	2

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	5.4 Wind Screen Wipers	The student should be able to: a) Explain the purpose of wind screen wipers in a vehicle. b) Explain the importance and operating principle of wind screen wipers. c) Dismantle and check, faulty in wind screen wipers. d) Replace and repair wind screen wipers e) Trace various wiring systems f) Connect wind screen wipers.	i) The teacher to arrange students in groups and use questions to guide them to: – Explain the purpose of wind screen wipers in a vehicle. – Explain the importance and operating principle of wind screen wipers. ii) The teacher to create activities for students to: – Dismantle and check, faulty in wind screen wipers. – Replace and repair wind screen wipers. – Trace various wiring systems. – Connect wind screen wipers. iii) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iii).	• Various types of Auxiliary systems layout teaching model • Pictures/ Drawings of different types of Auxiliary systems • Multimedia Projector • Video (CD/ DVD) showing Auxiliary systems animation (simulation) • Real vehicles • Various components of Auxiliary systems including fuses, switches, fuse box, lights, etc • Related tools	1. Is the student able to explain the purpose of wind screen wipers in a vehicle? 2. Is the student able to explain the importance and operating principle of wind screen wipers? 3. Is the student able to dismantle and check, faulty in wind screen wipers? 4. Is the student able to replace and repair wind screen wipers? 5. Is the student able to trace various wiring systems? 6. Is the student able to connect wind screen wipers?	2

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
6.0 MAINTENANCE PRACTICE	6.1 Introduction to Maintenance Practice	The student should be able to: a) Explain the importance of motor-vehicle maintenance practice. b) Identify people involved in planned maintenance practice.	i) The teacher to use questions to guide students to: – Explain the importance of motor-vehicle maintenance practice. – Identify people involved in planned maintenance practice. ii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i).	• Multimedia • Board • Industrial visit • Tools • PPE • Real vehicle	1. Can the student explain the importance of motor-vehicle maintenance practice? 2. Can the student identify people involved in planned maintenance practice?	2
	6.2 Introduction to Preventive Maintenance (PM)	The student should be able to: a) Define th term Preventive Maintenance PM. b) Differentiate PM from other Maintenance strategies. c) Identify area where PM is applicable.	i) The teacher to use brainstorming questions to guide students to define the term Preventive Maintenance (PM). ii) The teacher to use questioning strategies to guide students to: – Differentiate PM from other maintenance strategies. – Identify areas where PM is applicable. iii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i) and (ii).	• Manila sheet • Marker pen • Board • Posters	1. Can the student define the term Preventive Maintenance (PM)? 2. Can the student differentiate PM from other maintenance strategies? 3. Can the student identify areas where PM is applicable?	2

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	6.3 Introduction to Corrective Maintenance (CM)	The student should be able to: a) Define the term Corrective Maintenance (CM). b) Differentiate CM from other Maintenance strategies. c) Identify area where CM is applicable.	i) The teacher to use brainstorming questions to guide students to define the term Corrective Maintenance (CM). ii) The teacher to use questioning strategies to guide students to: – Differentiate CM from other maintenance strategies. – Identify areas where CM is applicable. iii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i) and (ii).	• Manila sheet • Marker pen	1. Can the student define the term Corrective Maintenance (CM)? 2. Can the student differentiate CM from other maintenance strategies? 3. Can the student identify areas where CM is applicable?	2
	6.4 Introduction to Breakdown Maintenance (BM)	The student should be able to: a) Define the term Breakdown Maintenance (BM). b) Differentiate BM from other maintenance strategies. c) Identify area where BM is applicable.	i) The teacher to use brainstorming questions to guide students to define the term Breakdown Maintenance BM. ii) The teacher to use questioning strategies to guide students to: – Differentiate BM from other maintenance strategies. – Identify application areas where BM is applicable.	• Manila sheet • Marker pen	1. Can the student define the term Breakdown Maintenance BM? 2. Can the student differentiate BM from other maintenance strategies? 3. Can the student identify areas where BM is applicable?	2

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
			iii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i) and (ii).			
	6.5 Introduction to Total Productive Maintenance (TPM)	The student should be able to: a) Define the term Total Productive Maintenance (TPM). b) Explain the involvement of people in all levels of TPM organization. c) Explain the benefits (direct and indirect) of TPM in a workplace.	i) The teacher to use brainstorming questions to guide students to define the term Total Productive Maintenance (TPM). ii) The teacher to use questioning strategies (what, why and how questions) to guide students to explain the involvement of people in all levels of Total Productive Maintenance (TPM). iii) The teacher to organise students into groups and guide them to explain the benefits (direct and indirect) of TPM in a workplace. iv) Students to present their responses for sharing and discussion. v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iii).	• Manila sheet • Marker pen • Multimedia package • Poster with diagrams of TPM	1. Is the student able to define the term Total Productive Maintenance (TPM)? 2. Is the student able to explain the involvement of people in all levels of TPM organisation? 3. Is the student able to explain the benefits (direct and indirect) of TPM?	2

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	6.6 Pillars of Total Productive Maintenance (TPM)	The student should be able to: a) List the eight pillars of Total Productive Maintenance (TPM). b) Describe each of eight pillars of TPM. c) Explain the importance of each pillar of TPM	i) The teacher to organise students in groups and guide them to: – List down the eight pillars of Total Productive Maintenance (TPM). – Describe each of eight pillars of TPM. ii) Students to share their responses for sharing and discussion. iii) The teacher to use questioning strategies (what, why and how questions) to guide students to explain the importance of each pillar of TPM? iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iii).	• Manila sheet • Marker pen • Multimedia package • Poster with a diagrams of 8 pillars of TPM	1. Is the student able to list the eight pillars of TPM? 2. Is the student able to describe each of eight pillars of TPM? 3. Is the student able to explain the importance of each pillar of TPM?	2
7.0 ENGINEERING DRAWING IV	7.1 Drawing Joints	The students should be able to: a) Identify the materials, instruments and equipment for drawing joints. b) Explain the methods of drawing joints	i) The teacher to organise students in groups and guide them to: – Identify the materials, instruments and equipment for drawing joints. – Explain the method of drawing joints	• Standard drawing paper • Manila sheet • Marker pen • Drawing instruments • Poster with pictures of different joints	1. Is the student able to Identify the materials, instruments and equipment for drawing joints? 2. Is the student able to explain the methods of drawing joints?	2

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		c) Draw different types of joints.	ii) The teacher to create activities for students to draw different types of joints (i.e.,screw threads, riveted, keyed, splined, welded etc). iii) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iii).		3. Can the student draw different types of joints?	
	7.2 Working Drawing	The students should be able to: a) Define the term working drawing. b) Identify different types of working drawings.	i) The teacher to use questions to guide students to: – Define the term working drawing. – Identify different types of working drawing. – List the importance of working drawings with regard to automotive working processes.	• Standard drawing paper • Manila sheet • Marker pen • Drawing instruments • Poster with pictures of different joints	1. Is the student able to define the term working drawing? 2. Is the student able to identify different types of working drawing?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		c) List the importance of working drawings with regard to automotive working processes. d) Draw detailed views of machine parts using standard abbreviations, symbols and conventions. e) Draw components view of machine parts.	ii) The teacher to create activities for students to: – Draw detailed views of machine parts using standards abbreviations. – Draw components view of machine parts. iii) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). iv) Students to present their responses for sharing and discussion. v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iii).		3. Is the student able to list the importance of working drawings with regard to automotive working processes? 4. Can the student draw detailed views of the machine parts using standard abbreviations? 5. Can the student draw components view of machine parts.	
	7.3 Assembly Drawing	The student should be able to: a) Define the term assembly drawing. b) Explain the reasons of having assembly drawing.	i) The teacher to use brainstorming questions to guide students to define the term assembly drawing. ii) The teacher to arrange students in groups and guide them to: – Explain the reasons of having assembly drawing.	• Standard drawing paper • Manila sheet • Marker pen • Drawing instruments	1. Is the student able to define assembly drawing? 2. Is the student able to explain the reasons of having assembly drawing?	8

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		c) Describe different types of assembly drawing. d) Draw parts or fully assembly of a machine and show views and sectional view of an assembly drawing	– Identify different types of assembly drawing (i.e.,part assembly drawing and fully assembly drawing). iii) The teacher to create activities for students to draw parts or fully assembly of a machine and show views and sectional view of an assembly drawing. iv) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). v) Students to share their responses for sharing and discussion. vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-v).	• Poster with pictures of different joints	3. Can the student describe types of assembly drawing? 4. Can the student draw parts or fully assembly of a machine and show views and sectional view of an assembly drawing?	
8.0 INTRODUCTION TO CAD II	8.1 Pictorial Drawing (Oblique, Isometric)	The student should be able to: a) Explain the process of drawing oblique and isometric drawings using CAD softwares.	i) The teacher to organise students in groups and guide them to explain the process of drawing oblique and isometric drawings using CAD softwares.	• Manila sheet • Marker pen • Computer loaded with CAD softwares	1. Can the student explain the process of drawing oblique and isometric drawings using CAD softwares?	8

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		b) Draw oblique and isometric drawings using CAD softwares	ii) The teacher to create activities for students to draw oblique and isometric drawings using CAD softwares. iii) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). iv) Students to share their responses for sharing and discussion. v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iv).		2. Can the student draw oblique and isometric drawings using CAD softwares?	
	8.2 Orthographic Projection	The student should be able to: a) Explain the process of drawing orthographic projection using CAD softwares.	i) The teacher to organise students in groups and guide them to explain the process of drawing orthographic projection using CAD softwares. ii) The teacher to create activities for students to: – Draw the Orthographic projection by using CAD softwares.	• Manila sheet • Marker pen • Computer loaded with CAD softwares	1. Can the student explain the process of drawing orthographic projection using CAD softwares?	6

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		b) Draw orthographic projection using CAD softwares. c) Draw orthographic drawing in first and third angle projections using CAD softwares.	– Draw orthographic drawing in first and third angle projections using CAD softwares iii) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). iv) Students to share their responses for sharing and discussion. v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-v).		2. Can the student draw orthographic projection using CAD softwares? 3. Can the student draw orthographic drawing in first and third angle projections using CAD softwares?	
	8.3 Dimensioning	The student should be able to: a) Describe how to use CAD softwares to draw different types of dimension lines. b) Draw different types of dimension lines using CAD softwares.	i) The teacher to organise students in groups and guide them to describe how to use CAD softwares to draw different types of dimension lines. ii) The teacher to create activities for students to draw dimension lines using CAD softwares. iii) With the aid of prepared assessment guideline, the teacher should guide the students to assess the activities performed in part (ii).	• Manila sheet • Marker pen • Multimedia • Computer loaded with CAD software	1. Can the student describe how to use CAD softwares to draw different types of dimension lines? 2. Can the student be able to draw different dimension lines using CAD softwares?	6

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
			iv) Students to share their responses for sharing and discussion. v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iv).			
9.0 AUTO-WORKSHOP PRACTICES	9.1 Lubrications Systems	The student should be able to: a) Explain the process of changing engine oil and oil filter. b) Explain the importance of changing engine oil and oil filter. c) Change engine oil and oil filter.	i) The teacher to organise students in groups and guide them to: – Explain the process of changing engine oil and oil filter. – Explain the importance of changing engine oil and oil filter. ii) The teacher to create activities for students to change engine oil and oil filter. iii) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iii).	• Real vehicle/ engine • Lubrications • Complete tools box • Oil filter • Oil drain/ oil caddy	1. Can the student explain the process of changing engine oil and oil filter? 2. Can the student explain the importance of changing engine oil and oil filter? 3. Can the student change engine oil and oil filter?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	9.2 Fuel System	The student should be able to: a) Replace fuel filter. b) Replace faulty fuel pump and adjust carburetor. c) Service fuel injectors and filters. d) Bleed fuel system.	i) The teacher to organise students in groups and guide them to explain the procedures for: – Replacing fuel filter. – Replacing faulty fuel pump and adjust carburetor. – Servicing fuel injectors and filters. – Bleeding fuel system. ii) The teacher to create activities for students to: – Replace fuel filter. – Replace faulty fuel pump. – Bleed fuel system. – Service fuel injector and filter. iii) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). iv) Students to share their responses for sharing and discussion. v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iv).	• Complete tools box • Real vehicle • Fuel filter • Fuel pump • Injector pump • Injector nozzles	1. Can the student replace fuel filter? 2. Can the student replace faulty fuel pump and adjust carburetor? 3. Can the student service fuel injectors and filters? 4. Can the student bleed fuel system?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	9.3 Auto-Electric System	The student should be able to: a) Dismantle starter motor in order to identify ammature, commutator brushes and mountings starter winding, solenoid and bendix drive b) Assemble ammature, commutator brushes and mountings starter winding, solenoid and bendix drive in a motor vehicle. c) Overhaul of alternator d) Prepare acid for filling battery	i) The teacher to guide students in groups to: – Dismantle starter motor in order to identify ammature, commutator brushes and mountings starter winding, solenoid and bendix drive. – Assemble ammature, commutator brushes and mountings starter winding, solenoid and bendix drive in a motor vehicle. ii) The teacher to create activities for students to: – Dismantle starter motor. – Overhaul the alternator – Prepare acid for filling battery – Connect batter to battery charger. – Identify ignition system components (i.e., ignition coil, distributor and capacitor and contact breaker high tension cables)	• Alternator components • Ignition system components • Hydrometer • Battery charger and connecting cables • Spark plugs • Stator motor assembly • Battery acid • PPE	1. Can the student dismantle starter motor in order to identify armature, commuter brushes and mounting starter winding, solenoid and bendix drive? 2. Can the student assemble ammature, commutator brushes and mountings starter winding, solenoid and bendix drive in a motor vehicle? 3. Can the student overhaul of alternator? 4. Can the student prepare acid for filling battery? 5. Can the student connect battery to battery changer?	8

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		c) Connect battery to battery changer. d) Identify ignition system components (i.e. ignition coil, distributor and capacitor and contact breaker high tension cables).	iii) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (i) and (ii). iv) Students to share their responses for sharing and discussion. v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iv).		6. Can the student identify ignition system components?	
	9.4 Engine Cooling System	The student should be able to a) Explain the procedure for changing radiator water horse. b) Explain the procedure for flushing radiator. c) Change radiator water horse. d) Flush radiator.	i) The teacher to guide students in groups to: – Explain the procedure for changing radiator water horse. – Explain the procedure for flushing radiator ii) The teacher to create activities for students to: – Change radiator water horse. – Flush radiator. iii) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii).	• Engine test • Complete tool box • Real vehicle • Radiator • Horse pipes	1. Can the student explain the procedure for changing radiator water horse? 2. Can the student explain the procedure for flushing radiator? 3. Can the student change radiator water horse? 4. Can the student flush radiator?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
			iv) Students to share their responses for sharing and discussion. v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks done in part (i-iv).			

MANUFACTURING ENGINEERING
FORM III

CLASS LEVEL COMPETENCIES

By the end of Form III, the student should have ability to:

a) use heat treatment techniques in improving mechanical properties of metals;
b) demonstrate use of metal forming processes;
c) demonstrate use of machine tools in producing engineering products;
d) use welding machine to perform arc welding and gas welding processes;
e) draw section views by considering section exceptions;
f) demonstrate technical drawing techniques in drawing intersection lines and developing prism and cylinders; and
g) apply CAD softwares in making manufacturing drawings.

CLASS LEVEL OBJECTIVES

By the end of Form III, the student should be able to:

a) develop skills of heat treatment for metals;
b) describe various metal forming processes;
c) develop skills of operating various machine tools to cut metals, turning, drill, grind, thread, taper turning etc;
d) use skills and knowledge learnt in performing arc welding and gas welding processes;
e) communicate effectively using engineering drawings;
f) use technical drawing techniques to draw intersection lines and develop prism and cylinders; and
g) use CAD softwares in making manufacturing engineering drawings.

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
1.0 MANUFACTURING ENGINEERING	Introduction to Manufacturing Engineering	The student should be able to: a) Explain the term Manufacturing engineering. b) Explain importance of Manufacturing engineering field in society. c) Differentiate Manufacturing engineering from other fields of engineering. d) Identify opportunities obtained in the field of Manufacturing engineering.	i) The teacher to use questions to guide students to: – Explain the meaning of Manufacturing engineering. – Explain importance of Manufacturing engineering field in society ii) The teacher to organise group discussions for students to: – Differentiate Manufacturing engineering from other fields of engineering. – Identify opportunities obtained in the field of Manufacturing engineering. iii) The teacher to use questioning strategies to guide students to explain the essence of studying Manufacturing engineering.	• Multimedia, TV, Computer • Reading texts on the topic • Posters showing importance of manufacturing Engineering in the society	1. Is the student able to explain the meaning of the term Manufacturing engineering? 2. Is the student able to explain importance of Manufacturing engineering field in society? 3. Is the student able to differentiate Manufacturing engineering from other fields of engineering? 4. Is the student able to identify opportunities obtained in the field of Manufacturing engineering?	5

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
		e) Explain the essence of studying Manufacturing engineering.	vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).		5. Is the student able to explain the essence of studying Manufacturing engineering?	
2.0 METAL FORMING AND HEAT TREATMENT	2.1 Metal forming Processes (hot and cold forming)	Students should be able: a) Define the term metal forming process. c) Explain metal forming processes. d) Differentiate metal forming process from other manufacturing processes. e) Describe hot and cold forming processes in manufacturing.	i) The teacher to use questions to guide students to: – Define the term metal forming processes. – Explain metal forming processes (i.e. forging, rolling, extrusion, blanking and punching etc). ii) The teacher to use questioning strategies (what, why and who question) to guide students to – Differentiate metal forming process from other manufacturing processes. – Describe hot and cold forming metal forming processes in manufacturing.	• Posters showing various metal forming processes • Computer • Forge tools • Manila sheet • Marker pen • Forming machines • Workpieces	1. Is the student able to define the term metal forming process? 2. Is the student able to explain metal forming processes? 3. Is the student able to differentiate metal forming process from other manufacturing processes? 4. Can the student describe hot and cold rolling processes?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
			iii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i) and (ii).			
	2.2 Heat Treatments of Metals	Students should be able to. a) Define the term heat treatment of metals. b) Define different heat treatment processes. c) Explain stages involved in heat treatment to plain carbon steel. d) Identify different color codes for heat treatment. e) Explain heat treatment processes. f) Explain the relationship of heat treatment temperature and carbon content.	i) The teacher to use questions to guide students to: – Define the term heat treatment of metal. – Define different heat treatment processes (such as annealing normalizing and case hardening). – Explain stages involved in heat treatment to plain carbon steel. ii) The teacher to arrange students in groups and guide them to: – Explain how to interpret the heat treatment charts. – Explain the relationship of heat treatment temperature and carbon content	• Manila sheet • Marker pen • Furnaces • Heat treatment charts/diagrams • VCD/DVD showing various heat treatments processes • Colour code poster • Equilibrium diagrams/charts	1. Is the students able to define the term heat treatment of metals? 2. Is the students able to define different heat treatment processes? 3. Is the students able to explain stages involved in heat treatment to plain carbon steel? 4. Is the student able to identify different color codes for heat treatment?	6

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
		g) Interpret heat treatment charts.	– Explain heat treatment processes. – Interpret heat treatment charts. iii) Students to present their responses for sharing and discussion. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).		5. Is the student able to explain heat treatment processes? 6. Is the student able to explain the relationship of heat treatment temperature and carbon content? 7. Is the student able to interpret heat treatment charts?	
3.0 MACHINE TOOLS I	3.1 Machine Tools and Accessories	The student should be able to: a) Define the term machine tools. b) List types of machine tools. c) Draw diagrams of machine tools. d) Operate various machines to cut materials.	i) The teacher to use questions to guide students to: – Define the term machine tools. – List different types of machine tools. ii) The teacher to create activities for students to: – Draw diagram of machine tools.	• Posters with pictures of different machines • Manila sheet • Marker pen • Computer animation • Drilling machine • Lathe machine • Milling machines etc	1. Is the student able to define the term machine tools? 2. Is the student able to list types of machine tools? 3. Can the student draw diagrams of machine tools?	6

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
			– Operate various machines used to cut materials. iii) The teacher should monitor and facilitate students in performing the tasks given in part (ii). iv) With the aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). v) Students to present their responses for sharing and discussion. vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).	• Power hacksaw machine etc • PPE	4. Can the student operate various machines to cut materials?	

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	3.2 Lathe Machine	Students should be able to: a) Explain safety precaution when working on a lathe machine. b) Identify different types of lathe machines. c) Explain different operations on a lathe machine. d) Describe procedures of mounting different accessories on a lathe machine. e) Select appropriate size and type of accessories for a particular usage.	i) The teacher to use questions to guide students to: – Explain safety precaution when working on a lathe machine – Identify different types of lathe machines. ii) The teacher to arrange students in groups and guide them to: – Explain different operations on lathe machine – Describe procedures of mounting different accessories on lathe machine. iii) The teacher to guide students to select appropriate size and types of accessories for a particular usage.	• Posters showing different pictures of lathe machines • Manila sheet • Marker pen • Computer software • Lathe machine • Lathe machine accessories	1. Is the student able to explain safety precaution when working on a lathe machine? 2. Is the student able to identify different types of lathe machines? 3. Is the student able to explain different operations on a lathe machine? 4. Is the student able to describe procedures of mounting different accessories on a lathe machine?	8

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			iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part(i-iii).		5. Is the student able to select appropriate size and type of accessories for a particular usage?	
	3.3 Lathe Machine Cutting Tools	Students should be able to: a) Identify lathe cutting tool materials. b) Describe physical properties of cutting tools. c) Describe how to grind cutting tools angles. d) Fix and set tool bits on a lathe machine. e) Cut simple workpieces on lathe machines.	i) The teacher to guide students in groups to: – Identify different tool used on a lathe machine. – Explain the physical properties of tools on lathe machine. – Describe how to grind cutting tools. ii) The teacher to create activities for students to: – Fix and set tool on a lathe machine. – Cut simple workpieces on lathe machines. – Sketch different type of lathe cutting tools.	• Posters with pictures showing different types of cutting tools • Manila sheet • Marker pen • Conventional lathe M/C, does not need computer software • Lathe machines • Tools grinder • PPE • Workpiece	1. Is the student able to identify lathe cutting tools materials? 2. Can the student describe physical properties of cutting tools? 3. Can the student describe the grind cutting tool angles? 4. Is the student able to fix and set tool bits on a lathe machine?	6

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
		f) Sketch different type of lathe cutting tools. g) Face and turn on a lathe machine.	– Face and turn on a lathe machine. iii) The teacher should monitor and facilitate students in performing the tasks given in part (ii). iv) Students to present their responses for sharing and discussion. v) With aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iv).		5. Can the student cut simple work pieces on lathe machines? 6. Is the student able to sketch different type of lathe cutting tools? 7. Is the student able to face and turn on a lathe machine?	
	3.4 Lubricants and coolants	Students should be able to: a) Explain the use of lubricants and coolants in machine tools.	i) The teacher to arrange students in groups and guide them to: – Explain the use of lubricants and coolants in machine tools.	• Posters showing different lubricants • Manila sheet	1. Is the student able to explain the use of lubricants and coolants in machine tools.?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
		b) Identify types of lubricants and coolants used in machine tools. c) Explain the importance of lubricants and coolants in machine tools. d) Explain the methods of applying coolants and lubricants in machine tools.	– Identify types of lubricants and coolants used in machine tools. – Explain the importance of lubricants and coolants in machine tools. – Explain different methods of applying lubricants to machine tools. ii) Students to present their responses for sharing and discussion. iii) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).	• Marker pen • Lubricants of different use • Coolant	2. Is the student able to identify types of lubricants and coolants used in machine tools? 3. Is the student able to explain the importance of lubricants and coolants in machine tools? 4. Is the student able to explain the methods of applying coolants and lubricants in machine tools?	
	3.5 Lathe Machine Operations	The student should be able to: a) Set a tool on a center height. b) Explain the effect of having a tool above or below the center.	i) The teacher to arrange students in groups and guide them to: – Set a tool on a center height. – Explain the effect of having a tool above or below center line.	• Posters with pictures of different types of lathe machines • Manila sheet • Marker pen • Facing tools • Turning tools • Threading tools	1. Can the student set tool on a center height? 2. Is the student able to explain the effect of having a tool above or below the center?	10

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
		c) Identify fine and course feeds, set feed and speeds on lathe machine. d) Select a proper tool for a particular machining process. e) Select proper lathe machine tools for a particular machining process. f) Perform various operations of lather machines (drilling, facing, turning, boring, knueling ect). g) Perform boring operations. h) Calculate speed feed on lathe machine.	– Identify fine and course feeds, set feed and speeds feed on lathe machine. ii) Students to present their responses for sharing and discussion. iii) The teacher to create activities for students to: – Select proper tools for particular machining process. – Select proper lathe machine tools for a particular machining process. – Perform knurling (straight and diamond) operations. – Perform boring operations. – Calculate speed feed on lathe machine. – Calculate gear train when cutting threads on lathe machine.	• Knurling tools (straight and diamond) • Boring tools • Lathe machine • PPE	3. Can the student identify fine and course feeds, set feed and speeds on lathe machine? 4. Can the student select a proper tool for a particular machining process? 5. Can the student select proper lathe machine tools for a particular machining process? 6. Can the student perform various operations on a lathe machine? 7. Can the student perform boring operations?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
		i) Calculate gear train when cutting threads on lathe machine.	iv) The teacher should monitor and facilitate students in performing the tasks given in part (iii). v) With aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii). vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iv).		8. Is the student able to calculate speed feed on lathe machine? 9. Can the student calculate gear train when cutting threads on lathe machine?	
	3.6 Drilling Machine	The student should be able to: a) Define the term drilling machine b) List ways of making a hole on a solid metal. c) Identify different types of drilling machines.	i) The teacher to use questions to guide students to: – Define the term drilling machine. – List ways of making a hole on a solid metal. – Identify different types of drilling machines.	• Drill bits • Drilling machines • Poster showing various drilling machines and drill bits	1. Is the student able to define the term drilling machine? 2. Is the student able to list ways of making a hole on a solid metal?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
		d) Explain the uses of a drilling machine in the manufacturing processes. e) Explain the importance of a drilling machine in the manufacturing processes. f) Explain different operations on a drilling machine. g) Describe the procedure of mounting different accessories on a drilling machine.	ii) The teacher to arrange students in groups and guide them to: – Explain the uses of a drilling machine in the manufacturing processes. – Explain the importance of a drilling machine in the manufacturing processes. – Explain different operations on a drilling machine. – Describe the procedure of mounting different accessories on a drilling machine. iii) Students to present their responses for sharing and discussion. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii)	• VCD/DVD showing various drilling operating • Reamers • Manila sheet • Marker pen • Radial drilling machine • Bench drilling machine • Pillar drilling machine • Column type drilling machine • Drilling accessories	3. Is the student able to identify different types of drilling machines? 4. Is the student able to explain the uses of a drilling machine in the manufacturing processes? 5. Is the student able to explain the importance of a drilling machine in the manufacturing processes? 6. Is the student able to explain different operations on a drilling machine?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
					7. Can the student describe the procedure of mounting different accessories on a drilling machine?	
	3.7 Cutting Tools for Drilling Machines	The student should be able to: a) Identify types of drilling tools. b) Identify types of drill bit materials. c) Explain the physical properties of drill bits. d) Draw labelled parts of a drill bit. e) Fix drill bits on drilling machine chuck f) Set drill bits on drilling machine?	i) The teacher to use questions to guide students to: – Identify different drill bit materials. – Explain the physical properties of cutting tools. – Identify types of drill bit materials. ii) The teacher to create activities for students to: – Draw labelled cutting tools for drilling machines. – Set a tool on a drilling machine. – Fix and set drill bits on drilling machine chuck.	• Posters with picture of different types of twist drills • Manila sheet • Marker pen • Posters with picture of drill, bore, countersinking operation • Drill bits • Reamers • Drilling machine • PPE	1. Is the student able to identify types of drilling tools? 2. Is the student able to identify drill bit materials? 3. Is the student able to explain the physical properties of drill bits? 4. Can the student sketch different types of drill bits? 5. Is the student able to fix drill bits on drilling machine?	8

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
		g) Drill/bore/ countersinking on a drilling machine.	– Drill /bore, countersunk on a drilling machine. iii) The teacher should monitor and facilitate students in performing the tasks given in part (ii). iv) With aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). v) Students to present their responses for sharing and discussion. vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iv)		6. Is the student able set drill bits on drilling machine? 7. Is the student able to drill/bore/ countersink on a drilling machine?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
	3.8 Drilling Machine Operations	Students should be able to: a) Describe the procedure of mounting different accessories on a drilling machine. b) Identify a proper tool for particular drilling processes. c) Identify drill holding devices. d) Explain the effects of twist drill off the center line. e) Explain the processes of selecting appropriate size and type of accessories for a particular usage.	i) The teacher to organise students into groups and guide them to: – Describe the procedure of mounting different accessories on a drilling machine. – Identify a proper tool for particular drilling processes. – Identify drill holding devices (i.e., chucks, sleeves). ii) The teacher to use questioning strategies (what, why and how questions) to guide students to; – Explain the effects of twist drill off the center line. – Explain the processes of selecting appropriate size and type of accessories for a particular usage.	• Lubricants tins • Manila sheet • Marker pen • Posters showing different type of drill operations • Counter boring tool • Countersunk tool • Centre drill • Pedestal grinding • Machine attached with a twist • Drilling machine attachments • PPE	1. Is the student able to describe the procedure of mounting different accessories on a drilling machine? 2. Is the student able to identify a proper tool (twist drill) for particular drilling processes? 3. Is the student able to identify drill holding devices? 4. Is the student able to explain the effects of twist drill off the center line?	6

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
		f) Explain the importance of using cutting fluids/lubricants in drilling operations. g) Explain safety precautions to be taken when working on a drilling machine.	– Explain the importance of using cutting fluids/ lubricants in drilling operations. – Explain safety precautions to be taken when working on a drilling machine. iii) Students to present their responses for sharing and discussion iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i) and (ii).		5. Is the student able to explain the processes of selecting appropriate size and type of accessories for a particular usage? 6. Is the student able to explain the importance of using cutting fluids/lubricants in drilling operations? 7. Is the student able to explain safety precautions to be taken when working on a drilling machine?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
	3.9 Drilling Practices	The student be able to: a) Select a proper tool for particular drilling processes. b) Set a tool on a drilling machine. c) Select correct drilling speeds and feeds. d) Grind drill bits accurately. e) Carry out drilling of a hole, countersinking and reaming operations.	i) The teacher should organise a field trip and create activities for students to: – Select a proper tool for particular drilling processes. – Set a tool on a drilling machine. – Select correct drilling speeds and feeds. – Grind drill bits accurately. – Carry out drilling of a hole, countersinking and reaming operations. ii) The teacher should monitor and facilitate students in performing the tasks given in part (i). iii) Students to present their work for sharing and discussion. iv) With aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (i).	• Poster with a picture of drilling machine • Drill bits • Drilling machines • Poster showing various drilling machines. • Radial drilling machine • Bench drilling machine • Pillar drilling machine • Column type drilling machine • Tool grinder • PPE	1. Is the student able to select a proper tool for particular drilling processes? 2. Is the student able to set a tool on a drilling machine? 3. Is the student able to select correct drilling speeds and feeds? 4. Is the student able to grind drill bits accurately? 5. Is the student able to carry out drilling of a hole countersinking and reaming operations?	10

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
			v) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iv).			
	3.10 Grinding machine	Students should be able to: a) Define the term grinding machine. b) Identify principal parts of a grinding machine. c) Describe uses of each grinding machine. d) Differentiate types of grinding machines.	i) The teacher to use brainstorming questions to guide students to define a term grinding machine. ii) The teacher to organise students into groups and guide them to: – Identify principal parts of a grinding machines. – Describe uses of each grinding machine. – Differentiate types of grinding machine (i.e. pedestal grinding machine surface grinding machine and cylindrical grinding machine). iii) Students to present their responses for sharing and discussion.	• Posters • Tools grinding machines • Surface grinding machine • Cylindrical grinding machine • Pedestal griding machine	1. Is the student able to define the term grinding machine? 2. Is the student able to identify principal parts of a grinding machine? 3. Is the student able to describe uses of each grinding machine? 4. Is the student able to differentiate types of grinding machines and their use?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
			iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i) and (ii).			
	3.11 Grinding Wheels	Students should be able to: a) Identify different types of grinding wheels. b) Identify shapes, form and bonds of different grinding wheels. c) Explain application of different types of grinding wheels. d) Differentiate grinding wheels for soft materials and hard materials. e) Explain grinding wheels materials and configurations (forms) or bond.	i) The teacher to use questions to guide students to: – Identify different types of grinding wheels. – Identify shapes, form and bonds of different grinding wheels. ii) The teacher to organise students into groups and guide them to: – Explain application of different types of grinding wheels. – Explain grinding wheel materials, bonds and their applications. – Differentiate grinding wheels for soft materials and hard materials	• Poster with pictures of grinding wheel (showing grinding wheel in use) • CD/DVD • Grinding wheels of different shape and form	1. Can students identify and name types of grinding wheels? 2. Can students identify shapes form and bonds of different grinding wheels? 3. Can the student explain application of different types of grinding wheels? 4. Can students differentiate grinding wheels for soft materials and hard materials?	2

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
			iii) Students to present their responses for sharing and discussion. iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i) and (ii).		5. Can students explain grinding wheels materials and configurations (forms) or bond?	
	3.12 Grinding operations	The students should be able to : a) List types of grinding operations. b) Identify grinding wheels defects. c) Draw simple diagrams of grinding machines and operations. d) Check quality of a grinding wheel. e) Test for cracks and trueness of grinding wheel. f) Dressing grinding wheels.	i) The teacher to use questions to guide students to list types of grinding operations. ii) The teacher to organise students in groups and guide them to: – Identify grinding wheels defects. – Describe the processes of testing for cracks and trueness of grinding wheel. iii) The teacher to design activities for students to: – Draw simple diagrams of grinding machines and operations.	• Poster with pictures of different types of grinding wheels • Marker pen • Manila sheets • VCD/DVD for different grinding operations • Grinding machine (i.e Tools grinder surface grinder and cylindrical grinder)	1. Can students list down types of grinding machines and operations? 2. Can students identify grinding wheels defects? 3. Can the student draw simple diagrams of grinding machines and operations? 4. Can the student check quality of a grinding wheel?	8

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
			– Check quality of a grinding wheel. – Test for cracks and Trueness of grinding wheel. – Dress grinding wheels. iv) The teacher should monitor and facilitate students in performing the tasks given in part (iii). v) With aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). vi) The teacher should give feedback and use students' responses as feedback in supporting students to perform the tasks given in part (i-v).	• Grinding wheels • Tools • Workpiece • PPE	5. Can the student test for cracks and trueness of grinding wheel? 6. Can students perform dressing of grinding wheels?	

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	3.13 Grinding Practice	The student should be able to: a) Select suitable grinding wheels for certain grinding operations. b) Mount a grinding wheel on a grinding machine. c) Select speeds and feeds for different grinding wheels.	i) The teacher to design activities for students to: – Select suitable grinding wheel for a certain operation. – Mount a grinding wheel on a machine – Select suitable speed and feed for a certain grinding wheel. ii) The teacher should monitor and facilitate students in performing the tasks given in part (i). iii) With aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (i). iv) Students to present their responses for sharing and discussion. v) The teacher should give feedback and use students' responses as feedback in supporting students to perform the tasks given in part (i-iv).	• Poster with pictures of different types of grinding wheels • Marker pen • Manila sheets • VCD/DVD for different grinding operations • Grinding machine (i.e Tools grinder surface grinder and cylindrical grinder) • Grinding wheels • Tools • Workpiece • PPE	1. Can the student select suitable grinding wheels for certain grinding operations? 2. Can students mount correctly a grinding wheel on grinding machine? 3. Can students select suitable speed and feed for a certain grinding wheel?	6

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
4.0 WELDING TECHNOLOGY	4.1 Electric arc Welding Accessories	Students should be able to: a) Identify various electric arc welding accessories. b) Explain the use of various accessories in electric arc welding. c) Describe consumable and non consumable electric arc welding processes. d) Use welding accessories in electric arc welding.	i) The teacher to use questions to guide students to: – Identify various electric arc welding accessories. ii) The teacher to organise students in groups and guide them to: – Explain the use of various accessories in electric arc welding. – Describe consumable and non consumable electric arc welding processes. iii) The teacher to create activities for students to: – Practice using welding accessories in electric arc welding. – Use accessories in electric arc welding. iv) The teacher should monitor and facilitate students in performing the tasks given in part (iii).	• Electric Arc welding accessories • Poster showing electric arc welding accessories • VCD/DVD on electric arc welding • PPE • Arc welding machine	1. Is the student able to identify various welding accessories? 2. Is the student able to explain the use of various accessories in electric arc welding? 3. Can the students differentiate consumable and non consumable welding processes? 4. Can the student use welding accessories in electric arc welding?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
			v) With aid of prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-v).			
	4.2 Electric arc Welding Machines	Students should be able to: a) Identify different types of electric arc welding machines. b) Explain the function of the different types of electric arc welding machines.	i) The teacher to arrange students in groups and guide them to: – Identify different electric arc welding machines (D C and A C welding transformer, welding rectifier, welding inverter, welding generator etc.) – Explain the function of the different type of electric arc welding machines.	• Electric Arc welding machines • Poster showing electric Arc welding machines • VCD/DVD showing welding equipments and machines	1. Is the student able to identify different types of electric arc welding machine? 2. Is the student able to explain the function of different types of electric arc welding machine?	8

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
		b) Explain the uses of different types of electric arc welding machines. c) Use different types of electric arc welding machines.	– Explain the uses of different types of electric arc welding machines. ii) The teacher to create activities for students to use different types of electric arc welding machines. iii) With aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii).	• Electrodes • Workpieces • PPE	3. Can the student explain the uses of different types of electric arc welding machines? 4. Can the student use different types of electric arc welding machines?	
	4.3 Electric arc Welding Machine Operations	The student should be able to: a) Select proper type and size of electrodes. b) Select correct welding current according to the job.	i) The teacher to organise students in groups and guide them to discuss how to select proper type and size of electrodes.	• Poster showing different electrodes and sizes. • Are welding machines	1. Is the student able to select proper type and size of electrodes?	10

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
		c) Use tapping and scratching methods.	ii) The teacher to use students' responses as feedback to support students to explain proper ways to select type and size of electrodes. iii) The teacher to create activities for students to: – Select proper type and size of electrodes. – Use tapping and scratching methods. iv) The teacher should monitor and facilitate students in performing the tasks given in part (iii). v) With aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii). vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-v).	• Electrodes • Electric are welding shields • PPE	2. Is the student able to select correct welding current according to the job? 3. Is the student able to use tapping and scratching methods?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
	4.4 Welding Electrodes	Students should be able to: a) Explain the term welding electrodes. b) Identify different types of welding electrodes. c) List parts of welding electrodes. d) Explain the meaning of core and coating. e) Explain the types of coating of welding electrodes. f) Identify electrodes according to their codes. g) Explain the importance of welding electrodes.	i) The teacher to use questions to guide student to: – Explain the term welding electrodes. – Identify different types of welding electrodes. – List parts of welding electrodes. – Explain the meaning of core and coating. ii) The teacher to arrange students in groups and guide them to: – Explain the types of coating of welding electrodes. – Identify electrodes according to their codes. – Explain the importance of welding electrodes.	• Poster with pictures of electrodes • Manila sheet • Marker pen • Welding Electrodes • Welding machines • Safety gears	1. Is the student able to define the term welding electrodes? 2. Is student able to identify types of welding electrodes? 3. Is the student able to list parts of welding electrodes? 4. Is the student able to explain the meaning of core and coating? 5. Is the student able to explain the types of coating of welding electrodes? 6. Is the student able to identify electrodes according to their codes?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
		c) Select the size of welding electrodes according to various jobs. d) Use different types and size of welding electrodes. e) Store and handle welding electrodes.	iii) The teacher to design activities for students to: – Select the size of welding electrodes according to various jobs. – Use different types of welding electrodes. – Store and handle welding electrodes. iv) The teacher should monitor and facilitate students in performing the tasks given in part (iii). v) With aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii). vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-v).		7. Is the student able to explain the importance of welding electrode? 8. Can the student select the size of welding electrodes according to various jobs? 9. Is the student able to use different types and size of welding electrodes? 10. Is the student able to store and handle welding electrodes?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
	4.5 Welding Techniques	Students should be able to: a) Prepare diagrams that explain the main features and working principles of the electric arc welding operation. b) Control the speed and movement of the welding electrode. c) Maintain the electric arc operation. d) Join workpieces by electric arc welding. e) Maintain the angle of the welding electrode	i) The teacher to create activities for students to: – Prepare diagrams that explain the main features and working principles of the electric arc welding operation. – Control the speed and movement of the welding electrode. – Maintain the electric arc operations. – Join various workpieces by welding. – Maintain angle of the welding electrode. ii) The teacher should monitor and facilitate students in performing the tasks given in part (i). iii) With aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii).	• Poster showing picture of welding techniques • Machine, electrodes • Manila sheet Marker pen • Workpiece • PPE	1. Is the student able to prepare diagrams that explain the main features and working principles of the electric arc welding operation? 2. Can the student control the speed and movement of the welding electrodes? 3. Can the student maintain the electric arc operation? 4. Is the student able to join work pieces by electric arc welding? 5. Is the student able to maintain the angle of the welding electrode?	10

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
			iv) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iii)			
	4.6 Gas Welding processes	Students should be able to: a) Explain the meaning of gas welding. b) Identify various gas welding accessories. c) Explain the use of gas welding accessories. d) Use accessories of gas welding e) Perform different gas welding techniques.	i) The teacher to use questions to guide students to: – Explain the meaning of gas welding. – Identify various gas welding accessories. ii) The teacher to arrange students in groups and guide them to explain the use of gas welding accessories. iii) The teacher to create activities for students to: – Use gas welding accessories(i.e., gas cylinders, regulator, pressure gauge, horses, welding torch, check valve).	• Gas welding accessories • Posters showing Gas welding accessories • VCD/DVD on gas welding • Personal Protective Equipment (PPE)	1. Is the student able to explain the meaning of gas welding? 2. Is the student able to identify various gas welding accessories? 3. Is the student able to describe the use of gas welding accessories? 4. Can the student use gas welding accessories? 5. Can the student perform different gas welding techniques?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
			– Perform different gas welding techniques. iv) The teacher should monitor and facilitate students in performing the tasks given in part (iii). v) With aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii). vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-iv).			

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
	4.7 Filler Metals (Filler Rods)	The student should be able to: a) Define the term filler rod. b) Identify different types and sizes of filler rods. c) Select the correct type and sizes of filler rods. d) Use different types and sizes of filler rods.	i) The teacher to use brainstorming questions to guide students to define the term filler metals. ii) The teacher to use questions to guide students to: – List down the filler metals. – Identify different types and size of filler rods. – Explain the way to select the correct types and size of filler rods. iii) The teacher to create activities for students to: – Select the correct type and sizes of filler rods. – Use different types and sizes of filler rods. iv) The teacher should monitor and facilitate students in performing the tasks given in part (iii). v) With aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii).	• Poster showing pictures of filler rods • Filler rods • Manila sheet • Marker pen • Personal Protective Equipments (PPE)	1. Is the student able to define the term filler rod? 2. Is the student able to identify different types and sizes of filler rods? 3. Can the student select the correct type and size of filler rods? 4. Can the student use different types and sizes of filler rods?	6

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
			vi) The teacher should give feedback and use students' responses as feedback to support students in performing the tasks given in part (i-v)			
	4.8 Panel Beating	The student should be able to: a) Define the term panel beating, b) Identify tools and equipment used in panel beating workshop c) Describe the process involved in panel beating. d) Conduct panel beating	i) The teacher to use questions to guide students to: – Define the term panel beating – Identify tools and equipment used in panel beating workshop (i.e., wooden block, sand bags, stakes and hammers). ii) The teacher to organise students in groups and guide them to describe the process involved in panel beating (i.e., realignment, stretching, planishing, welding, filling, sanding, spraying, joining, bolting and screwing. iii) The teacher to create activities for students to conduct panel beating.	• Panel beating tools • Multimedia • Projector • PPE • Posters showing different panel beating tools	1. Is the student able to define the term panel beating? 2. Is the student able to identify tools and equipment used in panel beating workshop? 3. Is the student able to describe the process involved in panel beating? 4. Is the student able to conduct panel beating?	8

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
			iv) The teacher should monitor and facilitate students in performing the tasks given in part (iii). v) With aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii). vi) Students to present their responses for sharing and discussion. vii) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks given in part (i-v).			
	4.9 Painting	The student should be able to: a) Define the term painting. b) Identify tools and equipment use in painting workshop.	i) The teacher to use questions to guide students to: – Define the term painting – Identify tools and equipment use in painting workshop.	• Compressor machine • Spraying gun • Tupertine • Metal filler • Paint • PPE	1. Can the student define the term painting? 2. Can the student identify tools and equipment use in painting workshop?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
		c) Describe the procedure to be followed in painting process. d) Describe the material used for painting. e) Paint different things.	ii) The teacher to organise students in groups and guide them to: – Describe the procedure to be followed in painting process (i.e., cleaning, thining, drying etc.) – Describe the material used for painting iii) The teacher to create activities for students to paint different things (i.e., vehicles, etc.). iv) The teacher should monitor and facilitate students in performing the tasks given in part (iii). v) With aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii). vi) Students to present their responses for sharing and discussion		3. Can the student describe the procedure to be followed in painting process? 4. Can the student describe the material used for painting? 5. Can the student paint different things?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
			vii) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks given in part (i-vi).			
5.0 ENGINEERING DRAWING III	5.1 Orthographic Projection	The student should be able to: a) Explain orthographic projection. b) Identify drawing symbols for first and third angle. c) Project views on vertical and horizontal principle plane. d) Construct orthographic drawing in first and third angle projection. e) Explain the importance of drawing symbols in orthographic	i) The teacher to guide students in groups to: – Explain the orthographic projection. – Identify drawing symbols for first and third angle. ii) The teacher to create activities for students to: – Project views on vertical and horizontal principle plane. – Draw views on vertical and horizontal principle plane (Front, end elevation and plan). – Draw object in first and third angle projections.	• Drawing board • Drawing Instrument/ equipments • VCD/DVD showing Orthographic Projection • Multimedia projection • Poster showing orthographic projection • ISO drawing paper	1. Is the student able to explain orthographic projection? 2. Is the student able to identify drawing symbols for first and third angle? 3. Can the student project views on vertical and horizontal principle plane? 4. Can the student construct orthographic drawing in first angle and third angle projection?	8

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
			iii) The teacher should monitor and facilitate students in performing the tasks given in part (ii). iv) Students to present their work for sharing and discussion. v) With aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). vi) The teacher to use questioning strategies (what, how, and why questions) to guide students to explain the importance of drawing symbols in orthographic. vii) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks given in part (i-vi)		5. Is the student able to explain the importance of drawing symbols in orthographic?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
	5.2 Auxiliary Views	The student should be able to: a) Explain the term auxiliary views b) Explain the importance of auxiliary views in engineering. c) Differentiate types of auxiliary elevation. d) Identify need and use of points, lines, and planes in space. e) Construct auxiliary views using auxiliary plan and auxiliary elevation.	i) The teacher to use brainstorming questions to guide students to explain the term auxiliary views. ii) The teacher to guide students in groups to: – Explain the importance of auxiliary views in engineering. – Differentiate types of auxiliary elevation. – Identify need and use of points, lines, and planes in space. iii) Students to present their responses for sharing and discussion. iv) The teacher to create activities for students to construct auxiliary views using auxiliary plan and auxiliary elevation. v) The teacher should monitor and facilitate students in performing the tasks given in part (iv).	• Scale rule • Drawing board • Drawing paper • Drawing instruments • Poster showing auxiliary views	1. Is the student able to explain the term auxiliary views? 2. Is the student able to explain the importance of auxiliary views? 3. Can the student differentiate types of auxiliary elevation? 4. Can the student identify need and use of points, lines, and planes in space? 5. Can the student construct auxiliary views using auxiliary plan and auxiliary elevation?	6

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
			vi) With aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iv). vii) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks given in part (i-vi)			
	5.3 LOCI (Mechanisms)	The student should be able to: a) Define the term locus of a point. b) Explain the procedure for constructing a locus of ladder movement crank and slide. mechanism using single point links with multiple points links and helix and coil spring.	i) The teacher to use brainstorming questions to guide students to define the term locus of a point. ii) The teacher to use questioning strategies to guide students to explain the procedure for constructing a locus of ladder movement, crank and slide using single point links with multiple points links and helix and coil spring.	• Posters with picture showing different meshes of the produces locus • Drawing set • Drawing paper • Video animation of LOCI • Multimedia project	1. Is the student able to define the term locus of a point? 2. Is the student able to explain the procedure for constructing a locus of ladder movement, crank and slide using single point links with multiple points links and helix and coil spring?	8

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
		c) Construct locus of a ladder movement crank and slides-single point links with multiple point and helix and coil springs.	iii) The teacher to create activities for students to construct locus of a ladder movement crank and slides- single point links with multiple point and helix and coil springs. iv) The teacher should monitor and facilitate students in performing the tasks given in part (iii). v) With aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii). vi) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks given in part (i-v)		3. Is the student able to construct a locus of ladder movement, crank and slides-single point links with multiple point and helix and coil springs?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
	5.4 Developments of Engineering objects	The student should be able to: a) Explain the meaning of development of objects in engineering drawing. b) Describe the purpose and use of development fields. c) Draw development of engineering objects. d) Develop two cylinders intersect at right angles.	i) The teacher to guide students in groups to: – Explain the meaning of development of objects in engineering drawing. – Describe the purpose and use of development fields. ii) The teacher to create activities for students to: – Draw development of engineering objects. – Develop two cylinders intersect at right angles. iii) The teacher should monitor and facilitate students in performing the tasks given in part (ii). iv) With aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii) .	• Poster with pictures showing different types of developments of machine components • Drawing instruments • Model of various components • Drawing sheets	1. Is the student able to define development of objects in engineering drawing? 2. Can the student describe the purpose and use of development fields? 3. Can the student draw development of engineering objects? 4. Can the student develop two cylinders intersect at right angles?	6

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
			v) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks given in part (i-iv).			
	5.5 Sectional Views	The student should be able to: a) Identify different types of sections. b) Explain different application of sections. c) Draw section lines in various drawings. Draw hatching lines in section drawing. d) Apply sections lines in various drawings. e) Apply hatching lines in section drawing. f) Draw various types of sectional views.	i) The teacher to use questions to guide students to: – Identify types of sections. – Explain different application of sections. ii) The teacher to create activities for students to: – Draw sections lines in various drawings. – Draw hatching lines in section drawing. – Apply sections lines in various drawings. – Apply hatching lines in section drawing. – Draw various types of sectional views	• Drawing template • Drawing sheet • Drawing instruments • Drawing table/ board	1. Can the student identify different types of sections? 2. Can the student explain different application of section? 3. Can the student draw various types of sectional views? 4. Can the student draw the hatching lines in section drawing? 5. Can the student apply sections lines in various drawings? 6. Can the student apply hatching lines in section drawing?	6

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
			iii) The teacher should monitor and facilitate students in performing the tasks given in part (ii). iv) With aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii) . v) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks given in part (i-iv)		7. Can the student draw various types of sectional views?	
	5.6 Limits and Fits	The student should be able to: a) Define the term limits and fits as applied in engineering drawing. b) Identify different types of limits and fits.	i) The teacher to use brainstorming questions to guide student to: – Define the term limits anf fits as applied in engineering drawing. – Identify different types of limits and fits	• Posters showing different tolerances and limits • Manila sheet • Marker pen	1. Is the student able to define the term limits and fits as applied in engineering drawing? 2. Is the student able to identify different types of limits and fits?	6

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
		b) Identify unilateral and bilateral tolerances as specified in the dimensioning of drawing. c) Explain the application of limits and fits in manufacturing process. e) Calculate tolerances relating to limits and fits as applied in engineering drawings. f) Determine the required size of the hole and shaft with reference to International Standard Organization (ISO).	ii) The teacher to guide students in groups to: – Identify unilateral and bilateral tolerances as specified in the dimension of drawing. – Explain the application of limits and fits in manufacturing process. iii) Students to present their work for sharing and discussion. iv) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks given in part (i-iii) v) The teacher to create activities for students to: – Calculate tolerances relating to limits and fits as applied in engineering drawings.		3. Is the student able to identify unilateral and bilateral tolerances as specified in the dimensioning of drawing? 4. Can the student explain the application of limits and fits in manufacturing process? 5. Can the student calculate tolerances relating to limits and fits as applied in engineering drawings?	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
			– Determine the required size of the hole and shaft with reference to International Standard Organization (ISO). vi) The teacher should monitor and facilitate students in performing the tasks given in part (v). vii) With aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (v). viii) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks given in part (i-vi).		6. Can the student determine the required size of the hole and shaft with reference to International Standard Organization (ISO).	

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
6.0 INTRODUCTION TO CAD I	6.1 Introduction to Computer Aided Drafting I	The student should be able to: a) Define the term Computer Aided Drafting (CAD). b) Explain the importance of CAD in manufacturing engineering. c) Describe the applications of CAD in manufacturing engineering. d) Explain the advantages and disadvantages of using CAD in manufacturing engineering.	i) The teacher to use brainstorming questions to guide students to define the term Computer Aided Drafting (CAD). ii) The teacher to arrange students in groups and guide them to: – Explain the importance of CAD in manufacturing engineering. – Describe the applications of CAD in manufacturing engineering. – Explain the advantages and disadvantages of using CAD in manufacturing engineering. iii) Students to present their responses for sharing and discussion, iv) The teacher should give feedback and use the students' responses as feedback to support the students in performing the tasks done in part (i-iii).	• Posters with pictures of objects drawn using CAD • Posters with pictures of computer inputs and output devices • CAD software (CorelDraw, Page Maker, Microsoft Office, CAD, Paint, Corel CAD etc) • Computer loaded with CAD software	1. Is the student able to define the term Computer Aided Drafting (CAD)? 2. Is the student able to explain the importance of CAD in manufacturing engineering? 3. Is the student able to describe the applications of CAD in manufacturing engineering? 4. Is the student able to explain the advantages and disadvantages of using CAD in manufacturing engineering?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
	6.2 CAD Software and Hardware	The student should be able to: a) List five (5) computer hardware. b) Identify hardware of CAD system and CAD software. c) Describe hardware of CAD systems. d) Explain the meaning of CAD. e) Describe elements of drawing in CAD. f) Explain the importance of CAD and its applications in manufacturing engineering.	i) The teacher to use questions to guide students to: – List five (5) computer hardware. – Describe hardware of CAD system and CAD software. ii) The teacher to arrange students in groups and guide them to: – Describe hardware of CAD systems (i.e.,CPU, Secondary Memory, and Workstation). – Explain the meaning of CAD. – Describe elements of drawing in CAD. iii) Students to present their responses for sharing and discussion.	• Posters with pictures of objects drawn using CAD • Posters with pictures of computer inputs and output devices • CAD package • CAD software (CorelDraw, Page Maker, Microsoft Office, Auto CAD, Paint, Corel CAD etc)	1. Can the student list five (5) computer hardware? 2. Can the student identify hardware of CAD system and CAD software? 3. Can the student describe hardware of CAD systems? 4. Can the student explain the meaning of CAD? 5. Can the student describe elements of drawing in CAD?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
			iv) The teacher to use questioning strategies (what, how, and what questions) to guide students to explain the importance of CAD and its applications in manufacturing engineering. v) The teacher to give feedback and use the students' responses as feedback to support the students to perform the tasks done in part (i-iii).	• Computer loaded with CAD softwares	6. Can the student explain the importance of CAD and its applications in manufacturing engineering?	
	6.3 CAD Application	The student should be able to: a) Describe elements of CAD softwares used for drawing manufacturing objects.	i) The teacher to arrange students in groups and guide them to: – Describe elements of CAD drawing used for drawing manufacturing objects. – Identify types of projections and geometrical modeling.	• Posters with pictures of objects drawn using CAD • Posters with pictures of computer inputs and output devices	1. Can the student describe elements of CAD drawing to use for drawing manufacturing objects?	12

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIOD
		b) Use elements of CAD drawing to draw manufacturing objects. c) Identify types of projections and geometrical modeling. d) Make manufacturing layouts and sketches using CAD softwares.	ii) Students to present their responses for sharing and discussion. iii) The teacher to create activities for students to: – Use elements of CAD drawing to draw manufacturing objects, – Make manufacturing layouts and sketches using AutoCAD. iv) The teacher should monitor and facilitate students in performing the tasks given in part (iii). v) With the aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii). vi) The teacher should give feedback and use the students' responses as feedback to support students to use the component of CAD in engineering drawing.	• CAD software (Corel Draw, Page Maker, Microsoft Office, CAD, Paint, Corel CAD etc) • Computer loaded with CAD softwares	2. Can the student use elements of CAD drawing to draw manufacturing e objects? 3. Can the student identify types of projections and geometrical modelling? 4. Can the student make manufacturing layouts and sketches using CAD softwares?	

FORM IV

COMPETENCIES

By the end of Form IV, the student should have ability to:

a) apply foundry techniques to produce components;
b) demonstrate the knowledge and skills of using milling and shaping machines;
c) prepare maintenance schedule and perform maintenance of different machine tools;
d) draw working drawings and assembly drawing;
e) draw various engineering drawings using technical drawing skills; and
f) draw various manufacturing engineering drawings using CAD.

OBJECTIVE

By the end of Form IV, the student should be able to:-

a) describe different foundry operations;
b) use milling and shaping machines to manufacture various parts;
c) describe different maintenance procedures;
d) interpret working drawing and assembly drawing; and
e) use CAD softwares in solving different manufacturing engineering problems.

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
1.0 FOUNDRY TECHNOLOGY	1.1 Introduction to Foundry Technology	The student should be able to: a) Define the term foundry technology. b) Explain the role of foundry technology in development. c) Explain the advantages and disadvantages of foundry in manufacturing process. d) Identify materials used in the foundry process. e) Assess the development of foundry industries technology in Tanzania.	i) The teacher to use brainstorming questions to guide students to define the term foundry technology. ii) The teacher to use questioning strategies (what, how, and why questions) to guide students to: – Explain the role of foundry technology in development. – Explain the advantages and disadvantages of using foundry in manufacturing process. iii) The teacher to use questions to guide students to identify materials used in foundry process. iv) The teacher to arrange students in groups and guide them to assess the development of the foundry industries in Tanzania. v) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks given in part (i-iv).	• Pattern • Posters showing different types of foundry products • Multimedia equipments • Moulding boxes • Tools • Moulding sands	1. Is the student able to define the term foundry technology? 2. Can the student explain the role of foundry technology in development? 3. Is the student able to explain the advantages and disadvantages of foundry in manufacturing processes? 4. Is the student able to identify materials used in the foundry process? 5. Is the student able to assess the development of foundry in Tanzania?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
					6. Is the student able to assess the development of foundry industries technology in Tanzania?	
	1.2 Pattern Making	The student should be able to: a) Define the term pattern. b) Name various types of patterns commonly used in foundry. c) Identify materials used in making patterns. d) Explain the characteristics of materials used in making patterns.	i) The teacher to use brainstorming questions to guide students to: – Define the term pattern making. – Name various types of patterns commonly used in foundry. ii) The teacher to guide students in groups to: – Identify materials used in making patterns. – Explain the characteristics of materials used in making patterns (i.e.,wear resistance, strength, repair-ability, corrosion etc). – Explain fundamental of patterns designs and common patterns allowances. iii) Students to present their responses for sharing and discussion.	• Models of patterns • Marker pen • Manila sheet • Poster with different types of pattern. • Tools • Materials for pattern making	1. Is the student able to define the term pattern? 2. Can the student name various types of patterns commonly used in foundry? 3. Is the student able to identify materials used in making patterns? 4. Is the student able to explain the characteristics of materials used in making patterns?	3

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		e) Explain the fundamentals of pattern designs and common pattern allowances.	iv) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks given in part (i-iii).		5. Is the student able to explain the fundamentals of pattern designs and common pattern allowance?	
	1.3 Molding Sand	The student should be able to: a) Define the term molding sand. b) Identify types of molding sand. b) Explain properties of molding sands.	i) The teacher to use questions to guide students to: – Define the term molding sand. – Identify molding sands. – Explain properties of molding sands. ii) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks given in part (i).	• Manila sheet • Marker pen • Sand (moulding) • Sand testing machine	1. Is the student able to define the term molding sand? 2. Is the student able to identify types of molding sands? 3. Is the student able to explain properties of mounding sands?	2
	1.4 Tools and Equipment	The student should be able to: a) Identify various tools and equipment used in the foundry workshop.	i) The teacher to use questions to guide students to identify tools and equipments used in foundry workshop. ii) The teacher to create activities for students to use tools and equipment in foundry workshop.	• Moulding box • Riddle • Hand hammer • Draw spike • Trowel • Mallet • Spruce pin • Riser pin	1. Is the student able to identify various tools and equipments used in the foundry workshop? 2. Can the student use properly tools and equipment in a foundry workshop?	3

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		b) Use properly the tools and equipment in foundry workshop.	iii) The teacher should monitor and facilitate students in performing the tasks given in part (ii). iv) With the aid of prepared assessment guideline, the teacher should guide the students to assess the activities performed in part (ii). v) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks given in part (i-iv).	• Slick • Shower • Vent wire		
	1.5 Furnaces	The student should be able to: a) Define the term furnaces. b) List types of furnaces. c) Explain the meaning of charging a furnace. d) Explain how to charge a furnace. e) Identify the charging elements of a furnance.	i) The teacher to use questions to guide students to: – Define the term furnaces – Explain the meaning charging a furnace. – List type of furnaces. – Explain how to charge the furnace. – Identify the charging elements. ii) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks given in part (i).	• Swab • Poster with picture of different furnaces • Manila sheet • Marker pen • Charging elements (scraps, silicon, graphite power, limestone) • Multimedia	1. Is the student able to define the term furnace? 2. Is the student able to list down types of furnaces? 3. Is the student able to explain the meaning charging a furnace? 4. Can the student explain how to charge a furnace? 5. Can the student identify the charging elements of a furnance?	3

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	1.6 Core and Core Making	The student should be able to: a) Define the term core. b) Identify types of core materials. c) Identify the characteristic of core materials. d) Identify properties of core materials. e) Explain procedures for making core. f) Make core materials.	i) The teacher to use questions to guide students to: – Define the term core. – Identify types of core materials. ii) The teacher to arrange students in groups and guide them to: – Identify the characteristic of core materials. – Identify properties of core materials. – Explain procedures for making core. iii) The teacher to create activities for students to make core. iv) The teacher should monitor and facilitate students in performing the tasks given in part (iii). v) Students to present their responses for sharing and discussion. vi) With aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (iii). vii) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks given in part (i-vi).	• Sample of different shapes of cores • Poster with pictures of different cores • Wood of different shapes • Manila sheet • Marker pen • Tools	1. Is the student able to define the term core. 2. Is the student able to identify types of core materials? 3. Is the student able to identify the characteristic of core materials? 4. Is the student able to identify properties of core materials? 5. Is the student able to explain procedures for making core? 6. Is the student able to make core materials?	4

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2.0 MACHINE TOOLS II	2.1 Introduction of Milling Machine	The student should be able to: a) Define the term milling machine. b) List types of milling machines. c) Identify principal parts of a milling machine. d) Draw and label a milling machine parts.	i) The teacher to use brainstorming questions to guide students to: – Define the term milling machine. – List types of milling machines. ii) The teacher to organise students into groups and guide them to identify the principal parts of a milling machine. iii) Students to present their responses for sharing and discussion. iv) The teacher to create activities for students to draw a simple diagram of a milling machine and label all parts. v) With aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). vi) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks given in part (i-iv).	• Marker pen • Manila sheet • Poster with pictures of different types of milling machines • Multimedia package	1. Is the student able to define the term milling machine? 2. Is the student able to list types of milling machine? 3. Is the student able to identify principal parts of a milling machine? 4. Is the student able to draw and label a milling machine parts?	2

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	2.2 Milling Cutters	The student should be able to: a) Define the term milling cutters. b) Identify different types of milling cutters. c) Explain different applications of milling cutters. d) Explain milling cutter materials. e) Grind milling cutter.	i) The teacher to use brainstorming questions to guide students to: – Define milling cutters. – Identify different types of milling cutters. ii) The teacher to guide students in groups to: – Explain different applications of milling cutters . – Explain milling cutter materials. – Explain on how to grind milling cutters. iii) The teacher to create activities and guide them to grind milling cutter iv) Students to present their responses for sharing and discussion. v) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks given in part (i-iii).	• Posters with pictures of different types of milling cutters • Manila sheet • Marker pen • Multimedia package • Milling cutters • Tool grinder • PPE	1. Is the student able to define milling cutters? 2. Is the student able to identify different types of milling cutters? 3. Is the student able to explain applications of different types of cutters? 4. Is the student able to explain milling cutter materials? 5. Is the student able to grind milling cutters?	3

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	2.3 Milling Operations	The student should be able to: a) Identify types of milling operations. b) Draw a simple diagram of a milling operation. c) Select a cutting tool for certain purpose. d) Mount a tool on a milling machine. e) Select speed and feed on the milling machine.	i) The teacher to use questions to guide students to identify types of milling operations. ii) The teacher to create activities for students to: – Draw a simple diagram of a milling operation. – Select a cutting tool for a certain purpose. – Mount a tool on a milling machine. – Select speed and feed on the milling machine. – Use indexing head to cut different types of shapes (gears, splines). iii) The teacher should monitor and facilitate students in performing the tasks given in part (ii). iv) Students to present their responses for sharing and discussion. iv) With aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii).	• Poster with pictures showing milling operations • Manila sheet • Marker pen • Multimedia package • Milling machine • Milling tools and accessories • Index head • PPE	1. Can the student identify types of milling operations? 2. Can the student draw a simple diagram of a milling operation? 3. Can the student select a cutting tool for certain purpose? 4. Can the student mount a tool on a milling machine? 5. Can the student select speed and feed on the milling machine?	8

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		f) Use indexing head to cut different types of shapes.	v) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks given in part(i-v).		6. Is the student able to use indexing head to cut different types of shapes?	
	2.4 Introduction of Shaping Machine	The student should be able to: a) Define the term shaping machine. b) Identify the principal parts of shaping machine. c) Draw and label a shaping machine tools and its parts.	i) The teacher to use questions to guide students to define the term shaping machine. ii) The teacher to guide student in groups to identify the principal parts of shaping machine. iii) The teacher to create activities for students to draw and label a shaping machine tools and its parts. iv) The teacher should monitor and facilitate students in performing the tasks given in part (iii). v) With aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). vi) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks given in part (i-v).	• Poster. • Different types of shaping tools. • Manila sheet etc. • Shaping machines.	1. Is the student able to define shaping machine? 2. Is the student able to identify the principal parts of shaping machine? 3. Is the student able to draw and label a shaping machine and its parts?	3

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	2.5 Shaping Machine Operations	The student should be able to: a) Identify difference between a crank shaping machine and hydraulic shaping machine. b) Identify different types of shaping tools. c) Determine shaping stroke.	i) The teacher to organise students in groups and guide them to: – Differentiate crank shaping machine and hydraulic shaping machine. – Is the student able to identify different types of shaping tools? ii) The teacher to create activities for students to determine shaping stroke. iii) The teacher should monitor and facilitate students in performing the tasks given in part (ii). iv) With aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). v) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks given in part (i-iv).	• Poster with different types of shaping tools • Manila sheet etc • Shaping machines • Posters with shaping machine	1. Can students differentiate crank and hydraulic shapers? 2. Is the student able to identify different types of shaping tools? 3. Is the student able to determine shaping stroke?	3

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
	2.6 Shaping Machine Tools	The student should be able to: a) Identify different types of shaping tools. b) Explain parts of shaping machine. c) Determine shaping tool materials. d) Determine shaping stroke for different materials. e) Grind different tool shapes/ angles for a particular work.	i) The teacher to use questions to guide students to: – Identify different types of shaping tools (eg. crank, gear and hydraulic). – Explain parts of shaping machine ii) The teacher to create activities for students to: – Determine shaping stroke for different materials. – Determine shaping tool materials. – Grind different tool shapes/ angles for a particular work. iii) The teacher should monitor and facilitate students in performing the tasks given in part (ii). iv) With aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). v) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks given in part (i-iv).	• Poster • Different types of shaping tools • Manila sheet etc • Shaping machines • Tool grinder • PPE • Shapping tool	1. Can the student identify different types of shaping tools? 2. Can the student explain parts of shaping machine? 3. Can the student determine shaping tool materials? 4. Can the student determine shaping stroke for different materials? 5. Can the student grind different tool shapes/angles for a particular work?	3

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3.0 MAINTENANCE PRACTICE	3.1 Introduction to Maintenance Practice	The student should be able to: a) Explain the importance of maintenance practice. b) Identify people involved in planned maintenance practice. c) Identify area where maintenance practice is applicable.	i) The teacher to use questions to guide students to: – Explain the importance of maintenance practices. – Identify people involved in PM. – Identify area where maintenance practice is applicable ii) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks mentioned in part (i).	• Multimedia • Board • Industrial visit • Chalk	1. Can the student explain the importance of maintenance practice? 2. Can the student identify people involved in planned maintenance practice? 3. Can the student identify area where maintenance practice is applicable?	2
	3.2 Introduction to Preventive Maintenance (PM).	The student should be able to: a) Define the term Preventive Maintenance PM. Differentiate PM from other Maintenance strategies.	i) The teacher to use brainstorming questions to guide students to define the term Preventive Maintenance (PM). ii) The teacher to use questioning strategies to guide students to: – Differentiate PM from other maintenance strategies. – Identify areas where PM is applicable.	• Manila sheet • Marker pen • Chalk	1. Can the student define the term Preventive Maintenance (PM)? 2. Can the student differentiate PM from other maintenance strategies?	1

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		c) Identify area where PM is applicable.	iii) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks mentioned in part(ii).		3. Can the student identify areas where PM is applicable?	
	3.3 Introduction to Corrective Maintenance (CM)	The student should be able to: a) Define the term Corrective Maintenance (CM). b) Differentiate CM from other Maintenance strategies. c) Identify area where CM is applicable.	i) The teacher to use brainstorming questions to guide students to define the term Corrective Maintenance (CM). ii) The teacher to use questioning strategies to guide students to: – Differentiate CM from other maintenance strategies. – Identify areas where CM is applicable. iii) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks mentioned in part (ii).	• Manila sheet • Marker pen • Chalk	1. Can the student define the term Corrective Maintenance (CM)? 2. Can the student differentiate CM from other maintenance strategies? 3. Can the student identify areas where CM is applicable?	1
	3.4 Introduction to Breakdown Maintenance (BM)	The student should be able to: a) Define the term Breakdown Maintenance (BM).	i) The teacher to use brainstorming questions to guide students to define the term Breakdown Maintenance BM. ii) The teacher to use questioning strategies to guide students to:	• Manila sheet • Marker pen • Chalk	1. Can the student define the term Breakdown Maintenance BM?	1

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		c) Differentiate BM from other maintenance strategies. d) Identify area where BM is applicable	– Differentiate BM from other maintenance strategies. – Identify areas where BM is applicable. iii) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks mentioned in part (i) and (ii).		2. Can the student differentiate BM from other maintenance strategies? 3. Can the student identify areas where BM is applicable?	
	3.5 Introduction to Total Productive Maintenance (TPM)	The student should be able to: a) Define the term Total Productive Maintenance (TPM). b) Explain the involvement of people in all levels of TPM organization. c) Explain the benefits (direct and indirect) of TPM in a workplace.	i) The teacher to use brainstorming questions to guide students to define the term Total Productive Maintenance (TPM). ii) The teacher to use questioning strategies (what, why and how questions) to guide students to explain the involvement of people in all levels of Total Productive Maintenance (TPM). iii) The teacher to organise students into groups and guide them to explain the benefits (direct and indirect) of TPM in a workplace. iv) Students to present their responses for sharing and discussion.	• Manila sheet • Marker pen • Multimedia package • Poster with diagrams of TPM • Chalk	1. Is the student able to define the term Total Productive Maintenance (TPM)? 2. Is the student able to explain the involvement of people in all levels of TPM organisation? 3. Is the student able to explain the benefits (direct and indirect) of TPM?	1

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			v) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks mentioned in part (i-iii).			
	3.6 Pillars of Total Productive Maintenance (TPM)	The student should be able to: a) List the eight pillars of Total Productive Maintenance (TPM). b) Describe each of eight pillars of TPM. c) Explain the importance of each pillar of TPM	i) The teacher to organise students in groups and guide them to: – List down the eight pillars of Total Productive Maintenance (TPM). – Describe each of eight pillars of TPM. ii) Students to share their responses for sharing and discussion. iii) The teacher to use questioning strategies (what, why and how questions) to guide students to explain the importance of ech pillar of TPM? iv) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks mentioned in part (i-iii).	• Manila sheet • Marker pen • Multimedia package • Poster with a diagrams of brame of TPM	1. Is the student able to list the eight pillars of TPM? 2. Is the student able to describe each of eight pillars of TPM? 3. Is the student able to explain the importance of each pillar of TPM?	1

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4.0 ENGINEERING DRAWING IV	4.1 Drawing Engineering Joints	The students should be able to: a) Identify the materials, instruments and equipment for drawing joints. b) Explain the methods of drawing joints c) Draw different types of joints.	i) The teacher to organise students in groups and guide them to: – Identify the materials, instruments and equipment for drawing joints. – Explain the method of drawing joints. ii) The teacher to create activities for students to draw different types of joints (i.e.,screw threads, riveted, keyed, splined, welded etc). iii) The teacher should monitor and facilitate students in performing the tasks given in part (ii). iv) With the aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). v) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks mentioned in part (i-iv).	• Standard drawing paper • Manila sheet • Marker pen • Drawing instruments • Poster with pictures of different joints	1. Is the student able to Identify the materials, instruments and equipment for drawing joints? 2. Is the student able to explain the methods of drawing joints? 3. Can the student draw different types of joints?	4

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	4.2 Working Drawing	The students should be able to: a) Define the term working drawings. b) Identify different types of working drawings. c) List the importance of working drawings with regard to manufacturing processes. d) Draw detailed views of machine parts using standard abbreviations, symbols and conventions.	i) The teacher to use questions to guide students to: – Define the term working drawing. – Identify different types of working drawing. – List the importance of working drawings with regard to manufacturing processes. ii) The teacher to create activities for students to: – Draw detailed views of machine parts using standards abbreviations. – Draw components view of machine parts. iii) The teacher should monitor and facilitate students in performing the tasks given in part (ii). iv) With the aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). v) Students to present their responses for sharing and discussion.	• Standard drawing paper • Manila sheet • Marker pen • Drawing instruments • Poster with pictures of different joints • Drawing board/ table	1. Is the student able to define the term working drawing? 2. Is the student able to identify different types of working drawings? 3. Is the student able to list the importance of working drawings with regard to manufacturing processes? 4. Can the student draw detailed views of the machine parts using standard abbreviations, symbols and conventions? 5. Can the student draw components view of machine parts?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		e) Draw components view of machine parts.	vi) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks mentioned in part (i-iv).			
	4.3 Assembly Drawing	The student should be able to: a) Define the term assembly drawing. b) Explain the reasons of having assembly drawing. c) Describe different types of assembly drawing. d) Draw parts or fully assembly of a machine and show views and sectional view of an assembly drawing	i) The teacher to use brainstorming questions to guide students to define the term assembly drawing. ii) The teacher to arrange students in groups and guide them to: – Explain the reasons of having assembly drawing. – Identify different types of assembly drawing (i.e.,part assembly drawing and fully assembly drawing). iii) The teacher to create activities for students to draw parts or fully assembly of a machine and show views and sectional view of an assembly drawing. iv) The teacher should monitor and facilitate students in performing the tasks given in part (iii).	• Standard drawing paper • Manila sheet • Marker pen • Drawing instruments	1. Is the student able to define assembly drawing? 2. Is the student able to explain the reasons of having assembly drawing? 3. Can the student describe types of assembly drawing? 4. Can the student draw parts or fully assembly of a machine and show views and sectional view of an assembly drawing?	4

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			v) With the aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). vi) Students to present their responses for sharing and discussion. vii) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks mentioned in part (i-vi).			
5.0 COMPUTER AIDED DRAFTING (CAD II)	5.1 Pictorial Drawing (Oblique, Isometric)	The student should be able to: a) Define the term isometric projection. b) Define the term oblique projection. c) Draw oblique and isometric drawings by using CAD softwares.	i) The teacher to use brainstorming questions to guide students to: – Define the term oblique projection. – Define the term isometric projection. ii) The teacher to create activities for students draw isometric and oblique projection using CAD softwares. iii) The teacher should monitor and facilitate students in performing the tasks given in part (ii). iv) Students to present their work for sharing and discussion.	• Manila sheet • Marker pen • Computer loaded with CAD softwares	1. Can the student Define the term oblique projection? 2. Can the student define the term oblique projection? 3. Can the student draw oblique and isometric drawings by using CAD softwares?	6

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			v) With the aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (i). vi) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks mentioned in part (i-v).			
	5.2 Orthographic Projection	The student should be able to: a) Explain the process of drawing orthographic projection using CAD softwares. b) Draw orthographic projection using CAD softwares.	i) The teacher to organise students in groups and guide them to explain the process of drawing orthographic projection using CAD softwares. ii) The teacher to create activities for students to: – Draw the Orthographic projection by using CAD softwares. – Draw orthographic drawing in first and third angle projections using CAD softwares. iii) The teacher should monitor and facilitate students in performing the tasks given in part (ii).	• Manila sheet • Marker pen • Computer loaded with CAD softwares • Posters showing orthographic projection • Posters showing orthographic drawing in first and third angle projections	1. Can the student explain the process of drawing orthographic projection using CAD softwares? 2. Can the student draw orthographic projection using CAD softwares? 3. Can the student draw orthographic drawing in first and third angle projections using CAD softwares?	4

TOPIC	SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NO. OF PERIODS
		c) Draw orthographic drawing in first and third angle projections using CAD softwares.	iv) With the aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii). v) Students to share their responses for sharing and discussion. vi) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks mentioned in part (i-vi).			
	5.3 Dimensioning	The student should be able to: a) Describe how to use CAD softwares to draw different types of dimension lines. b) Draw different types of dimension lines using CAD softwares.	i) The teacher to organise students in groups and guide them to describe how to use CAD softwares to draw different types of dimension lines. ii) The teacher to create activities for students to draw dimension lines using CAD softwares. iii) The teacher should monitor and facilitate students in performing the tasks given in part (ii). iv) With the aid of pre-prepared assessment guideline, the teacher should guide students to assess the activities performed in part (ii).	• Manila sheet • Marker pen • Multimedia • Computer loaded with CAD software	1. Can the student describe how to use CAD softwares to draw different types of dimension lines? 2. Can the student be able to draw different dimension lines using CAD softwares?	4

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			v) Students to share their responses for sharing and discussion. vi) The teacher should give feedback and use the students' responses as feedback to support students in performing the tasks mentioned in part (i-v).			