

National School Curriculum

INSTRUCTIONAL GUIDE FOR TVET (WELDING)

CLASSES XI & XII



Department of Curriculum and Professional Development
Ministry of Education, Royal Government of Bhutan



“Your parents, relatives, and friends would be very proud of what you have achieved. At your age, to have completed your studies is your personal accomplishment. Your knowledge and capabilities are a great asset for the nation. I congratulate you for your achievements. Finally, your capabilities and predisposition towards hard work will invariably shape the future of Bhutan. You must work with integrity, you must keep learning, keep working hard, and you must have the audacity to dream big.”

- His Majesty Jigme Khesar Namgyel Wangchuck

National School Curriculum

INSTRUCTIONAL GUIDE FOR TVET (WELDING)

CLASSES XI & XII



Department of Curriculum and Professional Development
Ministry of Education, Royal Government of Bhutan

Published by

Department of Curriculum and Professional Development
Ministry of Education
Royal Government of Bhutan
Thimphu, Bhutan.

Provisional Edition 2021**First Edition 2022**

www.education.gov.bt

© 2022 Department of Curriculum and Professional Development

All rights reserved. This publication is not for sale. No part of this book may be produced in any form without permission from the Ministry of Education

ISBN 978-99936-0-657-4

Acknowledgements

The Department of Curriculum and Professional Development (DCPD) would like to acknowledge the assistance provided by the Department of School Education, MoE, Royal Government of Bhutan in the development of Technical and Vocational Education and Training National School Curriculum Instructional Guide for classes IX - XII. The DCPD also extends its sincere gratitude to all the schools and individuals for their invaluable contributions towards the development of this instructional guide. The DCPD also wishes to extend heartfelt gratitude to the World Bank for rendering financial services during the course of the development of this instructional guide.

The DCPD also genuinely acknowledges the retrieval and use of contents and resources, either in part or whole, from relevant websites and other forms of sources with assurance that these resources will be used exclusively for educational purposes.

Contributors for the development of provisional edition 2021:

Advisors

1. Kinga Dakpa, Director General, REC, Paro
2. Wangpo Tenzin, Dean, Specialist, REC, Paro

Researchers and writers

1. Lal Maya Shyangdan, Assistant Instructor, Khuruthang MSS, Punakha
2. Tashi Wangmo, Assistant Instructor, Khuruthang MSS, Punakha
3. Kinley Namgyal, Specialist, REC, Paro.

Contributors for the development of first edition 2022:

Advisors

1. Tashi Namgyel, Director, DCPD, Thimphu
2. Wangpo Tenzin, Dean, Specialist, DCPD, Thimphu

Researchers and writers

1. Lal Maya Shyangdan, Assistant Instructor, Khuruthang MSS, Punakha
2. Kinley Namgyal, Specialist, DCPD, Thimphu

Foreword

COVID-19 has suddenly caused unforgiving disruptions in public education all over the world and brought about threats of fragmentation due to disparities in accessibility and connectivity in many systems. In Bhutan too, continuity of education and learning has been severely affected as a result of nationwide school closures and due to restrictions and health protocols. The disruptions have led to challenges in many existing patterns and trends in education resulting in a massive shift away from teaching and learning in traditional settings.

In the new normal education, human interaction and well-being are a priority. Digital technology that enables communication, collaboration and learning across distance, is a source of innovation and expanded potentials. As we embrace this exceptional opportunity to transform the world, and as we reimagine the organization of our educational institutions and learning environments, we need to think about where we want to go.

In the post COVID 19 era, we must prioritize the development of the whole person not just academic knowledge. Inspiration for the change can be drawn from the 1996 Delors report, *Learning the treasure within*, in its specification of four pillars of learning as “learning to know”, “to do”, “to be”, and “to live together”. Therefore, curricula must be increasingly perceived as an integrated and based on themes and problems that allows learners to learn to live in peace with our common humanity and our common planet. This has the potential in the development of a strong base of knowledge about one’s self and about the world and find purpose and be better able to participate in social and political milieu.

The National School Curriculum is, not just a mere response to the pandemic, but also a culmination of the curriculum reform work for the last four years by the then Royal Education Council. It is an attempt to transform education from the teaching of “what” to learning of “how” and “why” towards empowering learners with the transversal competencies and the 21st century skills, and preparing them to be lifelong learners. We are optimistic that this move orients our education process towards nurturing nationally rooted and globally competent citizens.

Wish all our learners and teachers a life enriching experiential teaching and learning.

Tashi Delek.



Tashi Namgyel
Director

Introduction

Technical and Vocational Education and Training (TVET) is aimed at providing knowledge and skills for employment. It comprises education, training and skills development related to a wide range of occupational fields, production, services and livelihood. The Department of Curriculum and Professional Development, Ministry of Education envisages that the TVET curriculum has a place in the mainstream education system, as it is the case in most of the education systems of the developed world. The formal Technical and Vocational Education and Training (TVET) began in 1965 at Don Bosco Technical School (DBTS), in Kharbandi (presently known as Rinchenling) in Phuntsholing. Even after that, major curriculum reform was planned by the then Department of Curriculum Research and Development (DCRD) in an attempt to make education relevant to the Bhutanese society through diversification of Secondary Education Curriculum in the schools, which included the introduction of TVET.

As per 'National Education Framework' developed collaboratively by the Royal Education Council (REC) and the Ministry of Education (MoE), it provides a pathway on integrating technical/vocational education in the mainstream school education curriculum and as elective subjects in higher classes (NEF, 2009; page 64).

With the collaborative efforts of the Ministry of Labour and Human Resources and the erstwhile Department of Curriculum Research and Development, Vocational Curriculum has been introduced in the schools with assistance from TTIs since 2011. After the first MoU that was signed between MoE and MoLHR in 2011, the second MoU was signed again in 2014, to improve technical/vocational courses. The technical/vocational courses offered by the TTIs/IZCs are adapted and redesigned and are offered in schools aligning to the 'Bhutan Education Blue Print' 2014-2024, which recommends upscaling and diversification of TVET in schools through the provision of alternative pathways in schools and the tertiary education systems, owing to the limited access to such courses, despite the growing demand for technical skills in the country.

The resolutions of the National School Curriculum Conference 2016, also strongly emphasised the need to upscale and deepen TVET. Accordingly, the TVET framework is developed from classes PP to XII, schools equipped with necessary resources and instructors trained. Tripartite MoU among the then REC, MoE and MoLHR was also signed in 2018 to implement the programmes collaboratively.

Although the TVET curriculum is competency based with more emphasis on hands-on experience, further improvements have been made taking care of cognitive and affective domains besides psychomotor. Teaching and learning approaches have also been enriched with the recommendation to use ICT and online resources. Since the pandemic (COVID-19) has resulted in the closure of schools, it has taught us lessons to be prepared for such an untoward situation in the future. Thus, the National School Curriculum Instructional Guide is prepared not only to encourage blended learning but also to facilitate remote learning. The guide would help the schools to implement the curriculum effectively without limiting to contact teaching/learning besides using a variety of pedagogies.

Purpose of the Instructional Guide

Among the many definitions of ‘curriculum’ this Instructional Guide underscores the meaning of curriculum as a standard and competency-based sequence of planned learning experiences where learners practise and achieve the proficiency in applying the learning experiences in real life scenarios. These proficiencies, in the curriculum framework, have been stated as “competencies” and ‘objectives’ for each class. In keeping with the principle, ‘less is more’ as stated the National School Curriculum, the contents of the curriculum have been reworked, so that learners can be engaged more in activities that can lead to the acquisition of required skills rather than having them ‘cover the syllabus’.

This Instructional Guide believes that the classroom teachers, as professional individuals, can make the most authentic and reliable judgment about each learner’s learning needs and the learning experiences to be provided to propel the learners in the learning continuum. With these beliefs and principles as the background, the following are the purposes of this document.

- Facilitate learners acquire required skills and competencies.
- Strengthen blended learning, including flipped classroom with multimedia, digital pedagogies and ICT devices and websites as tools to share the responsibility of learning amongst the learners, teachers, the parents and other stakeholders.
- Facilitate the use of Continuous Formative Assessment for learning using diverse appropriate assessment techniques and tools commensurate with individual differences in learning, and gather evidence to guide planning of educational programmes and activities for learners.
- Promote inclusive learning through the blended learning which facilitates learning anywhere, any time with the learner being responsible for the learning.
- Provide suggestive means of acquiring required skills by building interrelationship among, and through, the integration of the four strands of the curriculum.
- Help teachers assume the roles of facilitator, guide, motivator and evaluator.
- Guide teachers, parents and other stakeholders in helping learners achieve their potential.
- Empower teachers to design their own ‘course of study’ or ‘class curriculum’ for their students in line with the National School Curriculum Framework.
- Enhance sharing the burden of responsibility and accountability for learning amongst the stakeholders, including the learners themselves.

In this age of advanced communication and information technology, contents are widely available from a number of sources. Therefore, the teachers can select, structure and sequence the contents as required to best suit the learners’ need while maintaining coherence and consistency. In other words, while the contents of the curriculum are negotiable, the competencies and objectives are not. While, teachers may have access to number of materials, it should be kept in mind that the teaching and learning should be focused on achieving the competencies rather than ‘covering of the syllabus’. The teaching learning materials should be used as means to create a learning environment that is competency-based where the learners need to master the skills presented to them. While designing lesson plans and teaching learning activities, teachers need to ensure that the materials are relevant and appropriate for the given task.

The assessment should be competency-based wherein the teachers should assess the learners’ mastery of the skills stated as competencies and objectives for each class. Teachers should use appropriate assessment tools and techniques depending on the nature of the learning activities. The learners should be clearly informed about the success criteria, the areas of assessment and the tools to be used so that they know exactly what tasks are to be performed or expected of them. In the

process of the performance, the teacher should continuously provide feedback and, if necessary, modify instructions. Efforts have to be made to ensure that every learner has mastered the skills.

TABLE OF CONTENTS

Acknowledgements	iii
Foreword	iv
Introduction	v
Purpose of the Instructional Guide	vi
CLASS XI	1
MODULE 1: CARRYING OUT SHIELDED METAL ARC WELDING (SMAW)	1
Chapter 4: Performing SMAW on pipe	1
4.1 Performing fillet weld in horizontal rolled position (1F)	1
4.2 Performing groove weld in horizontal rolled position (1G)	2
4.3 Performing groove weld in a vertical fixed position (2G)	3
4.4 Performing fillet weld in horizontal fixed positions (5F)	4
4.5 Performing groove weld in horizontal fixed positions (5G)	4
Chapter 5: Performing arc cutting and gouging.....	6
5.1 Setting up arc cutting/gouging equipment.....	6
5.2 Performing arc cutting	7
5.3 Performing arc gouging	8
Chapter 6: Performing post SMAW work.....	9
6.1 Performing Penetrant Test(PT).....	9
6.2 Performing finishing work	10
6.3 Compiling work completion report	11
MODULE 2: CARRYING OUT OXY-ACETYLENE PROCESS.....	12
Chapter 1: Perform set up for Oxy-acetylene welding	12
1.1 Preparing base metal	12
1.2 Setting up oxy-acetylene welding equipment.....	13
1.3 Performing flame setting for oxy-acetylene welding	15
1.4 Setting up base metal.....	16
2.1 Performing straight line bead without filler rod.....	17
2.2 Performing straight line bead with filler rod	18
2.3 Welding fillet joint in flat position(1F)	19
2.4 Welding butt joint in flat position(1G)	20
2.5 Welding fillet joints in the horizontal position (2F)	21
2.6 Welding butt joint in the horizontal position (2G).....	22
2.7 Welding fillet joints in the vertical position (3F).....	22
2.8 Welding butt joint in the vertical position (3G)	23

Chapter 3: Perform oxy-acetylene cutting	24
3.1 Setting up oxy-acetylene cutting equipment	24
3.2 Perform flame setting for oxy-acetylene cutting	25
3.3 Prepare base metal	25
3.4 Performing straight cutting.....	26
3.5 Performing angle cutting.....	27
3.6 Performing profile cutting.....	28
Chapter 4: Perform brazing.....	29
4.1 Prepare base metal	29
4.2 Set up base metal	29
4.3 Braze the work piece	30
Chapter 5: Perform post work for oxy-acetylene processes.....	32
5.1 Performing visual inspection workpiece	32
5.2 Maintaining oxy-acetylene equipment	33
5.3 Compiling work completion report	34
RESOURCES.....	34

CLASS XI

MODULE 1: CARRYING OUT SHIELDED METAL ARC WELDING (SMAW)

Chapter 4: Performing SMAW on pipe

A. Competency/Competencies:

- i. Perform fillet weld in 1F position.

B. Learning objectives/Topic:

Learning objectives	Topic
4.1.1 Explain the current setting of plate weld in horizontal rolled position 4.1.2 Explain the pipe welding position 4.1.3 Explain the pipe welding techniques. 4.1.4 <i>Ensure appropriate use of PPE.</i>	4.1 Performing fillet weld in horizontal rolled position (1F) Overview: The learners can acquire the technique to perform fillet weld in 1F position besides knowing about different types of pipe welding positions.

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 1.1
- ✓ Share the web links <https://youtu.be/KpFXGbv1Kbg> to further clarify the different types of welding positions.
- ✓ Let learners in the group discuss different position in pipe welding and their applications referring to the CBLM and the link shared.
- ✓ Using the information gathered from the various resources, Let learners in the group prepare a presentation on different types of pipe welding position.
- ✓ Demonstrate the pipe welding in 1F position referring to the OPERATION SHEET 4.1.
- ✓ Let learners perform OPERATION SHEET 4.1 in groups followed by individual practices.
- ✓ Let learners solve SAMPLE SELF CHECK 4.1.
- ✓ Provide information on different types of welding positions through Google Classroom referring INFORMATION SHEET 4.1.
- ✓ Share the web link <https://youtu.be/KpFXGbv1Kbg> to further clarify the different types of welding positions.
- ✓ Using the information gathered from the various resources, Let learners in the group prepare a presentation using any one of the presentation software on different types of pipe welding position.
- ✓ Let learners solve SAMPLE SELF CHECK 1.1

D. Assessment:

- ✓ Assess the learners' conceptual understanding of different types of pipe welding positions using a rubric.
- ✓ Assess the learners' performance referring to OPERATION SHEET 4.1
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 4.1
- ✓ Assess the learners' conceptual understanding of different types of pipe welding positions using a rubric through the presentation uploaded in Google Classroom using rubrics and checklist.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 4.1 uploaded in Google Classroom or any other social media platforms.

E. Resources:

- ✓ CBLM
- ✓ <https://youtu.be/KpFXGbv1Kbg> (Explain different types of pipe welding position.)

A. Competency/Competencies:

- i. Perform groove weld in 1G position

B. Learning objectives/Topic:

Learning objectives	Topic
4.2.1 Explain current setting for groove weld in horizontal rolled position (1G) 4.2.2 Explain the types of pipe joints 4.2.3 State the application of groove joints in horizontal rolled position	4.2 Performing groove weld in horizontal rolled position (1G) Overview: The technique to perform groove weld in 1G position and the information on the different types of pipe joint are covered.

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 4.2.
- ✓ Share the web link <https://youtu.be/8-BcSwxV7TY> to clarify the types of pipe joints.
- ✓ Let learners read the information on the techniques of welding pipe in 1G from the CBLM.
- ✓ Demonstrate and perform OPERATION SHEET 4.2 in groups and later individually.
- ✓ Let learners solve SAMPLE SELF CHECK 4.2.

D. Assessment:

- ✓ Assess the learners' conceptual understanding of gas welding materials and gas welding hazardous through the presentation using rubrics and a checklist.
- ✓ Assess the learners' performance referring to OPERATION SHEET 4.2.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 4.2
- ✓ Assess the learners' conceptual understanding of different types of pipe joint through the presentation uploaded in Google Classroom using rubrics and checklist.

- ✓ Assess the learners' responses to SAMPLE SELF CHECK 4.2 uploaded in Google Classroom.
- ✓ The learner seeks and provides feedback to each other.

E. Resources:

- ✓ CBLM
- ✓ <https://youtu.be/8-BcSwxV7TY> (Explanation on different types of pipe joint)

A. Competency/Competencies:

- i. Perform groove weld in 2G position.

B. Learning objectives/Topic:

Learning objectives	Topic
4.3.1 Explain the selection of parameters for pipe welding in a 2G welding position 4.3.2 <i>Ensure appropriate use of PPE</i>	4.3 Performing groove weld in a vertical fixed position (2G) Overview: The technique to perform groove weld in 2G position is covered.

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 4.3
- ✓ Share the web link <https://youtu.be/hanLkqZdwGs> to understand more on the technique to perform groove weld in a vertical fixed position (2G).
- ✓ Demonstrate the technique to perform groove weld in a vertical fixed position (2G).
- ✓ Let learners carry out guided practice in a group followed by individual practice referring to OPERATION SHEET 4.3.
- ✓ Let learners solve SAMPLE SELF CHECK 4.3

D. Assessment:

- ✓ Assess the learners' performance referring to OPERATION SHEET 4.3.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 4.3.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 4.3 uploaded in Google Classroom or any other social platforms.

E. Resources:

- ✓ CBLM
- ✓ <https://youtu.be/hanLkqZdwGs> (Explains the techniques to perform groove weld in a vertical fixed position)

A. Competency/Competencies:

- i. Perform fillet weld in 5F position
- ii. Perform staggering

B. Learning objectives/Topic:

Learning objectives	Topic
4.4.1 Explain the selection of parameters for pipe welding in 5F position 4.4.2 Explain the importance of maintaining throat size 4.4.3 Explain the importance of staggering 4.4.4 State the method of pipe welding in 5F position 4.4.5 State the application of pipe welding in 5F position 4.4.6 <i>Ensure appropriate use of PPE.</i>	4.4 Performing fillet weld in horizontal fixed positions (5F) Overview: The importance of maintaining throat size and staggering can be learnt besides knowing the technique to perform fillet weld in 5F position.

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 4.4
- ✓ Let learners perform OPERATION SHEET 1.4 in groups and later individually.
- ✓ Let learners go through the notes provided in the Google Classroom.
- ✓ Let learners solve SAMPLE SELF CHECK 4.4

D. Assessment:

- ✓ The teachers may design the rubrics to assess their work by judging their assigned works.
- ✓ Teachers to assess the given work through social media (Telegram, Wechat, Google Classroom, Messenger and through mails)

E. Resources:

- ✓ CBLM

A. Competency/Competencies:

- i. Perform groove weld in 5G position.

B. Learning objectives/Topic:

Learning objectives	Topic
4.5.1 Explain the correct selection of welding parameters for pipe welding in the 5G position. 4.5.2 <i>Ensure appropriate use of PPE.</i>	4.5 Performing groove weld in horizontal fixed positions (5G) Overview: The technique to perform groove weld in 5G position is covered.

C. Learning Experiences:

- ✓ Let the learners read INFORMATION SHEET 4.5
- ✓ Demonstrate how to weld groove joint in horizontal fixed position (5G) in group-wise
- ✓ Let learners practice in a group followed by individual practice.
- ✓ Let learners perform OPERATION SHEET 4.5

D. Assessment:

- ✓ Assess the learners' performance to OPERATION SHEET 1.5 and assess their conceptual and practical understanding of gas welding butt joint in flat The teachers may design the rubrics to assess their work by judging their assigned works.
- ✓ Teachers to assess the given work through social media (Telegram, Wechat, Google Classroom, Messenger and through mails)

E. Resources:

- ✓ CBLM

Chapter 5: Performing arc cutting and gouging

A. Competency/Competencies:

- i. Perform set up for arc cutting/gouging

B. Learning objectives/Topic:

Learning objectives	Topic
5.1.1 Explain the power source of SMAW(AC/DC) 5.1.2 Explain the difference between MMA gouging and cutting 5.1.3 <i>Ensure appropriate use of PPE</i>	5.1 Setting up arc cutting/gouging equipment Overview: This lesson covers the basic information on arc cutting and gouging besides different types of power source used for arc cutting and arc gouging. The comparison between the gouging and cutting is also explained.

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 5.1.
- ✓ Share the web link <https://youtu.be/qMoPUXbtTyM> to understand the basic set up of arc cutting equipment.
- ✓ Demonstrate the setup for arc cutting and gouging equipment.
- ✓ Let learners carry out guided practice in a group followed by an individual.
- ✓ Let learners perform OPERATION SHEET 5.1
- ✓ Let learners solve SAMPLE SELF CHECK 5.1.

D. Assessment:

- ✓ Assess the learners' performance to OPERATION SHEET 5.1 and assess their conceptual and practical understanding of setting up the arc cutting and gouging using a rubric.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 5.1
- ✓ Provide additional questions.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 5.1 uploaded in Google Classroom and any other social platforms.

E. Resources:

- ✓ CBLM
- ✓ <https://youtu.be/qMoPUXbtTyM> (Basic demonstration of setting up arc cutting and gouging equipment)

A. Competency/Competencies:

- i. Perform arc cutting

B. Learning objectives/Topic:

Learning objectives	Topic
5.2.1 Explain the basic principle of arc cutting 5.2.2 State the selection of parameters 5.2.3 State the types of cutting electrode 5.2.4 Explain the selection of electrode 5.2.5 List the composition of arc cutting electrode 5.2.6 State the importance of polarity in arc cutting 5.2.7 State the application and limitation of arc cutting. 5.2.8 <i>Ensure appropriate use of PPE</i>	5.2 Performing arc cutting Overview: Informations on the basic principle of arc cutting, its parameter selection and types of electrodes are covered. The application and limitation of arc welding cutting is also covered besides imparting the techniques of arc cutting.

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 5.2
- ✓ Demonstrate how to arc cut in the group.
- ✓ Let learners perform OPERATION SHEET 5.2 in a group followed by individual practice.
- ✓ Let learners solve SAMPLE SELF CHECK 5.2

D. Assessment:

- ✓ Assess the learners' conceptual understanding of arc cutting by conducting a class test.
- ✓ Assess the learners' performance referring to OPERATION SHEET 5.2.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 5.2

E. Resources:

- ✓ CBLM

A. Competency/Competencies:

- i. Perform arc gouging

B. Learning objectives/Topic:

Learning Objectives	Topic
5.3.1 Define gouging 5.3.2 State the types of gouging process 5.3.3 Explain the application of arc gouging 5.3.4 State the selection of parameters 5.3.5 List the methods of arc gouging 5.3.6 <i>Ensure appropriate use of PPE.</i>	5.3 Performing arc gouging Overview: The learners can perform arc gouging besides knowing the types and application of arc gouging.

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 5.3. on the techniques of arc gouging.
- ✓ Share the web link <https://youtu.be/Fv9trcAzsU4> to understand
- ✓ Demonstrate the techniques to perform arc gouging.
- ✓ Let learners read and perform OPERATION SHEET 5.3 in a group followed by an individual. Provide guided practice.
- ✓ Let learners solve SAMPLE SELF CHECK 5.3.

D. Assessment:

- ✓ Assess the learners' performance of OPERATION SHEET 5.3.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 5.3.
- ✓ Provide feedback.

E. Resources:

- ✓ CBLM
- ✓ <https://youtu.be/Fv9trcAzsU4> (Explanation on the basic techniques on arc gouging)

Chapter 6: Performing post SMAW work

A. Competency/Competencies:

- i. Perform penetrant test

B. Learning objectives/Topic:

Learning objectives	Topic
6.1.1 Define penetrant test 6.1.2 State the purpose of penetrant test 6.1.3 Explain the principle of penetrant test 6.1.4 Explain the acceptance criteria for PT 6.1.5 Define dwell time, drying time, development time, evaluation time and interpretation time 6.1.6 Explain the types of penetrant test 6.1.7 Describe the types of indication 6.1.8 State the types of testing method 6.1.9 Define capillary action 6.1.10 Explain the types of weld defects and its remedies 6.1.11 <i>Betime conscious</i>	6.1 Performing Penetrant Test(PT) Overview: This lesson covers the basic information on penetrant test and its types. It also covers the principle of penetrant test.

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 6.1.
- ✓ Share the web link <https://youtu.be/kEfwkLhNOnM> to understand the basic principle of penetrant test.
<https://youtu.be/XxZrcr98Zog> to understand the dye penetrant test
<https://youtu.be/kL2koZRNCb0> to understand the liquid penetrant test
<https://youtu.be/93sRATwdHo4> and <https://youtu.be/m7ABg--BVv8> to understand the principle of magnetic particle test.
<https://youtu.be/ngg6QS3B6Yw> to understand more on the types of welding defects.
- ✓ Demonstrate the principle of penetrant test.
- ✓ Let learners practice in a group followed by an individual.
- ✓ Provide guided practices and necessary intervention.
- ✓ Let learners perform OPERATION SHEET 6..
- ✓ Let learners solve SAMPLE SELF CHECK 6.1.

D. Assessment:

- ✓ Assess the learners' performance to OPERATION SHEET 6.1 and assess their conceptual and practical understanding of the basic principle of penetrant test using a rubric.

- ✓ Assess the learners' responses to SAMPLE SELF CHECK 6.1
- ✓ Provide additional questions.
- ✓ Provide necessary intervention.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 6.1 uploaded in Google Classroom and any other social platforms.
- ✓ Provide feedback and intervention.

E. Resources:

- ✓ CBLM
- ✓ <https://youtu.be/kEfwkLhNOnM> (the basic principle of penetrant test)
- ✓ <https://youtu.be/XxZrcr98Zog> (the dye penetrant test)
- ✓ <https://youtu.be/kl2koZRNcb0> (the liquid penetrant test)
- ✓ <https://youtu.be/93sRATwdHo4> and <https://youtu.be/m7ABg--BVv8> (the principle of magnetic particle test)
- ✓ <https://youtu.be/ngg6QS3B6Yw> (the types of welding defects)

A. Competency/Competencies:

- i. Perform finishing work

B. Learning objectives/Topic:

Learning objectives	Topic
6.2.1 Explain the importance of surface cleaning 6.2.2 Explain weld defects in SMAW process and its causes and remedies 6.2.3 State the types of paint and its importance 6.2.4 <i>Be time conscious</i>	6.2 Performing finishing work Overview: This lesson covers the basic information on how to finish the practical works which includes the information on the surface cleaning and also the types of paint used in metal work.

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 6.2.
- ✓ Share the web link <https://youtu.be/ALLhN0i6ycw> to understand the basic principle of penetrant test.
- ✓ Demonstrate the surface finishing.
- ✓ Let learners practice in a group followed by an individual.
- ✓ Provide guided practices and necessary intervention.
- ✓ Let learners perform OPERATION SHEET 6.2.
- ✓ Let learners solve SAMPLE SELF CHECK 6.2.

D. Assessment:

- ✓ Assess the learners' performance to OPERATION SHEET 6.1 and assess their conceptual and practical understanding of the surface finishing using a rubric.

- ✓ Assess the learners' responses to SAMPLE SELF CHECK 6.2
- ✓ Provide additional questions.
- ✓ Provide necessary intervention.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 6.2 uploaded in Google Classroom and any other social platforms.
- ✓ Provide feedback and intervention.

E. Resources:

- ✓ CBLM

A. Competency/Competencies:

- i. Compile work completion report.

B. Learning objectives/Topic:

Learning objectives	Topic
6.3.1 Explain the report format 6.3.2 Explain the importance of work completion report 6.3.3 Explain the basic estimation and costing for SMAW process	6.3 Compiling work completion report Overview: After the completion of every practical works, This lesson covers the basic information on penetrant test and a report writing is necessary to keep the record of the work carried out besides the knowing the estimation and the costing of SMAW process.

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 6.3.
- ✓ Demonstrate how to calculate the estimating and costing of the SMAW process. .
- ✓ Let learners practice in a group followed by an individual.
- ✓ Provide guided practices and necessary intervention.
- ✓ Let learners perform OPERATION SHEET 6.3
- ✓ Let learners solve SAMPLE SELF CHECK 6.3.

D. Assessment:

- ✓ Assess the learners' performance to OPERATION SHEET 6.3 and assess their conceptual understanding of the estimation and costing of work piece using a rubric.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 6.3
- ✓ Provide additional questions.
- ✓ Provide necessary intervention.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 6.3 uploaded in Google Classroom and any other social platforms.
- ✓ Provide feedback and intervention.

E. Resources:

✓ CBLM

CLASS XII

MODULE 2: CARRYING OUT OXY-ACETYLENE PROCESS

Chapter 1: Perform set up for Oxy-acetylene welding

A. Competency/Competencies:

- i. Prepare base metal for oxy-acetylene welding as per the requirement.

Learning objectives	Topic
1.1.1 Explain the types of base metal 1.1.2 State the types of marking and cutting tools 1.1.3 State the importance of cutting tolerance 1.1.4 Explain the types of joints 1.1.5 List the types of welding position 1.1.6 <i>Betime conscious</i> 1.1.7 <i>Bevigilant</i>	1.1 Preparing base metal Overview: The topic is about how the workpiece is prepared before oxy-acetylene welding. It includes the information on different types of marking tools, types of joint and types of welding position.

B. Learning objectives/Topic:

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 1.1
- ✓ Share the web links <https://youtu.be/w83NMv9c4I4> to further clarify the different types of marking tools.
- ✓ Let learners in the group discuss different marking tools used and their functions. The learner looks for the information referring to the CBLM and the link shared.
- ✓ Using the information gathered from the various resources, Let learners in the group prepare a presentation on different types of marking tools used.
- ✓ Let learners perform SKILL SHEET 1.1 and OPERATION SHEET 1.1 in groups followed by individual practices.
- ✓ Let learners solve SAMPLE SELF CHECK 1.1.

D. Assessment:

- ✓ Assess the learners' conceptual understanding of different marking tools used using a rubric.
- ✓ Assess the learners' performance referring to SKILL SHEET 1.1 and OPERATION SHEET 1.1
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 1.1

E. Resources:

- ✓ Competency-Based Learning Material
- ✓ <https://youtu.be/w83NMv9c4I4> (Different types of marking tools)

A. Competency/Competencies:

- i. Adjust and set the welding equipment to perform gas welding

B. Learning objectives/Topic:

Learning objectives	Topic
1.2.1 Explain the oxy-acetylene welding 1.2.2 Differentiate the features of oxygen and acetylene cylinder 1.2.3 Explain the Do's and Don'ts while handling gas cylinders 1.2.4 List the type of gas 1.2.5 Explain the importance of cracking gas cylinder 1.2.6 Explain the working principle of regulator 1.2.7 State the function of regulator 1.2.8 List the types of regulator 1.2.9 Explain the function of flashback arrestor(FBA) 1.2.10 Explain the construction and working principle of blowpipe 1.2.11 State characteristics of hose 1.2.12 <i>Bevigilant</i> 1.2.13 <i>Bework ethics and integrity</i> 1.2.14 <i>Beefficient in using resources</i> 1.2.15 <i>Ensure proper handling of tools, equipment and materials</i>	1.2 Setting up oxy-acetylene welding equipment Overview: The topic covers basic informations on the setting up of the oxy-actylene welding like the safety precaution of cylinders, and the importance of cracking the gas cylinders, etc.,

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 1.2
- ✓ Share the web links <https://youtu.be/XJ1Loh7eF-A> and <https://youtu.be/mibENu9te20> to further clarify the working principle of oxy-acetylene welding.
- ✓ Let learners in the group discuss difference between the features of oxygen and acetylene cylinders. The learner looks for the information referring to the CBLM and the link shared.
- ✓ Let learners read the information on the Do's and Don'ts of gas cylinders handling from the CBLM and the link <http://www.ionapex.com/safety-talks/all-topics/gas-cylinders-dos-and-donts.shtml>
- ✓ Let learners perform OPERATION SHEET 1.2 in groups followed by individual practices

- ✓ Let learners solve SAMPLE SELF CHECK 1.2.
- ✓ Let learners read INFORMATION SHEET 1.2
- ✓ Share the web link <https://youtu.be/XJ1Loh7eF-A> to further clarify the working principle of oxy-acetylene welding.
- ✓ Share the web link <https://youtu.be/YskH4MHBQFw> to explore gas welding safety.
- ✓ Let learners read the information on the Dos and Don'ts of gas cylinders handling from the CBLM and from the link <http://www.ionapex.com/safety-talks/all-topics/gas-cylinders-dos-and-donts.shtml>
- ✓ Let learners read the OPERATION SHEET 1.2.
- ✓ Share the web link https://www.boc.com.au/wcsstore/AU_BOC_Industrial_Store/pdf/product/en_AU/Guidelines-for%20Gas-Welding-and-Cutting.pdf (refer page no 14-18) to explore setting up, lighting up, and shutting down of the oxy-acetylene welding.
- ✓ Let learners solve SAMPLE SELF CHECK 1.2.

D. Assessment:

- ✓ Assess the learners' conceptual understanding of gas welding materials and gas welding hazardous through the presentation using rubrics and a checklist.
- ✓ Assess the learners' performance referring to OPERATION SHEET 1.2.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 1.2

E. Resources:

- ✓ Competency-Based Learning Materials
- ✓ <https://weldguru.com/welding-metals/> (Explanation on types of welding metals)
- ✓ <https://youtu.be/ibbqPMR1sYU> (Explanation on the principle and function of flashback arrestor)
- ✓ <https://youtu.be/JObaMbIT8Bs> (Explanation of the principle and function of flashback arrestor)
- ✓ <https://youtu.be/X96UnvRtHRo> (Explanation of the causes of flashback)
- ✓ <https://youtu.be/9adOLZaP7SA> (Explanation of the hazards of gas welding)

A. Competency/Competencies:

- i. Perform flame setting for oxy-acetylene welding.

B. Learning objectives/Topic:

Learning objectives	Topic

1.3.1 Explain the working principle of oxy-acetylene welding 1.3.2 State the characteristics of oxygen and acetylene 1.3.3 Explain the types of flame and its characteristics 1.3.4 List the application of flames 1.3.5 Explain the indication, causes and remedies of backfire and flash back 1.3.6 State the importance of nozzle tip cleaning 1.3.7 List the advantages and limitations of oxy-acetylene welding 1.3.8 <i>Betime conscious</i>	1.3 Performing flame setting for oxy-acetylene welding Overview: The topic covers the basic information of flame setting for oxy-acetylene welding. It also covers the importance of nozzle tip cleaning.
---	--

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 1.3.
- ✓ Share the web link <https://youtu.be/ibbqPMR1sYU> to clarify the working principle of flashback arrestor of oxy-acetylene welding.
- ✓ Let learners in groups explore the following web links:
<https://weldguru.com/welding-metals/>
<https://youtu.be/X96UnvRtHRo>
<https://youtu.be/9adOLZaP7SA> to discuss different materials used to weld and hazards of oxy-acetylene welding.
- ✓ Using the information gathered from the various resources, Let learners in the group prepare a presentation on gas welding materials and gas welding hazardous.
- ✓ Let learners read the information on the characteristics of oxygen and acetylene from the CBLM.
- ✓ Let learners perform OPERATION SHEET 1.3.
- ✓ Let learners solve SAMPLE SELF CHECK 1.3.

D. Assessment:

- ✓ Assess the learners' performance referring to OPERATION SHEET 1.3.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 1.3.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 1.3 uploaded in Google Classroom or any other social platforms.

E. Resources:

- ✓ CBLM
- ✓ <https://youtu.be/ibbqPMR1sYU> (Principle of flashback arrestor)

A. Competency/Competencies:

- i. Set up base metal.

B. Learning objectives/Topic:

Learning objectives	Topic
1.4.1 Explain the selection of nozzle 1.4.2 List the types of clamping device 1.4.3 Explain the distortion of base metal and its control	1.4 Setting up base metal Overview: The importance to select the correct nozzle to obtain the best weld bead is covered in setting up base metal.

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 1.4
- ✓ The link <https://youtu.be/OEAbInBpric> can be shared to explore more on the clamping devices.
- ✓ Demonstrate the different types of nozzle.
- ✓ Let learners perform OPERATION SHEET 1.4 in groups and later individually.
- ✓ Let the learner solve SAMPLE SELF CHECK 1.4

D. Assessment:

- ✓ The learners perform OPERATION SHEET 1.4 and assess their performances.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 1.4
- ✓ Provide additional questions.

E. Resources:

- ✓ CBLM
- ✓ <https://youtu.be/OEAbInBpric> (Types of clamping devices)

Chapter 2: Performing oxy-acetylene welding

A. Competency/Competencies:

- i. Perform straight line bead without filler rod.

B. Learning objectives/Topic:

Learning objectives	Topic
2.1.1 State the application of straight line bead without filler rod	2.1 Performing straight line bead without filler rod Overviews: The performance of straight line bead without filler rod is covered besides knowing about the welding techniques.
2.1.2 Explain the importance of maintaining blowpipe angle	
2.1.3 List the welding techniques	
2.1.4 Explain the types of blowpipe and their functions	
2.1.5 Explain the importance of using ceramic blanket after welding	
2.1.6 <i>Betime conscious</i>	

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 2.1
- ✓ The web link <https://youtu.be/6LOo2eZvSdw> can be shared to understand more on the selection of blowpipe.
- ✓ Demonstrate how to gas weld straight line bead without using filler rod in group-wise
- ✓ Let learners carry out guided practice in a group followed by individual practice.
- ✓ Let learners perform OPERATION SHEET 2.1
- ✓ Let learners solve SAMPLE SELF CHECK 2.1

D. Assessment:

- ✓ Assess the learners' performance to OPERATION SHEET 2.1 and assess their conceptual and practical understanding of gas welding in straight line bead without filler rod using a rubric.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 2.1
- ✓ Provide additional questions.

E. Resources:

- ✓ CBLM
- ✓ <https://youtu.be/6LOo2eZvSdw> (Selection of blowpipe)

A. Competency/Competencies:

- i. Perform straight line bead with filler rod.

B. Learning objectives/Topic:

Learning objectives	Topic
2.2.1 State the application straight line bead with filler rod 2.2.2 List the types of filler rod 2.2.3 Explain the selection of filler rod 2.2.4 Explain the feeding techniques of filler rod	2.2 Performing straight line bead with filler rod Overview: The performance of straight line bead with filler rod is covered besides knowing about the types of filler rod and its selection.

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 2.2.
- ✓ Share the web link https://youtu.be/MqTKF9gX_HE to understand the types of filler rod.
- ✓ Demonstrate the techniques to perform straight line bead with filler rod.
- ✓ Let learners carry out guided practice in a group followed by an individual.
- ✓ Let learners perform OPERATION SHEET 2.2
- ✓ Let learners solve SAMPLE SELF CHECK 2.2.

D. Assessment:

- ✓ Assess the learners' performance to OPERATION SHEET 2.2 and assess their conceptual and practical understanding of straight line bead with filler rod using a rubric.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 2.2
- ✓ Provide additional questions.

E. Resources:

- ✓ CBLM
- ✓ https://youtu.be/MqTKF9gX_HE (Types of filler rod)

A. Competency/Competencies:

- i. Weld fillet joint in flat position(1F)

B. Learning objectives/Topic:

Learning objectives	Topic
2.3.1 Explain the selection of parameter 2.3.2 List the types of welding position 2.3.3 State the application of fillet joint in flat position 2.3.4 <i>Ensure appropriate use of PPE</i>	2.3 Welding fillet joint in flat position(1F) Overview: Welding fillet joint in flat position (1F) can be learnt besides knowing the types of welding position.

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 2.3
- ✓ The link <https://youtu.be/hr4bKrv0rsI> (from 0sec to 1min 46sec) can be shared to explore the techniques of gas welding while performing OPERATION SHEET 2.3.
- ✓ Demonstrate how to gas weld fillet joints in the flat position
- ✓ Let learners perform OPERATION SHEET 2.3 in groups and later individually.
- ✓ Let learners solve SAMPLE SELF CHECK 2.3

D. Assessment:

- ✓ Let learners perform OPERATION SHEET 2.3 and assess their performances.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 2.3
- ✓ Provide additional questions.
- ✓ Assess the learners' conceptual understanding of gas welding fillet joints on flat position (1F) using a rubric and provide necessary intervention.

E. Resources:

- ✓ CBLM
- ✓ <https://youtu.be/hr4bKrv0rsI> (Explains the techniques of gas welding)

A. Competency/Competencies:

- i. Weld butt joint in flat

B. Learning objectives/Topic:

Learning Objectives	Topic
2.4.1 State the application of butt joint in flat position 2.4.2 <i>Betime conscious</i> 2.4.3 <i>Ensure appropriate use of PPE.</i>	2.4 Welding butt joint in flat position(1G) Overview: Welding butt joint in flat position (1G) can be learnt besides knowing the application of butt joint.

C. Learning Experiences:

- ✓ Let the learners read INFORMATION SHEET 2.4
- ✓ Demonstrate how to weld butt joint in flat position (1G) in group-wise
- ✓ Let learners carry out guided practice in a group followed by individual practice.
- ✓ Share the web link <https://youtu.be/FDSSEef3CL0> to explore the techniques of performing gas welding butt joint in flat position (1G) while reading OPERATION SHEET 2.4
- ✓ Let learners solve SAMPLE SELF CHECK 2.4

D. Assessment:

- ✓ Assess the learners' performance to OPERATION SHEET 2.4 and assess their conceptual and practical understanding of gas welding butt joint in flat position(1G) using a rubric.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 2.4
- ✓ Provide additional questions.

E. Resources:

- ✓ CBLM
- ✓ <https://youtu.be/FDSSEef3CL0> (Techniques to gas weld the butt joint in flat position)

A. Competency/Competencies:

- i. Weld fillet joints in the horizontal position(2F)

B. Learning objectives/Topic:

Learning objectives	Topic
2.5.1 Describe 2F 2.5.2 Describe the application of welding fillet joints in the horizontal position 2.5.3 Weld fillet joints in the horizontal position(2F) 2.5.4 <i>Ensure appropriate use of PPE</i>	2.5 Welding fillet joints in the horizontal position (2F) Overview: Welding fillet joint in horizontal position (2F) can be learnt besides knowing the application of fillet joint in the horizontal position.

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 2.5.
- ✓ Share the web link https://youtu.be/Li_pAMrUWSw to understand the technique to weld fillet joints in the horizontal position of gas welding.
- ✓ Share the web link <https://weldguru.com/welding-positions/> to explore fillet and groove weld joint in a different position.
- ✓ Demonstrate the techniques to weld the fillet joint in the horizontal position in gas welding.
- ✓ Let learners carry out guided practice in a group followed by an individual.
- ✓ Let learners perform OPERATION SHEET 2.5
- ✓ Let learners solve SAMPLE SELF CHECK 2.5.

D. Assessment:

- ✓ Assess the learners' performance to OPERATION SHEET 2.5 and assess their conceptual and practical understanding of gas welding fillet joints in the horizontal position (2F) using a rubric.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 2.5
- ✓ Provide additional questions.

E. Resources:

- ✓ CBLM
- ✓ https://youtu.be/Li_pAMrUWSw (Demo of fillet weld joint in horizontal position)
- ✓ <https://weldguru.com/welding-positions/> (Articles on fillet and groove weld joint in a different position)

A. Competency/Competencies:

- i. Weld butt joint in the horizontal position(2G)

B. Learning objectives/Topic:

Learning objectives	Topic
2.6.1 Define 2G 2.6.2 Describe the application of welding butt joint in the horizontal position 2.6.3 Weld butt joint in the horizontal position (2G) 2.6.4 <i>Ensure appropriate use of PPE</i>	2.6 Welding butt joint in the horizontal position (2G) Overview: Welding butt joint in horizontal position (2G) can be learnt besides knowing the application of butt joint in the horizontal position(2G)

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 2.6
- ✓ Demonstrate how to weld butt joint in the horizontal position (2G) in the group.
- ✓ Let learners perform OPERATION SHEET 2.6 in a group followed by individual practice.
- ✓ Let learners solve SAMPLE SELF CHECK 2.6

D. Assessment:

- ✓ Assess the learners' conceptual understanding of butt joint in horizontal position conducting the class test.
- ✓ Assess the learners' performance referring to OPERATION SHEET 2.6
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 2.6

E. Resources:

- ✓ CBLM

A. Competency/Competencies:

- i. Weld fillet joints in the vertical position for welding sheet metals.

B. Learning objectives/Topic:

Learning Objectives	Topic
2.7.1 State the application of fillet joint in vertical position 2.7.2 <i>Betime conscious</i>	2.7 Welding fillet joints in the vertical position (3F) Overview: Welding fillet joint in vertical position (2F) can be learnt besides knowing the application of fillet joint in the vertical position(2F)

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 2.7
- ✓ Demonstrate the techniques to weld the fillet joint in the vertical position in gas welding.
- ✓ Let learners read and perform OPERATION SHEET 2.7 in a group followed by an individual. Provide guided practice.
- ✓ Let learners solve SAMPLE SELF CHECK 2.7

D. Assessment:

- ✓ Assess the learners' performance of OPERATION SHEET 2.7.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 2.7.

E. Resources:

- ✓ CBLM
- ✓ Video on performing fillet joint in the vertical position

A. Competency/Competencies:

- i. Weld butt joints in the vertical position for welding sheet metals.

B. Learning objectives/Topic:

Learning Objectives	Topic
2.8.1 State the application of butt joint in vertical position 2.8.2 <i>Betime conscious</i>	2.8 Welding butt joint in the vertical position (3G) Overview: Welding butt joint in vertical position (2G) can be learnt besides knowing the application of butt joint in the vertical position(2G)

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 2.8
- ✓ Demonstrate the techniques to weld the butt joint in the vertical position in gas welding.
- ✓ Let learners read and perform OPERATION SHEET 2.8 in a group followed by an individual. Provide guided practice.
- ✓ Let learners solve SAMPLE SELF CHECK 2.8

D. Assessment:

- ✓ Assess the learners' performance of OPERATION SHEET 2.8.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 2.8.

E. Resources:

- ✓ CBLM
- ✓ Video on performing fillet joint in the vertical position

Chapter 3: Perform oxy-acetylene cutting

A. Competency/Competencies:

- i. Set the oxy-acetylene equipment to perform the cutting.

B. Learning objectives/Topic:

Learning objectives	Topic
3.1.1 Explain oxy-acetylene cutting process 3.1.2 Explain the working principle of oxy-acetylene cutting and its application 3.1.3 Describe the construction of cutting blowpipe 3.1.4 List the advantages and limitations of oxy-acetylene cutting process	3.1 Setting up oxy-acetylene cutting equipment Overview: The topic covers the basic information of oxy-acetylene cutting process and its working principle.

C. Pedagogy/learning experience

- ✓ Let learners read INFORMATION SHEET 3.1
- ✓ Share the web link <https://youtu.be/DaRnLakLoAc> to further clarify the working principle of oxy-acetylene cutting, the cutting process, and the construction of blowpipe.
- ✓ Based on the information gathered, the learners in the group prepare a presentation using any one of the presentation software on the difference between oxy-acetylene welding blowpipe and cutting blowpipe.
- ✓ Let learners read and perform OPERATION SHEET 3.1 in groups followed by individual practice.
- ✓ Let learners solve SAMPLE SELF CHECK 3.1.

D. Assessment:

- ✓ Assess the learners' conceptual understanding of oxy-acetylene cutting by providing assignments.
- ✓ Assess the learners' performance on OPERATION SHEET 3.1 using the checklist.
- ✓ Assess the learners' response to SAMPLE SELF CHECK 3.1.

E. Resources:

- ✓ CBLM
- ✓ <https://youtu.be/DaRnLakLoAc> (Working principle of gas cutting)

A. Competency/Competencies:

- i. Perform the oxy-acetylene cutting nozzle .

B. Learning objectives/Topic:

Learning objectives	Topic
3.2.1 State the types of cutting nozzle 3.2.2 Describe selection of cutting nozzle 3.2.3 Describe the importance of gas pressure setting	3.2 Perform flame setting for oxy-acetylene cutting Overview: The topic covers the basic information of oxy-acetylene cutting nozzle and its types.

C. Pedagogy/learning Experiences:

- ✓ Let the learners read INFORMATION SHEET 3.2
- ✓ Based on the information gathered, the learners in the group prepare a presentation using any one of the presentation software on the difference between types of cutting nozzles.
- ✓ Let the learners read and perform OPERATION SHEET 3.2 in groups followed by individual practice.
- ✓ Let the learners solve SAMPLE SELF CHECK 3.2.

D. Assessment:

- ✓ Assess the learners' conceptual understanding of oxy-acetylene cutting nozzle.
- ✓ Assess the learners' performance on OPERATION SHEET 3.2 using the checklist.
- ✓ Assess the learners' response to SAMPLE SELF CHECK 3.2.

E. Resources:

- ✓ CBLM

A. Competency/Competencies:

- i. Prepare base metal.

B. Learning Objectives/Topic:

Learning objectives	Topic
3.3.1 Explain the purpose of marking 3.3.2 List the types of marking tools 3.3.3 Explain the importance of cutting tolerance 3.3.4 Define template 3.3.5 Explain the importance of template	3.3 Prepare base metal Overview: The topic covers the basic information of marking tools and its importance.

C. Learning Experiences:

- ✓ Let the learners read INFORMATION SHEET 3.3
- ✓ Based on the information gathered, the learners in the group prepare a presentation using any one of the presentation software on different types of marking tools and equipments
- ✓ Let the learners read and perform OPERATION SHEET 3.3 in groups followed by individual practice.
- ✓ Let the learners solve SAMPLE SELF CHECK 3.3.

D. Assessment:

- ✓ Assess the learners' conceptual understanding of marking tools and its importance.
- ✓ Assess the learners' performance on OPERATION SHEET 3.3 using the checklist.
- ✓ Assess the learners' response to SAMPLE SELF CHECK 3.3.

E. Resources:

- ✓ CBLM

B. Competency/Competencies:

- i. Perform straight cutting in gas welding as per the job requirement.

C. Learning objectives/Topic:

Learning objectives	Topic
3.4.1 State the application of straight cutting 3.4.2 State the gas cutting defects and its remedies 3.4.3 <i>Bevigilant</i>	3.4 Performing straight cutting Overview: The topic covers the application of straight cutting besides the defects of gas cutting.

D. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 3.4 and OPERATION SHEET 3.4.
- ✓ Share the web link <https://youtu.be/7EGmrPiumEU> to understand the techniques of gas cutting in straight lines and the importance of maintaining the gap between cutting torch and workpiece.
- ✓ Demonstrate the techniques to cut materials and the importance of maintaining the gap between cutting torch and workpiece.
- ✓ Let learners perform OPERATION SHEET 3.4 in a group followed by an individual. Provide guided practice.
- ✓ Let learners solve SAMPLE SELF CHECK 3.4.

E. Assessment:

- ✓ Assess the learners' performance on OPERATION SHEET 3.4 using a checklist.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 3.4

F. Resources:

- ✓ CBLM
- ✓ <https://youtu.be/7EGmrPiumEU> (Explanation and demonstration of gas cutting in a straight line)

A. Competency/Competencies:

- i. Perform angle cutting

B. Learning objectives/Topic:

Learning objectives	Topic
3.5.1 Explain the relationship between cutting nozzle size, thickness of plate and cutting oxygen pressure 3.5.2 Describe the method of piercing a hole 3.5.3 State the application of angle cutting 3.5.4 <i>Bevigilant</i>	3.5 Performing angle cutting Overview: The topic covers the relationship between cutting nozzle size, the thickness of plate and the cutting oxygen pressure besides the application of angle cutting.

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 3.5 and OPERATION SHEET 3.5.
- ✓ Share the explore web link <https://youtu.be/IIejwFSz2SQ> to understand the techniques to perform gas cutting at angle or circle.
- ✓ Demonstrate the techniques to cut materials at an angle or in a circle.
- ✓ Let learners perform OPERATION SHEET 3.5 in a group followed by an individual. Provide guided practice.
- ✓ Let learners solve SAMPLE SELF CHECK 3.5.

D. Assessment:

- ✓ Assess the learners' performance on OPERATION SHEET 3.5 using the checklist.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 3.5.

E. Resources:

- ✓ CBLM
- ✓ <https://youtu.be/IIejwFSz2SQ> (Explanations on techniques to perform gas cutting in circle or angle)

A. Competency/Competencies:

- i. Create the cut surface without concavity.
- ii. Cut mild steel in profile shapes.

B. Learning objectives/Topic:

Learning objectives	Core concepts(Chapters/Topics)
3.6.1 Define profile cutting 3.6.2 State the application of profile cutting 3.6.3 List the cutting problems and causes 3.6.4 <i>Bevigilant</i> 3.6.5 <i>Ensure appropriate use of PPE</i>	3.6 Performing profile cutting Overview: The topic prepares the learners for profile cutting. It also covers the information like the application of profile cutting and the problems of cutting and its remedies.

C. Learning experience

- ✓ Let learners read INFORMATION SHEET 3.6
- ✓ Demonstrate different shape to be cut in metal and methods of profile cutting referring to OPERATION SHEET 3.6
- ✓ Let learners carry out guided practice in a group followed by individual practice.
- ✓ Let learners perform OPERATION SHEET 3.6
- ✓ Let learners solve SAMPLE SELF CHECK 3.6.

D. Assessment:

- ✓ Assess the learners' performance OPERATION SHEET 3.6 using the checklist.
- ✓ Assess the answers of SAMPLE SELF CHECK 3.6
- ✓ Assess the learners' conceptual understanding of profile cutting using a rubric.
- ✓ Assess the learners' conceptual understanding of profile cutting using a rubric.
- ✓ Assess the answers to SAMPLE SELF CHECK 3.6 uploaded in Google Classroom or any other social media.

E. Resources:

- ✓ CBLM

Chapter 4: Perform brazing

A. Competency/Competencies:

- i. Prepare base metal for brazing.

B. Learning objectives/Topic:

Learning objectives	Topic
4.2 Explain brazing 4.3 State the types of base metal	4.1 Prepare base metal Overview: The topic covers the basic information of brazing.

C. Learning Experiences:

- ✓ Let the learners read INFORMATION SHEET 4.1
- ✓ Share the web link <https://youtu.be/zbqsmvKk2Sk> to further clarify the working principle of brazing process.
- ✓ Let the learners read and perform OPERATION SHEET 4.1 in groups followed by individual practice.
- ✓ Let the learners solve SAMPLE SELF CHECK 4.1.

D. Assessment:

- ✓ Assess the learners' conceptual understanding of the working principle of brazing.
- ✓ Assess the learners' performance on OPERATION SHEET 4.1 using the checklist.
- ✓ Assess the learners' response to SAMPLE SELF CHECK 4.1.

E. Resources:

- ✓ CBLM
- ✓ <https://youtu.be/zbqsmvKk2Sk> (Working principle of brazing)

A. Competency/Competencies:

- i. Set up base metal.

B. Learning objectives/Topic:

Learning objectives	Topic
4.3.1 Explain the types of brazing joint 4.3.2 Explain the difference between oxy-acetylene welding and brazing	4.2 Set up base metal Overview: The topic covers the basic information of types of joint used in brazing and the difference between oxy-acetylene welding and brazing.

C. Learning Experiences:

- ✓ Let the learners read INFORMATION SHEET 4.2
- ✓ Share the web link <http://www.gsegmedia.com> to further clarify the difference between the brazing and oxy-acetylene welding.
- ✓ Let the learners read and perform OPERATION SHEET 4.2 in groups followed by individual practice.
- ✓ Let the learners solve SAMPLE SELF CHECK 4.2.

D. Assessment:

- ✓ Assess the learners' conceptual understanding on the difference between the brazing and oxy-acetylene welding.
- ✓ Assess the learners' performance on OPERATION SHEET 4.2 using the checklist.
- ✓ Assess the learners' response to SAMPLE SELF CHECK 4.2.

E. Resources:

- ✓ CBLM
- ✓ <http://www.gsegmedia.com> (Working principle of brazing)

A. Competencies:

- i. Braze the work piece.

B. Learning objectives/Broad theme/ Chapter/Strand/Topics:

Learning objectives	Core concepts(Chapters/Topics)
4.3.1 State the methods of brazing 4.3.2 Explain the importance of brazing flux 4.3.3 State the types of brazing flux 4.3.4 List the types of brazing filler metal 4.3.5 Explain brazing problems and its remedies 4.3.6 List the advantages and limitations of brazing 4.3.7 Explain the working principle of brazing 4.3.8 State the brazing temperature 4.3.9 Explain the differences between brazing and soldering	4.3 Braze the work piece Overview: The topic covers the basic information on brazing, the importance of brazing flux, advantages and disadvantages of brazing.

C. Learning Experiences:

- ✓ Let the learners read INFORMATION SHEET 4.3
- ✓ Share the web link <https://youtu.be/GER8xXvFgNI> to further clarify on the difference between brazing and soldering.
- ✓ Let the learners read and perform OPERATION SHEET 4.3 in groups followed by individual practice.
- ✓ Let the learners solve SAMPLE SELF CHECK 4.3.

D. Assessment:

- ✓ Assess the learners' conceptual understanding difference between brazing and soldering.
- ✓ Assess the learners' performance on OPERATION SHEET 4.3 using the checklist.
- ✓ Assess the learners' response to SAMPLE SELF CHECK 4.3.

E. Resources:

- ✓ CBLM
- ✓ <https://youtu.be/GER8xXvFgNI> (differencebetween brazing and soldering)

Chapter 5: Perform post work for oxy-acetylene processes

A. Competency/Competencies:

- i. Inspect the workpiece visually before and after welding.

B. Learning objectives/Topic:

Learning objectives	Topic
5.1.1 Explain importance of visual inspection 5.1.2 Describe types of surface defects 5.1.3 <i>Bevigilant</i> 5.1.4 <i>Ensure appropriate use of PPE.</i>	5.1 Performing visual inspection workpiece Overview: The topic covers the information on the inspection of workpiece after they are done with welding. It also covers the types of surface defects.

C. Learning Experiences::

- ✓ Let learners read INFORMATION SHEET 5.1.
- ✓ Share the web link <https://youtu.be/Ncguc7THEUY> to understand the methods to inspect the workpiece.
- ✓ Let learners inspect their job piece that they have practice referring to OPERATION SHEET 3.1 and SKILL SHEET 5.1.
- ✓ Let learners solve SAMPLE SELF CHECK 5.1.

D. Assessment:

- ✓ Assess the learners' performance on OPERATION SHEET 5.1 using the checklist.
- ✓ Assess the learners' response to SAMPLE SELF CHECK 5.1.

E. Resources:

- ✓ CBLM
- ✓ <https://youtu.be/Ncguc7THEUY> (Demonstration on the inspection of welded materials)

A. Competency/Competencies:

- i. Prevent the failure of equipment while using oxy-acetylene equipment.

B. Learning objectives/Topic:

Learning objectives	Topic
5.2.1 Explain importance of maintenance 5.2.2 Explain preventive and periodic maintenance of oxy-acetylene equipment 5.2.3 <i>Ensure appropriate use of PPE.</i>	5.2 Maintaining oxy-acetylene equipment Overview: The topic covers the importance of maintaining the oxy-acetylene equipment after completing welding and cutting works.

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 5.2
- ✓ Share the link <https://youtu.be/Wlf7-9utYdw> to further clarify preventive measures and care of the oxy-acetylene setup.
- ✓ Let learners in the group discuss types of maintenance. The learner looks for information from <https://www.interplaylearning.com/blog/different-types-of-maintenance> and the CBLM.
- ✓ Based on the information gathered, Let learners in the group prepare a presentation using any one of the presentations.
- ✓ Demonstrate the flame setting referring to the OPERATION SHEET 5.2 to maintain oxy-acetylene equipment.
- ✓ Let learners perform OPERATION SHEET 5.2 in groups and later individually.
- ✓ Let learners solve SAMPLE SELF CHECK 2.2.

D. Assessment:

- ✓ Assess the presentation of the learner to assess the conceptual understanding of types of maintenance and their importance using the rubric and provide necessary intervention.
- ✓ Assess the learners' performance on OPERATION SHEET 5.2 using rubrics.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 5.2.

E. Resources:

- ✓ Competency-Based Learning Material for Class XII
- ✓ <https://youtu.be/Wlf7-9utYdw> (Explains the preventive measures and care of the oxy-acetylene setup.)
- ✓ <https://www.interplaylearning.com/blog/different-types-of-maintenance> (Notes on types of maintenance)

A. Competency/Competencies:

- i. Calculate the cost of materials before performing any fabrication and repair works.
- ii. Compile the work completion report.

B. Learning objectives/Topic:

Learning objectives	Topic
5.3.1 Explain the importance of work completion report	5.3 Compiling work completion report Overview: The topic covers the importance of work completion report.
5.3.2 Explain the report format	
5.3.3 Explain the basic estimation and costing for oxy-acetylene processes	
5.3.4 <i>Be vigilant</i>	

C. Learning Experiences:

- ✓ Let learners read INFORMATION SHEET 5.3
- ✓ Let learners explore the purpose of estimation.
- ✓ Let learners research how they estimate materials when they make any kind of product.
- ✓ Let the learners do simple estimations.
- ✓ Let learners solve SAMPLE SELF CHECK 3.3.

D. Assessment:

- ✓ Assess the learners' conceptual understanding of estimating and costing by conducting the class test.
- ✓ Assess the learners' responses to SAMPLE SELF CHECK 3.3.

E. Resources:

- ✓ CBLM

RESOURCES

1. Technical and Vocational Education and Training (TVET) New Normal Curriculum Framework (Classes: PP-XII)
2. Competency Based Learning Materials (Welding)