EXTERNAL INTEGRATED SUMMATIVE ASSESSMENT

CODED WELDER SKILLS PROGRAMME

THEORY PAPER 1D - MEMORUNDUM

STUDENT NAME & SURNAME	
ID NUMBER	
EISA REGISTRATION NUMBER	
ASSESSMENT CENTRE	
ASSESSMENT CENTRE NUMBER	
ACCREDITATION NUMBER	
SKILLS PROGRAMME	**Coded Welder**
SKILLS PROGRAMME NUMBER	**SP-210402**
NQF LEVEL	**4**
CREDITS	**96**
PAPER	**1D**
DATE OF EISA DD/MM/YYYY	
DURATION	**1 Hour 30 Minutes**
TOTAL MARKS	**100**

GENERAL EISA RULES

1. Students are only allowed to use the supplied EISA booklets.
2. Students are only allowed to use a black pen for their answers.
3. Students to ensure that their name, surname and EISA registration number appears on the front of your EISA booklet.
4. This is a closed book examination; therefore, no other material or belongings are to be brought into the assessment centre. Should you bring any other material or belongings into the assessment centre, you will be required to leave such at the front of the assessment centre examination room.

The assessment centre will not be held liable for any loss or damage to property brought into the assessment centre examination room.

5. All EISA booklets must be handed back to the invigilator intact. No pages may be torn off from the EISA booklet. The removal of EISA booklets from the examination room is prohibited.

6. Students may make use of a calculator in this EISA.

7. Unless this is an online examination where access to a computer will be made available to you; the use of any communication devices, including smart watches, cell phones, tablets, iPads, headphones and laptops is prohibited.

8. All cell phones are to be switched off for the duration of the EISA.

9. The invigilator will not assist you with the explanation of questions related to the EISA.

10. Students are prohibited from conversing in any manner with other students.

11. Students may not leave the examination venue within one hour of the start of the examination and in the last 10 minutes of the allotted examination period.

12. Students who are found to be disruptive and unruly in the assessment centre will be requested to leave the assessment centre by the invigilator.

I HEREBY CONFIRM THAT I HAVE READ THE ABOVE EISA RULES AND DECLARE THAT I UNDERSTAND AND ACCEPT THESE RULES.

____

SIGNATURE OF STUDENT

CANDIDATE INSTRUCTIONS

- Answer all questions.
- No reference of any kind is allowed. This includes the use of reference notes (in any form, cell phone, i-pad, watch, creep notes, people etc.) during a test. Any unauthorised obtaining of tests or test information beforehand is prohibited. Any person who fails to comply with this might be subjected to disciplinary processes and/or any other action prescribed by law.
- Read the questions fully before answering them and ensure you understand them. You may ask for clarity from your invigilator when you are unsure.
- Make sure you have all you need before commencing writing, like pen and paper, instruments, calculator, pencil etc. (whatsoever you will need).

- All answers must be written in black ink and drawings in pencil.
- Notify your invigilator of any special needs like illness, ailments or any problem that may disturb or hinder your writing of the EISA.
- Complete all your details fully on the front page and ensure you sign at the bottom of each page.
- All questions must be directed to the invigilator only, no student is allowed to communicate with other students during this assessment.
- The allocated time for the test is 1 Hour, 30 minutes only and shall not be exceeded.
- Candidates must complete all questions in this EISA.
- Should you require additional space to complete your answer, please request additional paper from your invigilator. Ensure that you indicate your name, surname and EISA registration number at the top of the additional paper. Also ensure that the question number is clearly marked on your additional paper.

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ELO 1:

1. Apply generic health and safety principles to produce weld specimens or components using hand and power tools

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Question 1 **Apply safe working procedures**

a) What are the three (3) general categories of ventilation strategies / methods?

[3]

Marking Guidelines

Allocate one (1) mark for every correct answer given, adding up to a total of three (3) marks. **Use discretion to allocate marks for any other relevant points that may be given by the students.**

Ventilation strategies fall into three general categories:

- Natural Dilution Ventilation
- Mechanical Dilution Ventilation
- Local Exhaust Ventilation

b) Name any Five (5) risks / hazards associated with welding.

[5]

Marking Guidelines

Allocate one (1) mark for every correct answer given, adding up to a total of five (5) marks. **Use discretion to allocate marks for any other relevant points that may be given by the students.**

Welding Risks

- Electric shock.
- Fumes and gases.
- Fire and explosions.
- Injuries from insufficient PPE.

- Injuries from burns
- Injuries from arc-eyes
- Excessive heat
- Excessive noise

c) What criteria should one use when selecting hearing protection? Name two (2).

[2]

Marking Guidelines

Allocate one (1) mark for every correct answer given, adding up to a total of two (2) marks. **Use discretion to allocate marks for any other relevant points that may be given by the students.**

Hearing protection should be selected based on four criteria;

- ability to reduce the noise exposure,
- compatibility with other items of PPE (such as welding masks, safety helmets, etc.),
- comfort, and
- suitability for the working environment and activity.

d) What safety checks should be applied on an engine driven welder? Name any five (5).

[5]

Marking Guidelines

Allocate one (1) mark for every correct answer given, adding up to a total of five (5) marks. **Use discretion to allocate marks for any other relevant points that may be given by the students.**

For an engine-driven welder:

- Is it running OK?
- Are all the hoses on tight?
- Is the fuel cap on tight?
- Is the engine leaking fuel or oil? Some jobsites look for this and may refuse entry if your engine is leaking.
- Take caution not to spill fuel when refueling.

- Have a fire extinguisher handy just in case. Fuels present a fire hazard and we must always follow appropriate hot work procedures.
- Is the original enclosure and fan guarding in place? Check with your welding equipment distributor if you are unsure.

Question 2 **Personal Protective Equipment (PPE)**

a) What head and ear protection are required when welding? Give reasons thereof…

[6]

Marking Guidelines

Allocate one (1) mark for every correct answer given, adding up to a total of six (6) marks. **Use discretion to allocate marks for any other relevant points that may be given by the students.**

Head and Ear Protection

- Wear a fire-resistant welder's cap or other head covering under your helmet. It will protect your head and hair from flying sparks, spatter, burns, and radiation.
- When working out of position, such as overhead, wear approved earplugs or muffs. They prevent sparks, spatter, and hot metal from entering your ears and causing burns.
- If loud noise is present, wear approved earplugs or muffs to protect your hearing and prevent hearing loss.

b) Why should you use fire resistant clothing when welding?

[2]

Marking Guidelines

Allocate two (2) marks for the correct answer given, total marks is two (2) marks. **Use discretion to allocate marks for any other relevant points that may be given by the students.**

Fire resistant clothing protects you from heat, fire and radiation created in the welding process and shields you from burns. It should have no cuffs, and pockets must be covered by flaps or taped closed. You should not use synthetic clothing. Instead, opt for leather and flame-resistant treated cotton.

c) What is environmental protection? **[2]**

Marking Guidelines

Allocate two (2) marks for the correct answer given, total marks is two (2) marks. **Use discretion to allocate marks for any other relevant points that may be given by the students.**

Environmental protection refers to any measure that is taken to conserve, maintain or preserve the state of the environment.

Question 3 **Maintain welding hand-tools**

a) Name and Describe typical scenarios where issue-based risk assessments are used? List any (3) three.

[6]

Marking Guidelines

Allocate one (1) mark for every correct name and one (1) mark for description given, adding up to a total of six (6) marks. **Use discretion to allocate marks for any other relevant points that may be given by the students.**

Issue Based Risk Assessments are typically conducted:

i. After a new machine or equipment was purchased. The purpose of this assessment is to determine if the machine or equipment is safe and in compliance with legal and other requirements;
ii. After an incident - During the incident investigation process weaknesses with internal policies or procedures could have been identified. The incident investigation may also show additional precautionary measures are required as to prevent a re-occurrence; and or

iii. When new legislation was promulgated – New legislation may prescribe requirements which are currently not being complied with. Assessing the contents of the legislation will show these non-conformances and will allow employers to ensure compliance;

b) Identify the following hand-tools and state their function in the welding industry:

[4]

Marking Guidelines

Allocate one (1) mark for tool name given and one (1) mark for function given, adding up to a total of four (4) marks.

Use discretion to allocate marks for any other relevant points that may be given by the students.

No	Memorandum		Marks
1	Identify the following hand-tools and state their function in the welding industry:		4
b.	 *Chipping hammer*	*Chipping hammers have a flat side and a pointed side, optimized for different kinds of slag and spatter removal.*	[2]
c.	 *Metal brush / wire brush*	*A metal brush removes slag and charring from the top of cooled welds and leaves the whole thing looking nice and clean.*	[2]
Total			**4**

Question 4 **Maintain welding power-tools**

a) Answer the following questions:

[5]

Marking Guidelines

Allocate one (1) mark for every correct answer given, adding up to a total of five (5) marks. **Use discretion to allocate marks for any other relevant points that may be given by the students.**

No	Memorandum	Marks
1	Name the two types of portable grinders.	2
	• *Disk type* • *Wheel type* • *Battery operated* • *Electric grinder* • *Air powered grinder*	
2	List two PPE that must be worn when using power brushes.	2
	• *Safety glasses, full face shield with side shields* • *Overalls.*	
3	Why should you never carry a portable grinder by the cord?	1
	This can break the electrical connections inside the machine.	
Total		**5**

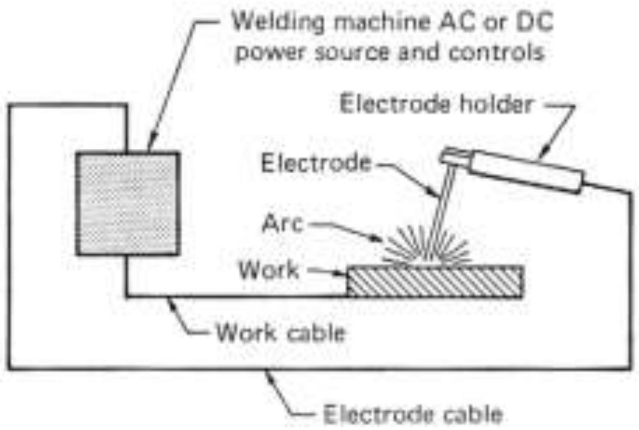
Question 5 **Demonstrate understanding of welding processes (SMAW)**

a) Draw and label a basic arc-welding circuit.

[5]

Marking Guidelines

Allocate five (5) marks for the correct drawing , adding up to a total of five (5) marks. **Use discretion to allocate marks for any other relevant points that may be given by the students.**



b) By marking use of the a basic arc-welding circuit mentioned on "**a**" above, explain the process resulting into a fusion bond between the parent material and filler material.

[5]

Marking Guidelines

Allocate five (5) marks for every correct answer given, adding up to a total of five (5) marks. **Use discretion to allocate marks for any other relevant points that may be given by the students.**

The basic arc-welding circuit process is as follows:

- An AC or DC power source, fitted with whatever controls may be needed, is connected by a work cable to the workpiece and by a "hot" cable to an electrode holder of some type, which makes an electrical contact with the welding electrode.
- An arc is created across the gap when the energized circuit and the electrode tip touches the workpiece and is withdrawn, yet still with in close contact.
- The arc produces a temperature of about 6500ºF at the tip. This heat melts both the base metal and the electrode, producing a pool of molten metal sometimes called a "crater."
- A shielding gas (mainly carbon-dioxide) is created from the flux-coating of the electrode, thus displacing oxygen and nitrogen from the weld pool.
- The crater solidifies behind the electrode as it is moved along the joint. The result is a fusion bond.

Question 6 **Demonstrate understanding of welding processes (GTAW)**

a) Argon is a monatomic (single-atom) gas commonly used for GTAW on all materials, why?

[1]

Marking Guidelines

Allocate one (1) mark for the correct answer given, adding up to a total of on (1) mark. **Use discretion to allocate marks for any other relevant points that may be given by the students.**

Since Argon is chemically inert, making it suitable for welding on reactive or refractory metals.

b) Describe the differences between flux and slag.

[4]

Marking Guidelines

Allocate two (2) marks for each correct answer given, adding up to a total of four (4) marks.

Use discretion to allocate marks for any other relevant points that may be given by the students.

Flux is the substance added to molten metals to bond with impurities that can be readily removed. Slag is the waste material which is removed. In metallurgy, substance used to remove or prevent the formation of undesirable oxide and other substances during welding. Fluxes are similarly used during the refining of metals. They range from the acid silica to the neutral borax and the basic lime, and they also include rosins and various corrosives. The choice of flux used depends on the materials involved in the given operation.

Slag is impure residue, consisting largely of calcium, iron, aluminium, and magnesium silicate, derived during the process of pig-iron and steel production and during the smelting of metals, such as copper, lead, and nickel.

Question 7 **Explain welding imperfections and defects**

a) Name Six (6) defects which can occur at a welded joint?

[6]

Marking Guidelines

Allocate one (1) mark for every correct answer given, adding up to a total of six (6) marks.

Use discretion to allocate marks for any other relevant points that may be given by the students.

The defects which can occur at a welded joint are:

- Slag inclusions
- Porosity
- Lack of penetration
- Lack of sidewall fusion
- Liquation cracking
- Solidification cracking
- Hydrogen cracking
- Excessive undercut

b) Describe briefly what is water jet eroding?

[2]

Marking Guidelines

Allocate two (2) marks for the correct answer given, adding up to a total of two (2) marks. **Use discretion to allocate marks for any other relevant points that may be given by the students.**

The water jet eroding technique involves directing a jet of high-pressure water which contains abrasive particles at the weld. The abrasive particles erode the weld face material removing the weld toe area including undercuts and slag inclusions. During the process the position of the nozzle is held approximately 45º to the x-axis. The physical mechanisms for the resulting improvement in fatigue strength are similar to other weld toe treatments, namely, the weld toe angle is reduced to provide a smooth transition to the base plate, and weld toe inclusions and undercuts are removed resulting in a reduction in the weld toe stress concentration.

c) Describe Magnetic particle inspection?

[2]

Marking Guidelines

Allocate two (2) marks for the correct answer given, adding up to a total of two (2) marks. **Use discretion to allocate marks for any other relevant points that may be given by the students.**

Magnetic particle inspection is a method of locating and defining discontinuities in magnetic materials. It is excellent for detecting surface defects in welds, including discontinuities that are too small to be seen with the naked eye, and those that are slightly subsurface. This method may be used to inspect plate edges prior to welding, in process inspection of each weld pass or layer, post-weld evaluation and to inspect repairs.

Question 8 **Identify welding symbols**

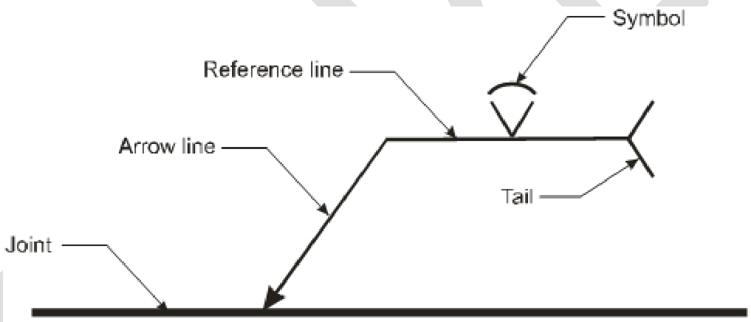
a) Label the following welding symbol..

[5]

Marking Guidelines

Allocate one (1) mark for every correct answer given, adding up to a total of five (5) marks. **Use discretion to allocate marks for any other relevant points that may be given by the students.**

a)

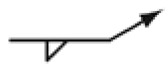
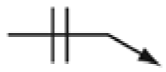


b) Describe and sketch the welding symbols used in the industry in accordance with the AWS instruction manual.

(3)

Marking Guidelines

Allocate one (1) mark for each description and sketch drawn, adding up to a total of three (3) marks. **Use discretion to allocate marks for any other relevant points that may be given by the students.**

a.	What is the welding symbol for a fillet weld, arrow side?		
b.	What is the welding symbol for a seam weld, other side?		
c.	What is the welding symbol for a square weld, both sides?		

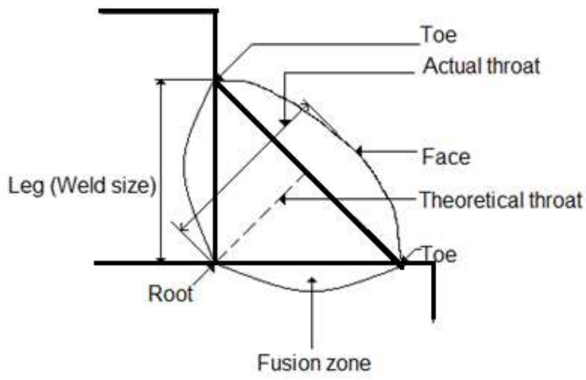
c) Below is a labelled sketch of a fillet weld, explain what it consists of.

[7]

Marking Guidelines

Allocate one (1) mark for every correct answer given, adding up to a total of seven (7) marks.

Use discretion to allocate marks for any other relevant points that may be given by the students.



A fillet weld generally has a triangular cross section with each leg of the triangle being connected to each of the pieces being attached. A fillet weld consists of the following parts as depicted in the figure above.

- Leg (weld size) – the distance from the root of the joint to the toe.
- Actual throat – the distance from the root of the joint to the face of the fillet weld.
- Theoretical throat – the perpendicular distance from the root of the joint to the hypotenuse of the largest right triangle that can be inscribed within the specific cross section of the weld.
- Face – this refers to the exposed surface of a weld on the side from which welding was undertaken.
- Fusion zone – on the cross section of a weld this refers to the area of base metal that has melted.
- Root – as shown on the cross section, the root is the point at which the two joined metals are closest to each other.
- Toe – the junction between the face of the weld and the base metal

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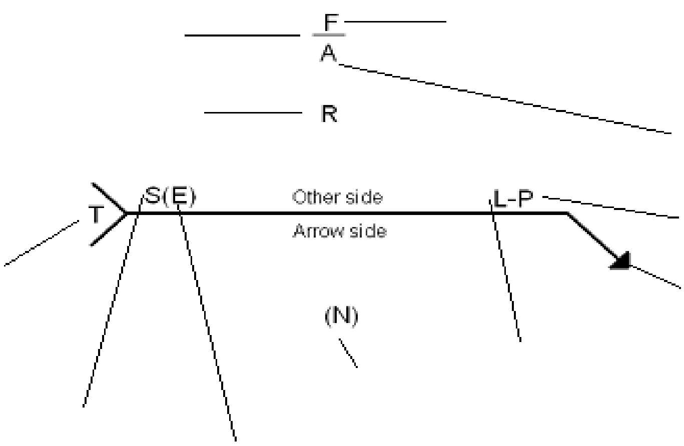
Question 9 **Identify welding symbols (WPS)**

a). Give Ten (10) elements that welding symbols describe by making reference to the below sketch:

[10]



Marking Guidelines

Allocate one (1) mark for every correct answer given, adding up to a total of ten (10) marks.

Use discretion to allocate marks for any other relevant points that may be given by the students.

a) Type of the weld process;

b) Combination of weld processes;

c) Position of the weld (single or both sides of the joint);

d) Size of the weld;

e) Extent of the weld (continuous or pitch weld);

f) Type of preparation (V-, J-, U-, bevel-weld);

g) Profile of the weld;

h) Final finish of the weld (ground, machined);

i) Back grinding or gouging;

j) Use of backing plate or material;

k) Methods and extent;

l) Special requirements.

<u>Question 10</u> **Demonstrate understanding of welding consummables**

a) Describe four (4) factors which influence the chemical composition of the flux coating on electrodes. **[4]**

Marking Guidelines

Allocate one (1) mark for every correct answer given, adding up to a total of four (4) marks.

Use discretion to allocate marks for any other relevant points that may be given by the students.

A. Arc stability.
B. Depth of penetration

C. Metal deposition rate

D. Positional capability.

b) Describe the guidelines for choosing the best filler rod for stainless sheet metal as opposed to carbon steel?

[2]

Marking Guidelines

Allocate two (2) marks for the correct answer given, adding up to a total of two (2) marks. **Use discretion to allocate marks for any other relevant points that may be given by the students.**

For stainless sheet metal, one size lower than you would use for carbon steel seems to help because typically, less amperage is used on stainless steel than on carbon steel. At low amperage, a large rod chills the puddle a lot and can cause a very irregular bead.

c) Name four (4) factors that determines the desirable rate of gas flow in GTAW welding processes?

[4]

Marking Guidelines

Allocate one (1) mark for any correct answer given, adding up to a total of four (4) marks. **Use discretion to allocate marks for any other relevant points that may be given by the students.**

The desirable rate of gas flow depends primarily on:

- weld geometry,
- speed,
- current,
- the type of gas,
- and the metal transfer mode being utilized.

TOTAL MARKS FOR THE EISA: 100

ALLOCATION GRID (For use by the Assessor only)

QUESTION	MARK	MARKS AWARDED
1	15	
2	10	
3	10	
4	5	
5	10	

6	5	
7	10	
8	15	
9	10	
10	10	
TOTAL QUESTION PAPER 1D	100	
GRAND TOTAL	100	