

Fabrication and Welding Engineering - National Technical Certificate (NTC) and Advanced National Technical Certificate (ANTC)

Advanced National Technical Certificate

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Welding

PROGRAMME:	Advanced National Technical Certificate In Fabrication And Welding Engineering Craft
MODULE:	CFW 21-Welding
DURATION:	15 Hours/week 4 Tutorial; 11 Practical
GOAL:	The Module is designed to equip the trainee with advanced skills and knowledge required to carry out gas shielded arc and ancillary welding process with proficiency

General Objectives:

1. Understand and Apply the general safety precautions related to gas shielded arc and ancillary welding processes
2. Understand the constructional features and the working principles of TIG and MIG welding machines and accessories
3. Understand the basic principles and techniques of TIG and MIG welding and be able to apply them in fabricating simple machine component parts
4. Apply appropriate workshop processes and techniques to mark out and form projects for welding
5. Make different types of welded joints in all positions
6. Understand and apply the fuel-gas cutting process in cutting metals to given specification.

Practical Competence

On completion of this module, the student will be able to:

7. Comply with general safety related to gas shielded arc and ancillary welding process
8. Apply basic principles and techniques of TIG and MIG welding in fabricating simple machine component parts
9. Use workshop process techniques and tools to mark out and form projects in welding
10. perform welding operations in all position involving different types of joints

11. Cut metals to given specification using the fuel gas cutting process

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN FABRICATION AND WELDING ENGINEERING CRAFT PRACTICE			
COURSE: WELDING		Course Code: CFW 21	Contact Hours: 15 per week 4 Tutorials; 11 Practicals
Course Specification: Theoretical/Practical contents			
General Objective 1.0: Understand and Apply the general safety precautions related to gas shielded arc and ancillary welding processes			
Week	Specific Learning Outcome	Teachers Activities	Resources
1	<p>1.1 Know the importance of a safe working environment with particular reference to personal safety, and the student's responsibility to others.</p> <p>a. State the reasons for the use of face protection and the wearing of protective clothing.</p> <p>b. Describe the dangers inherent in the following: grinding, oxy-acetylene welding, metal arc welding, shearing, bending, folding, compressed air, lifting tackle.</p> <p>c. State the correct methods for handling, storing and using compressed gas cylinders.</p> <p>d. State the dangers of electric shock and describe user precautions.</p>	<ul style="list-style-type: none"> • Explain the importance of a safe working environment with respect to safety to self and others as per 1.1 (a-d) 	<ul style="list-style-type: none"> • Welding tools, lesson plan chalkboard goggle and appropriate equipment

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COURSE: WELDING

Course Code: CFW 21

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week 4 Tutorials; 11
Practicals**

Course Specification: Theoretical/Practical contents

General Objective 1.0: Understand and Apply the general safety precautions related to gas shielded arc and ancillary welding processes

Week	Specific Learning Outcome	Teachers Activities	Resources
	1.2 List and explain the hazards related to gas shielded arc welding. e.g. <ul style="list-style-type: none"> a. arc eye b. burning c. radiation d. electric shock e. toxic fumes, etc. 	<ul style="list-style-type: none"> • Describe the hazard related to gas shielded arc welding as listed in 1.2 (a-e) 	<ul style="list-style-type: none"> • Lesson plan • Chalkboard. And chart
	1.3 Select, use and care for the protective wears used in gas shielded arc welding operations: e.g. <ul style="list-style-type: none"> a. head and pan shields b. hand gloves c. apron d. spats e. boots, etc. 	<ul style="list-style-type: none"> • Explain the use and care for the protective wears used in gas shielded arc welding operations as in 1.3 (a-e) • Show students items listed in 1.3 (a-e) • Ask student to sketch the items 	<ul style="list-style-type: none"> • Lesson plan and protective wears
	1.4 Apply with facility, appropriate safety precautions required in carrying out TIG and MIG welding operations: <ul style="list-style-type: none"> a. in confined spaces b. on empty vessels or drums that had contained inflammable or toxic materials near inflammable materials, e.g. petrol tanker, etc 	<ul style="list-style-type: none"> • Demonstrate with facilities appropriate safety precautions required in carrying out TIG and MIG welding operation as listed in 1.4 (a-c) 	<ul style="list-style-type: none"> • Lesson plan and protective wears • Welding Equipment

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Course Specification: Theoretical/Practical contents

General Objective 2.0: Understand the constructional features and the working principles of TIG and MIG welding machines and accessories

Week	Specific Learning Outcome	Teachers Activities	Resources
	<p>2.1 Explain the constructional features and functions of the following equipment and accessories:</p> <ul style="list-style-type: none"> a. DC and AC machines b. High frequency unit c. Gas economizer d. Regulator e. Air and water cooled torches f. Pedal switch g. Gas nozzles h. Suppressor unit i. Flow meter j. Contactor k. Nylon hoses, etc 	<ul style="list-style-type: none"> a. State the constructional features and functions of equipment and accessories listed in 2.1 (a-k) b. Show students items listed in 2.1 (A-K) c. Ask students to sketch the items d. Give student short notes on each 	<ul style="list-style-type: none"> e. Lesson plan, chalkboard, sketches and charts and some accessories
	<p>2.2 State the advantages and disadvantages of AC and DC welding systems</p> <p>2.3 Identify the electrodes and filler wires for TIG process and state their composition</p> <p>2.4 Identify the following gas cylinders by their colour codes:</p> <ul style="list-style-type: none"> a. argon b. helium c. carbon dioxide d. hydrogen e. nitrogen <p>2.5 State the main advantage of the TIG process over other welding processes.</p>	<ul style="list-style-type: none"> f. Explain the advantages and disadvantages of AC and DC welding system g. Describe the electrode and filler wires for TIG process and state their composition and show students samples of electrode and filler wire h. Ask students to explain and show gas cylinders by their colour code as listed in 2.4 (a-e) i. Call on students to identify them j. Give detailed notes k. Ask students to explain the main advantage of TIG process over other welding processes 	<ul style="list-style-type: none"> l. Lesson plan, chalkboard m. Lesson plan, chalkboard and TIG accessories n. Lesson plan and chalkboard

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Course Specification: Theoretical/Practical contents

General Objective 3.0: Understand the basic principles and techniques of TIG and MIG welding and be able to apply them in fabricating simple machine component parts

Week	Specific Learning Outcome	Teachers Activities	Resources
3	3.1 Explain the following major process variables and characteristics. a. Electrical b. Direct current, pulsed current alternating current rectification and modulation volt,/ampere characteristics arc initiation. c. Electrodes d. Types, shapes, current carrying capacities and applications. e. Shielding Gases f. Pure and mixed, functions and applications g. d) Filler materials and their composition	<ul style="list-style-type: none"> • Ask students to describe the major process variables and characteristics as listed in 3.1 (a-d) • Demonstrate TIG welding to students, emphasizing types of current rectification and modulation • Show students the different types of electrodes and the profiles • Explain the importance of shielding glasses • Give detailed notes on all of the above 	<ul style="list-style-type: none"> • Lesson plan, Chalkboard • Sketches/Charts accessories and materials
	3.2 Appreciate the applications of TIG welding process and select suitable operating characteristics for the welding of the following: low carbon steels, high yield steels, stainless alloys, nimonic alloys, titanium alloy, cooper alloys and aluminum alloys.	<ul style="list-style-type: none"> • Explain the application of TIG welding process and state operating characteristics for the welding listed in 3-2 and give detailed notes 	<ul style="list-style-type: none"> • Lesson plan, • Chalkboard • Charts

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Week	Specific Learning Outcome	Teachers Activities	Resources
4	3.3 Compare backing materials, purging and under-bead shielding as a means of producing acceptable welds.	• Explain backing materials purging and under-bead shielding as mean of producing acceptable welds.	• Lesson plan and chalkboard
	3.4 Explain the effects of joint preparation on the production of acceptable and economical welds by the TIG welding processes	• State the effect of joint preparation on the production of acceptable and economical welds by TIG welding processes and give notes.	- do -
	3.5 Explain the importance of adhering to specifications, codes and standards for TIG welding processes.	• State the importance of adhering to specification codes and standards for TIG welding processes and give notes	- do -

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Week	Specific Learning Outcome	Teachers Activities	Resources
5	<p>3.6 List and state the functions of TIG welding accessories, e.g. electrode holder, earth lead, welding lead, etc.</p> <p>3.7 Describe with sketches the materials composition of different types of electrodes used for TIG welding.</p> <p>3.8 Set and use the TIG welding machines to weld the following metals - aluminum, copper and stainless steel at specified voltage observing safety precautions</p> <p>3.9 Explain the difference between TIG and MIG processes.</p>	<ul style="list-style-type: none"> • Explain the functions of TIG welding accessories as listed in 3.6 • With the aid of sketch or diagram, ask student to sketch each of the items • Ask students to explain with sketches the materials composition of different types of electrodes use for TIG welding. • Ask students to demonstrate the setting up and use of TIG welding machines for welding metals as listed in 3.8 observing all safety precautions • Call on students to perform above. • Ask students to state the differences between TIG and MIG processes 	<ul style="list-style-type: none"> • Lesson plan, Chalkboard and • TIG welding accessories • do - • Lesson plan • TIG welding machine equipment and materials. • Lesson plan Chalkboard and Charts

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General Objective 3.0: Understand the basic principles and techniques of TIG and MIG welding and be able to apply them in fabricating simple machine component parts

Week	Specific Learning Outcome	Teachers Activities	Resources
	<p>3.10 Explain the factors that govern the design of joints requiring MIG and TIG processes e.g.</p> <p>a) type of metal</p> <p>b) thickness of metal</p> <p>c) shape of material</p> <p>d) position of joint; and welding various metal joints using TIG and MIG processes in the following positions:</p> <p>a) flat positions</p> <p>b) confined space</p> <p>c) other positions</p>	<ul style="list-style-type: none"> • State the factors that govern the design of joints requiring MIG and TIG processes as listed in 3.10 (a0c) and demonstrate the welding of metal joints using TIG and MIG processes in positions listed in 3.10 • Ask the students to practice the process • Give detailed notes 	<ul style="list-style-type: none"> • Lesson plan Chalkboard • TIG welding equipment and accessories and materials.
	<p>3.11 Sketch and explain the meaning of the various arc welding symbols/conventions, e.g. symbol of a single V butt weld with sealing run, symbol of weld on both sides etc.</p>	<ul style="list-style-type: none"> • Sketch and state the meaning of the various arc welding symbols/conventions as out line in 3.11 	<ul style="list-style-type: none"> • Lesson plan Chalkboard and • Sketch/chart

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General Objective 3.0: Understand the basic principles and techniques of TIG and MIG welding and be able to apply them in fabricating simple machine component parts

Week	Specific Learning Outcome	Teachers Activities	Resources
	<p>3.12 Weld metals using at least six of the following ancilliary welding processes:</p> <ul style="list-style-type: none"> a. resistance b. spot c. seam d. projection e. submerged arc f. flash butt g. fire cracker h. stud i. atomic hydrogen, etc. j. Thermit k. Helectrode l. plasma arc 	<ul style="list-style-type: none"> • Demonstrate the welding of metals using at least six of the ancillary welding processes listed in 3.12 (a-l) • Prepare and give detailed notes • Explain the factors governing the choice of any of the ancillary processes named in 3.12 above 	
6	<p>3.13 Outline the factors governing the choice of any of the ancilliary processes named in 3.12 above</p> <p>3.14 Produce using TIG and MIG welding techniques the following items:</p> <ul style="list-style-type: none"> a. pressure vessels b. pipe flanges c. boiler drums d. box section chassis e. tool post guides on a lathe machine f. fixed clusters, etc. <p>3.15 Weld the fixed cluster in a gearbox.</p>	<ul style="list-style-type: none"> • Demonstrate the use of TIG and MIG welding techniques on the listed items in 3.14 (a - f) • Give detailed notes • Demonstrate the welding of fixed cluster in a gearbox 	<ul style="list-style-type: none"> • Lesson plan Ancilliary/welding equipment, tools and materials - do - • Lesson plan, TIG and MIG welding equipment, accessories and materials - do -

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Practicals**

Course Specification: Theoretical/Practical contents

General Objective 3.0: Understand the basic principles and techniques of TIG and MIG welding and be able to apply them in fabricating simple machine component parts

Week	Specific Learning Outcome	Teachers Activities	Resources
	<p>3.16 Explain the principles of MIG welding and state the techniques of consumable and non-consumable electrodes and wires and their composition.</p> <p>3.17 Explain the details of equipment used and describe the setting of their controls</p> <p>3.18 state the effects of wrong setting, type of defects, causes and elimination</p>	<ul style="list-style-type: none"> • State the principles of MIG welding and explain the techniques of consumable and non-consumable electrode and wires and their composition. • Give detailed notes • State the details of equipment used and explain the setting of their controls • Explain the effect of wrong setting, type of defects, causes and elimination. 	<ul style="list-style-type: none"> • Lesson plan Chalkboard Appropriate electrodes and wires - do - • Lesson plan, Chalkboard Sketches/Chart

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General Objective 3.0: Understand the basic principles and techniques of TIG and MIG welding and be able to apply them in fabricating simple machine component parts

Week	Specific Learning Outcome	Teachers Activities	Resources
	3.19 Explain the following major process variable and characteristics: a. Modes of metal transfer b. Electrical - power supply characteristics - characteristics relative to modes of metal transfer - current density, speed, feed, voltage and inductance e. c. Shielding gases - pure and mixed, functions and Applications.	• State the major process variables and characteristics, listed in 3.19 (a-c)	- do -

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Course Specification: Theoretical/Practical contents

General Objective 3.0: Understand the basic principles and techniques of TIG and MIG welding and be able to apply them in fabricating simple machine component parts

Week	Specific Learning Outcome	Teachers Activities	Resources
	<p>3.20 Apply the MIG welding process and select suitable operating characteristics for welding:</p> <ul style="list-style-type: none"> a. M.S (Mild Steel) in different welding position b. S.S (Stainless Steel) c. Aluminium d. Pipes and pipe joints e. Titanium alloys f. Copper alloys, etc. 	<ul style="list-style-type: none"> • Demonstrate the MIG welding process and show suitable operating characteristics for welding of items listed in 3.20 and give detailed notes 	<ul style="list-style-type: none"> • Lesson plan • MIG equipment & Accessories/Materials
7	<p>3.21 Explain the principles of spot welding and describe the size and shape of electrode in relation to metal thickness</p> <p>3.22 State the purpose of spot welding in machine shop or industry</p> <p>3.23 State the effects of current, time and force in spot welding process</p> <p>3.24 Evaluate the effect of heat balance and heat shrinkage in welding</p> <p>3.25 Describe the methods of external cooling on welds</p> <p>3.26 Discriminate between the types of welds e.g. plasma arc or sub-merge arc and spot welding</p>	<ul style="list-style-type: none"> • Ask students to state the principle of spot welding and explain the size and shape of electrode in relation to thickness • Explain the purpose of spot welding in machine shop or industry • Explain the effect of current time and force in spot welding process • Explain the effect of heat balance and heat shrinkage in spot welding • Explain the method of external cooling on welds • Explain the difference between the types of welds produced by plasma arc, sub-merged arc and spot welding • Give detailed notes on all of the above 	<ul style="list-style-type: none"> • Lesson plan • Chalkboard • Spot welding machine - do -

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Course Specification: Theoretical/Practical contents

General Objective 4.0: Apply appropriate workshop processes and techniques to mark out and form projects for welding

Week	Specific Learning Outcome	Teachers Activities	Resources
	4.1 Mark out the following projects in welding - applying appropriate tools, techniques and safety practice: a. Rectangular container b. Cylindrical shaped objects c. Solid corner joints d. Butt joint	<ul style="list-style-type: none"> • Demonstrate the marking out of project in welding as listed in 4.1 (a-d) applying appropriate tools, techniques and safety practices • Give students projects involving items listed in 4.1 	<ul style="list-style-type: none"> • Lesson plan Spot Welding, Appropriate Equipment, Tools, Materials and Protective Wear
	4.2 Prepare bronze components for welding avoiding sharp edges and weld to specification.	<ul style="list-style-type: none"> • Ask students to demonstrate preparation and welding of bronze component for avoiding sharp edges and welding to specifications and give notes 	<ul style="list-style-type: none"> • Lesson plan, Welding Equipment Tools and Materials
	4.3 Prepare stainless steel components for welding using welding rods and techniques and observing safety precautions.	<ul style="list-style-type: none"> • Demonstrate preparation and welding of stainless steel components using welding rods and techniques and observing safety precautions. 	<ul style="list-style-type: none"> • - do -
	4.4 Identify and state the type, composition and properties of common stainless steels used in metal work	<ul style="list-style-type: none"> • List types of stainless steel • Explain their composition • Discuss their properties and uses 	<ul style="list-style-type: none"> • Lesson plan, Chalkboard, Sketches Chart and Different pieces of stainless steel.

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Course Specification: Theoretical/Practical contents

General Objective 5.0: Make different types of welded joints in all positions

Week	Specific Learning Outcome	Teachers Activities	Resources
9	5.1 Describe with sketches the application of the following joints in metal fabrication: a. Square butt b. Single vee c. Double vee d. Single U e. Open corner, etc.	<ul style="list-style-type: none"> • Explain with sketches the application of the following joint in metal fabrication as listed in 5.1 (a-e) • Ask students to sketch the joints • Give detailed notes on each. 	<ul style="list-style-type: none"> • Lesson plan • Chalkboard and • Charts
	5.2 Prepare edges for welding the joints in 5.1 observing safety rules.	<ul style="list-style-type: none"> • Demonstrate how to prepare edge for welding the joints in 5.1 observing safety rules • Ask the student to prepare edges for welding joints in 5.1 	<ul style="list-style-type: none"> • Lesson plan, Necessary Tools, Equipment and Materials
10	5.3 Weld pipes and flanges in various positions e.g: a) fixed position b) rotated position	<ul style="list-style-type: none"> • Demonstrate how to weld pipes and flanges in various position - both fix and rotated 	- do -
	5.4 Prepare metal surfaces and make multi-run and weaving welds	<ul style="list-style-type: none"> • Demonstrate how to prepare metal processes and make multi run and weaving 	- do -
	5.5 Weld joints in vertical, horizontal and overhead positions	<ul style="list-style-type: none"> • Demonstrate how to weld joint in vertical, horizontal and overhead positions. • Ask the student to carry out the above operations and give detailed notes 	- do -

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COURSE: WELDING

Course Code: CFW 21

Contact Hours: 15 per week 4 Tutorials; 11 Practicals

Course Specification: Theoretical/Practical contents

General Objective 6.0: Understand and apply the fuel-gas cutting process in cutting metals to given specification.

Week	Specific Learning Outcome	Teachers Activities	Resources
11	6.1 State the principles and applications of fuel-gas cutting process, e.g.: a. Manual b. Machine	<ul style="list-style-type: none"> • Explain the principles and applications of fuel-gas cutting as listed in item 6.1 (a-b) • Give the students, projects involving the two processes 	Lesson plan, Chalkboard
	6.2 Describe various fuel-gas used in oxy-fuel cutting e.g: a. acetylene b. propane c. butane d. coal-gas, etc	<ul style="list-style-type: none"> • Ask students to state various fuel-gases used in oxy-fuel cutting gas listed in 6.2 (a-d) 	- do -
12	6.3 State the advantages and disadvantages of using the above-named fuel-gas for oxy-fuel cutting operations	<ul style="list-style-type: none"> • Explain the advantages and disadvantages of using above named fuel gases for oxy-fuel cutting operation. 	- do -
	6.4 Prepare templates for the mass production of given objects of regular or irregular shapes by profile cutting	<ul style="list-style-type: none"> • Demonstrate how to prepare templates for mass production of given object by profile cutting 	• Lesson plan, Equipment Tools and Materials
	6.5 Cut smooth, curved, circular and straight objects using the hand cutting torch including oxy-lance and flame gauging	<ul style="list-style-type: none"> • Demonstrate and explain how to cut smooth, curved circular and straight objects using hand flame gauging. 	• Lesson plan Appropriate Equipment Tools and Materials
	6.6 Produce project involving Arc and Ancillary welding process	Assist student to design and produce projects involving Arc and ancillary welding. Test and evaluate the student Give detailed notes on all of the above	Arc and ancillary welding equipment.
Week 13 Examination - Practical 60%, Theory 40%			

Structural Mechanics and Specification

PROGRAMME:	Advanced National Technical Certificate In Fabrication And Welding Engineering Craft
MODULE:	CFW 22-Structural Mechanics and Specification
DURATION:	15 Hours/week 4 Tutorial; 11 Practical
GOAL:	The Module is designed to provide the trainee with the knowledge of simple structural Mechanics and standard specifications required to appreciate steel designs and working drawings

General Objectives:

1. Apply simple structural mechanics and standard specifications to structural steel work design.
2. Interpret and produce structural steel working drawings

Practical Competence

On completion of this module, the student will be able to:

12. Apply with facilities, standard specification for structural steel construction
13. perform simple calculation on structural steel construction
14. interpret and produce simple structural steel working drawings
15. produce projects applying simple structural mechanics and standard specification to structural steel work

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COURSE: STRUCTURAL MECHANICS AND SPECIFICATION	Course Code: CFW 22	Contact Hours: 15 per week - 4 tutorials; 11 practicals
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Course Specification Theoretical/Practical contents

General Objective 1.0: Apply simple structural mechanics and standard specifications to structural steel work design.

Week	Specific Learning Outcome	Teachers Activities	Resources
1-2	1.1 Apply with facility standard specifications for structural steel construction using America or British Standards and their Nigerian counterparts.	<ul style="list-style-type: none"> • Demonstrate the application of standard specifications for structural steel construction. And give detailed notes 	<ul style="list-style-type: none"> • Lesson plan • Chalkboard • Charts.
	1.2 Calculate weight of given structural steel components using appropriate table of specifications.	<ul style="list-style-type: none"> • Explain and calculate the weight of a given structural steel components using appropriate specifications • Give the students problems to solve 	<ul style="list-style-type: none"> • Lesson plan • Chalkboard.
3	1.3 Draw diagrams to show the applications of the following in structural steel work: <ul style="list-style-type: none"> a. tensile forces and stresses b. compressive forces and stresses c. shear forces and stresses 	<ul style="list-style-type: none"> • Sketch diagrams to show the application of structural steel work forces and stresses and ask the students to do same. 	<ul style="list-style-type: none"> • Lesson plan • Chalkboard • Charts
	1.4 Calculate the reaction at the supports of cantilever and simply supported beams having points and uniform loading e.g. simple shed frame with flat roof.	<ul style="list-style-type: none"> • Explain and calculate the reaction at the support of cantilever and simple supported beam having points and uniform loading. 	<ul style="list-style-type: none"> • Lesson plan • Chalkboard, etc.

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Course Specification Theoretical/Practical contents			
General Objective 1.0: Apply simple structural mechanics and standard specifications to structural steel work design.			
Week	Specific Learning Outcome	Teachers Activities	Resources
4	1.5 Calculate bending moments and moment of resistance of simply supported beam with point and uniform loading.	<ul style="list-style-type: none"> • Explain the calculation of bending moments and moment of resistance of simply supported with point and uniform loading. • Give the students problems to solve 	<ul style="list-style-type: none"> • Lesson plan • Chalkboard • Charts.
	1.6 Determine sizes of materials or sections required for columns, rafters, etc.	<ul style="list-style-type: none"> • Explain how to determine sizes of materials required for columns, rafters, etc. 	<ul style="list-style-type: none"> • Lesson plan • Chalkboard • Charts
	1.7 Sketch bending moment diagram for cantilever with uniform load and calculate the bending moment.	<ul style="list-style-type: none"> • Sketch and explain bending moment diagram for cantilever with uniform load and calculation on the bending moment. 	<ul style="list-style-type: none"> • Lesson plan • Chalkboard • Charts
5	1.8 Apply 1.4 in determining reaction at support of actual frames. e.g. b. canopy c. riveted angle stiffened for crane beams	<ul style="list-style-type: none"> • Demonstrate how to apply 1.4 in determining reaction at support of actual frames. 	<ul style="list-style-type: none"> • Lesson plan • Appropriate tools and equipment.
	1.9 Apply stress diagrams to determine load on member of structural frames. e.g. trusses.	<ul style="list-style-type: none"> • Explain how to apply stress diagrams to determine load on member of structural frames. 	<ul style="list-style-type: none"> • Lesson plan • Chalkboard • Charts • Appropriate tools and equipment
	1.10 Calculate bending stress due to web or flange connections. E.g. floor beams multistory frame building.	<ul style="list-style-type: none"> • Explain the calculation of bending stress due to web or flange connections 	<ul style="list-style-type: none"> • Lesson plana • Chalkboard

PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN FABRICATION AND WELDING ENGINEERING CRAFT PRACTICE			
COURSE: STRUCTURAL MECHANICS AND SPECIFICATION		Course Code: CFW 22	Contact Hours: 15 per week - 4 tutorials; 11 practicals
Course Specification Theoretical/Practical contents			
General Objective 1.0: Apply simple structural mechanics and standard specifications to structural steel work design.			
Week	Specific Learning Outcome	Teachers Activities	Resources
6	1.11 Explain the purpose of the following in structural steel assembly: b. rag bolt c. gusset plate d. base plate	<ul style="list-style-type: none"> Enumerate the purpose of the following in structural steel assembly: rag bolt gusset plate base plate 	<ul style="list-style-type: none"> Lesson plan Chalkboard Posters Samples
	1.12 Calculate the deflections on a column or other members using standard specifications/formulae.	<ul style="list-style-type: none"> Solve some problems involving calculations on deflections on a column or other members using standard specifications/formulae. Give the students problems to solve 	<ul style="list-style-type: none"> Lesson plan Chalkboard Charts.
General Objective 2.0: Interpret and produce structural steel working drawings			
Week	Specific Learning Outcome	Teachers Activities	Resources
	2.1 Read and interpret working drawings of structural steel work	<ul style="list-style-type: none"> Explain how to read and interpret working drawings of structural steel work 	<ul style="list-style-type: none"> Lesson plan Chalkboard Relevant work drawings.
	2.2 Design and produce simple structural drawings observing conventional standards, symbols and notations.	<ul style="list-style-type: none"> Demonstrate how to design and produce simple structural drawings observing conventional standards, symbols and notations. 	<ul style="list-style-type: none"> Lesson plan Chalkboard Relevant work drawings
	2.3 Produce project applying simple structural mechanics and standard specification to structural steel work	<ul style="list-style-type: none"> Ask student to produce project applying simple structural mechanics and standard specification to structural steel work. Test and evaluate the students 	-do-
Week 13 Examination - Practical 60%, Theory 40%			

Structural Steel Work

PROGRAMME:	Advanced National Technical Certificate In Fabrication And Welding Engineering Craft
MODULE:	CFW 23-Structural Steel Work
DURATION:	15 Hours/week 4 Tutorial; 11 Practical
GOAL:	The Module is designed to provide the trainee with further knowledge and skills to carry out simple design, fabrication and erection of structural steel work

General Objectives:

1. Develop and Produce Templates for Structural Steel Work
2. Fabricate and Assemble various structural steel components for and products such as roof trusses, stanchions, girders, slop-plating, bridges, tanks, etc.
3. Inspect finished structural steel work for defects and rectify the defects as necessary

Practical Competence

On completion of this module, the student will be able to:

1. Develop and produce template for structural steel work
2. Fabricate and assemble various structural steel component
3. carry out inspection on structural steel project
4. Rectify defects in structural steel project
5. provide and develop temperature for structural steel work

**PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN FABRICATION AND WELDING
ENGINEERING CRAFT PRACTICE**

COURSE: STRUCTURAL STEEL WORK

Course Code: CFW 23

Contact Hours: 15 per week - 4 Tutorials, 11 practicals

Course Specification Theoretical/Practical contents

General Objective 1.0 Develop and Produce Templates for Structural Steel Work

Week	Specific Learning Outcome	Teachers Activities	Resources
4	1.1 Calculate areas of irregular surfaces using the following rules: a. mid-ordinates rule b. Simpson's rule	<ul style="list-style-type: none"> • Solve problems involving calculation on areas of irregular surfaces using various methods 	<ul style="list-style-type: none"> • Lesson plan • Chalkboard
	1.2 Develop given templates having: a. regular surfaces b. irregular surfaces	<ul style="list-style-type: none"> • Demonstrate how to develop templates having: • regular surfaces • irregular surfaces 	<ul style="list-style-type: none"> • Lesson plan • Chalkboard. • Drawing instruments
	1.3 Cut out the developed templates from the following materials: a. wood b. card-board c. other suitable materials	<ul style="list-style-type: none"> • show students how to how to cut out developed templates from various materials. 	<ul style="list-style-type: none"> • Lesson plan • Template materials Relevant tools and equipment.
	1.4 Reproduce the cut templates in 1.3 above from structural steel materials using the following workshop processes: a. cutting - using oxy-fuel gas, profile cutting and power saw b. punching - using punching machine c. chamfering - using oxy-fuel gases	<ul style="list-style-type: none"> • Demonstrate how to reproduce cut templates in 1.3 from structural steel materials using various workshop processes. • Ask students to perform the above functions 	<ul style="list-style-type: none"> • Lesson plan • Materials, Relevant Tools and Equipment.

**PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN FABRICATION AND WELDING
ENGINEERING CRAFT PRACTICE**

COURSE: STRUCTURAL STEEL WORK	Course Code: CFW 23	Contact Hours: 15 per week - 4 Tutorials, 11 practicals
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Course Specification Theoretical/Practical contents

General Objective 2.0: Fabricate and Assemble various structural steel components for and products such as roof trusses, stanchions, girders, slop-plating, bridges, tanks, etc.

Week	Specific Learning Outcome	Teachers Activities	Resources
5-7	2.1 Explain the functions of jigs and fixtures in structural steel works	<ul style="list-style-type: none"> • State the functions of jigs and fixtures in structural steel works. • Give notes 	<ul style="list-style-type: none"> • Lesson plan • Chalkboard, Sample of jigs and fixtures
	2.2 Make simple jigs, fixtures and manipulators for assembling structural steel members.	<ul style="list-style-type: none"> • Demonstrate how to make simple jigs, fixtures and manipulators for assembling structural steel members. 	<ul style="list-style-type: none"> • Lesson plan • Appropriate tools and Equipment.
	2.3 Assemble structural components using the following jointing methods: <ol style="list-style-type: none"> welding (arc and gas) riveting bolting 	<ul style="list-style-type: none"> • Demonstrate how to assemble structural components using various jointing methods • Students asked to perform the above function 	<ul style="list-style-type: none"> • Lesson plan Appropriate Tools and Equipment and Structural Components
	2.4 Explain the purpose of metal finishing e.g. <ol style="list-style-type: none"> protection from the weather and corrosion decoration 	<ul style="list-style-type: none"> • State the purpose of metal finishing 	<ul style="list-style-type: none"> • Lesson plan • Chalkboard
	2.5 Describe the composition of various materials used for finishing structural steel work	<ul style="list-style-type: none"> • Explain the composition of various materials used for finishing structural steel work 	<ul style="list-style-type: none"> • Lesson plan • Chalkboard • Samples of materials for finishing
	2.6 Prepare the surfaces of structural steel components for finishing using the following techniques: <ol style="list-style-type: none"> brushing - using wire brush de-greasing, using suitable degreasing agent de-scaling 	<ul style="list-style-type: none"> • Demonstrate how to prepare the surfaces of structural steel components for finishing using various techniques • Ask student to perform above operations 	<ul style="list-style-type: none"> • Lesson plan • Samples of Structural Components, Appropriate tools and equipment

**PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN FABRICATION AND WELDING
ENGINEERING CRAFT PRACTICE**

COURSE: STRUCTURAL STEEL WORK	Course Code: CFW 23	Contact Hours: 15 per week - 4 Tutorials, 11 practicals
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Course Specification Theoretical/Practical contents

General Objective 2.0: Fabricate and Assemble various structural steel components for and products such as roof trusses, stanchions, girders, slop-plating, bridges, tanks, etc.

Week	Specific Learning Outcome	Teachers Activities	Resources
8	2.7 Apply suitable undercoat to structural steel components e.g. red oxide by brushing or spray methods.	<ul style="list-style-type: none"> • Demonstrate how to apply undercoat to structural steel components 	<ul style="list-style-type: none"> • Lesson plan • Appropriate Tools and Equipment
	2.8 Store and maintain structural steel materials and equipment	<ul style="list-style-type: none"> • Explain methods of storing and maintaining structural steel components 	<ul style="list-style-type: none"> • Lesson plan • Chalkboard • Visit Relevant Stores.

General Objective 3.0: Inspect finished structural steel work for defects and rectify the defects as necessary

Week	Specific Learning Outcome	Teachers Activities	Resources
9-12	3.1 Identify common defects in structural steel assembly e.g. <ul style="list-style-type: none"> a. distortion b. undercutting c. lack of reinforcement d. lack of penetration of weld, etc. and state their causes. 	<ul style="list-style-type: none"> • State common defects in structural steel assembly as listed in 3.1 • Show student sample of defects • Give detailed notes • Ask students to demonstrate how to carry out visual inspection to detect defects on finished structural steel assembly 	<ul style="list-style-type: none"> • Lesson plan • Chalkboard • Any Relevant Materials • Lesson plan • Sample of defects • Sample of finished weld Components, Relevant Tools and Equipment.
	3.2 Carry out visual inspection to detect defects on finished structural steel assembly	<ul style="list-style-type: none"> • Ask students to demonstrate how to rectify defects in assembled structural steel components 	<ul style="list-style-type: none"> • Lesson plan • Samples of Components with weld defects,
	3.3 Rectify defects in assembled structural steel components	<ul style="list-style-type: none"> • Give detailed notes 	<ul style="list-style-type: none"> • Relevant Tools and Equipment.
	3.4 Produce and develop templates for structural steel work	<ul style="list-style-type: none"> • Test and evaluate the students 	
	3.5 Fabricate and assemble various structural steel component		

Week 13 Examination - Practical 60%, Theory 40%

Sheet metal work

PROGRAMME:	Advanced National Technical Certificate In Fabrication And Welding Engineering Craft
MODULE:	CFW 24-Sheet Metal Work
DURATION:	15 Hours/week 4 Tutorial; 11 Practical
GOAL:	The Module is designed to upgrade the professional competence of operators who has good knowledge of the use and application of sheet metal working equipment, materials, processes, techniques and safety precautions

General Objectives:

1. Understand the Principles of Pantograph System and pattern forming attachment
2. Understand the construction of patterns and masters of irregular trinket box shapes using pattern forming machine/attachment.
3. Understand the mechanical cutting of basic geometrical shapes
4. Understand the processes of planning and layout of engineering workshops/industry.

Practical Competence

On completion of this module, the student will be able to:

1. Apply machines for the production of sheet metals work
2. Design, Construct and decorate articles
3. Construct patterns of irregular shapes using pattern forming attachment
4. Participate in the planning and laying out engineering workshop/industry

**PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN FABRICATION AND WELDING
ENGINEERING CRAFT PRACTICE**

COURSE: SHEET METAL WORK	Course Code: CFW 24	Contact Hours: 15 per week-4 theory: Practical 11
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Course Specification: Theoretical/Practical contents

	General Objective 1.0: Understand the Principles of Pantograph System and pattern forming attachment		
Week	Specific Learning Outcome	Teachers Activities	Resources
1-3	1.1 State the principles, functions and the constructional details of pattern forming machines and attachments	• Explain the principles, functions and the constructional details of pattern forming machines	• Lesson plan • Chalkboard • Posters/charts.
	1.2 Explain the types and characteristics of the machines in 1.1 above	• Explain the types and characteristics of the machines in 1.1	• Lesson plan • Chalkboard • Posters
	1.3 Apply the machines for the production of sheet metal work	• Demonstrate how to apply the machines for the production of sheet metal work. Give note on all of above	• Lesson plan • Relevant tools and equipment
	General Objective 2.0: Understand the construction of patterns and masters of irregular trinket box shapes using pattern forming machine/attachment.		
Week	Specific Learning Outcome	Teachers Activities	Resources
4-6	2.1 Explain the methods of box and tray construction, using beadings and joints.	• Sate the methods of box and tray construction, using beadings and joints. Give detailed note.	• Lesson plan • Chalkboard • Drawing instruments
	2.2 Explain the making of articles such as oblique tee with branch, lobster back bend, and similar utensils which involve the development of a pattern.	• Demonstrate how to produce articles such as oblique tee with branch, lobster back bend, and similar utensils which involve the development of a pattern.	• Lesson plan • Chalkboard • Drawing instruments appropriate tools and equipment
	2.3 Design, construct and decorate articles combing ornament with utility.	• Demonstrate how to design, construct and decorate articles combining ornament with utility.	• Relevant materials for demonstration

**PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN FABRICATION AND WELDING
ENGINEERING CRAFT PRACTICE**

COURSE: SHEET METAL WORK

Course Code: CFW 24

**Contact Hours: 15 per
week-4 theory: Practical
11**

Course Specification: Theoretical/Practical contents

General Objective 3.0: Understand the mechanical cutting of basic geometrical shapes

Week	Specific Learning Outcome	Teachers Activities	Resources
7-8	a. 3.1 Review of sheet metal materials and their preparation for industrial use of the following metals: Tin, Lead, Zinc, Copper, and Aluminium	<ul style="list-style-type: none"> • Explain and review non-ferrous sheet metal material and their preparation for industrial use. <p>Give detailed note</p>	<ul style="list-style-type: none"> • Lesson plan • Chalkboard • Materials
	3.2 State the composition of more important brasses and bronzes, inconel and monel; their properties and chief uses, the composition and properties of wrought aluminium alloys, magnesium and titanium alloys in common use.	<ul style="list-style-type: none"> • Explain the composition of more important alloy metals and alloy elements; their properties and uses. 	<ul style="list-style-type: none"> • Lesson plan • Chalkboard • Samples of materials
	3.3 Describe the process of manufacture of mild steel sheets of various tempers, the manufacture of coated sheets such as tinned sheets, templates and galvanized iron.	<ul style="list-style-type: none"> • Explain the process of manufacture of coated sheet metals, listed in 3.3. Give detailed notes. 	<ul style="list-style-type: none"> • Lesson plan • Chalkboard • Samples of materials

**PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN FABRICATION AND WELDING
ENGINEERING CRAFT PRACTICE**

COURSE: SHEET METAL WORK

Course Code: CFW 24

**Contact Hours: 15 per
week-4 theory: Practical
11**

Course Specification: Theoretical/Practical contents

General Objective 3.0: Understand the mechanical cutting of basic geometrical shapes

Week	Specific Learning Outcome	Teachers Activities	Resources
9	<p>3.4 Develop and produce at least two sheet metal projects involving the use of more advanced machines and the application of advanced pattern development covered in fabrication drawing.</p> <p>Note: Some of the sheet metal project should include:</p> <ul style="list-style-type: none"> a. trinket box of all types b. lobster back bend c. oblique tee with branch d. small bait can e. petrol or oil measure f. oval container with lid or with loose lid g. oiled bottle h. conical jug i. scoop j. funnel k. ornamental bowls and vases. Etc. 	<ul style="list-style-type: none"> • Demonstrate how to develop and produce sheet metal projects involving the use of more advanced machines. • Give student project on the above to produce some of the items listed in 3.4 	<ul style="list-style-type: none"> • Lesson plan • Drawing instruments, appropriate materials, tools and equipment.
	<p>3.5 Explain the methods of producing more difficult work in hollowing, raising and planishing, hand flattening and setting.</p>	<ul style="list-style-type: none"> • State the methods of producing more difficult beating sheet metal work. • Discuss and demonstrate processes involved 	<ul style="list-style-type: none"> • Lesson plan • Chalkboard.

**PROGRAMME: ADVANCED NATIONAL TECHNICAL CERTIFICATE IN FABRICATION AND WELDING
ENGINEERING CRAFT PRACTICE**

COURSE: SHEET METAL WORK

Course Code: CFW 24

**Contact Hours: 15 per
week-4 theory: Practical
11**

Course Specification: Theoretical/Practical contents

General Objective 4.0: Understand the processes of planning and layout of engineering workshops/industry.

Week	Specific Learning Outcome	Teachers Activities	Resources
10-12	<p>4.1 Demonstrate the methods of planning and the layout of shops in engineering workshops/factory regulations.</p> <p>4.2 Know the types of workshops/industry, e.g. mechanical, electrical, welding, carpentry, etc.</p> <p>4.3 State the types and function of sections in the workshops.</p> <p>4.4 Describe and lay out plan for single, batch and quantity production of engineering components.</p> <p>4.5 Arrange workshops according to the lay out plans</p> <p>4.6 Produce project involving pattern forming machines</p>	<ul style="list-style-type: none"> • State the methods of planning and layout of shops in engineering workshops/factory regulations. Give detailed note • Explain different types workshops/industry. Give detailed notes. • Explain the types and function of sections in the workshop. • Explain lay out plan for single, batch and quantity production of engineering components. • Explain how to arrange workshops according to the lay out plans • Test and evaluate the students • Take student on excursion to industries 	<ul style="list-style-type: none"> • Lesson plan • Chalkboard, Charts visit factory • Lesson plan • Visit workshops/industries • Lesson plan • Visit workshops/industries • Lesson plan • Chars • Visit factory/industry. • Lesson plan • Charts. • Lesson plan • Material, tool and equipment
Week 13 Examination - Practical 60%, Theory 40%			