



**Section I : Attempt all the Twelve (12) questions**

**(60 marks)**

**01.** In plate welding position numbers 1,2,3, and 4 and letters F and G have their proper meaning. Give type of weld and welding position of the following representation. **(5 marks)**

a) 1G

b) 2F

**02.** Identify five (5) tools/equipment used for cleaning during and after welding. **(5 marks)**

**03.** Explain the following terms:

a) Size of the weld.

b) Face of the weld.

c) Toe of the weld.

d) Fusion zone.

e) Root penetration.

**(5 marks)**

**04.** State five (5) functions of flux coating.

**(5 marks)**

**05.** What do you understand by shielded metal arc welding (SMAW) process?

**(5 marks)**

**06.** With the help of neat sketch show Electric Arc Welding Machine.

**(5 marks)**

**07.** Explain the following electrode specification.

**(5 marks)**

**E 70 X X**

**08.** Enumerate five (5) types of visual defects.

**(5 marks)**

**09. a)** Give three (3) different methods of cleaning.

**(3 marks)**

**b)** Is it necessary to clean welded surface? If yes how?

**(2 marks)**

**10.** In welding, we mostly consider technical terms in the way of communicating with labor market. Define the following terms:

**a)** A bill of quantity (BOQ)

**b)** Serial number.

**(5 marks)**

**11. a)** Define Electrode dry oven.

**(3marks)**

**b)** Mention two (2) classes of electrode.

**(2marks)**

**12.** Give five (5) parts of an angle grinder.

**(5marks)**

**Section II: Attempt any Four (4) questions out of Six (6) (40 marks)**

**13. a)** What are the causes of lack of penetration of welding defect?

b) Propose the remedies for the above defect. **(10 marks)**

**14. a)** Define weaving. **(2 marks)**

b) By using a neat sketch draw and differentiate four (4) weaving techniques used in SMAW plate. **(8 marks)**

**15. a)** Define the following defects and give two (2) possible causes.

**(9 marks)**

i. Distortion

ii. Slag Inclusion

iii. Under cut

b) Give the symbol of the following weld:

Square groove weld. **(1 mark)**

**16. a)** Give at least two (2) remedies for each of the following defects:

**(6 marks)**

i. Porosity

ii. Lack of Fusion

iii. Cracking (Craters)

b) Enumerate at least four (4) applications of edge preparations.

**(4 marks)**

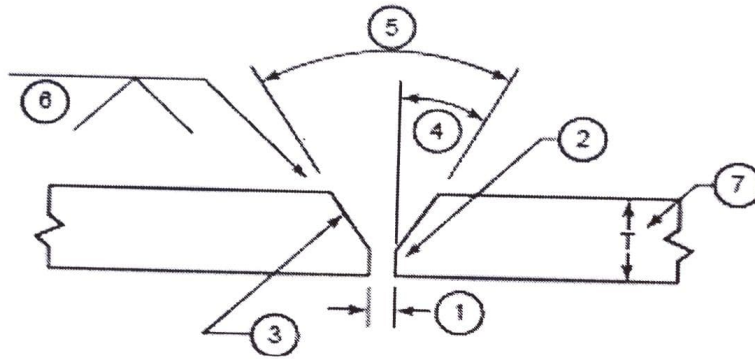
17. The following figure represents any type of weld.

a. Identify that type of weld.

(3 marks)

b. Name parts 1, 2, 3, 4, 5, 6, and 7

(7 marks)



18. Give and explain three (3) different metal joining methods.

(10marks)

# Section I

① a) 1G: flat or down hand position  
in groove weld. 2 marks

b) & F: Horizontal position & fillet  
weld. 2 marks

② Cleaning of tools or equipments

- \* wire brush (1)
- \* Mop (1)
- \* air compressor (1)
- \* cloth rug (1)
- \* bloom (1)

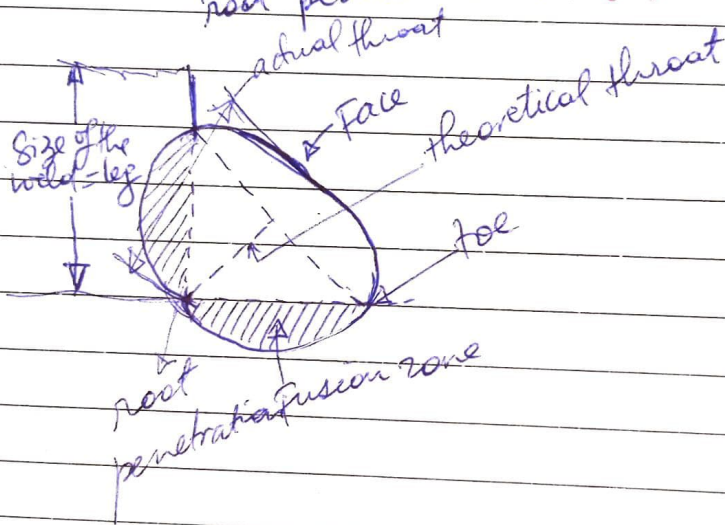
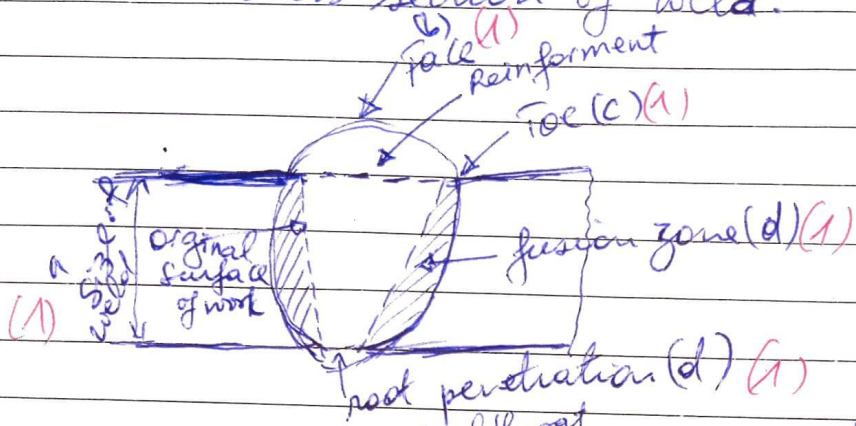
③ a) Size of the weld: the size of the weld is  
the depth of chamfering  
plus the root penetration when specified  
on groove weld.

b) Face of the weld: this is exposed surface of  
the weld, made by an arc or  
gas welding process on the side from  
which the welding was done.

c) Toe of the weld: is the junction between the face  
of the weld and the base metal.

d) Fusion zone (filler penetration): this fusion is the  
area of base metal  
melted as determined in the cross section of a  
weld.

e) Root penetration: This is the point at which the bottom of the weld intersects the base metal surface, as shown in the cross section of weld.



4) function of flux coating *1 mark/each.*

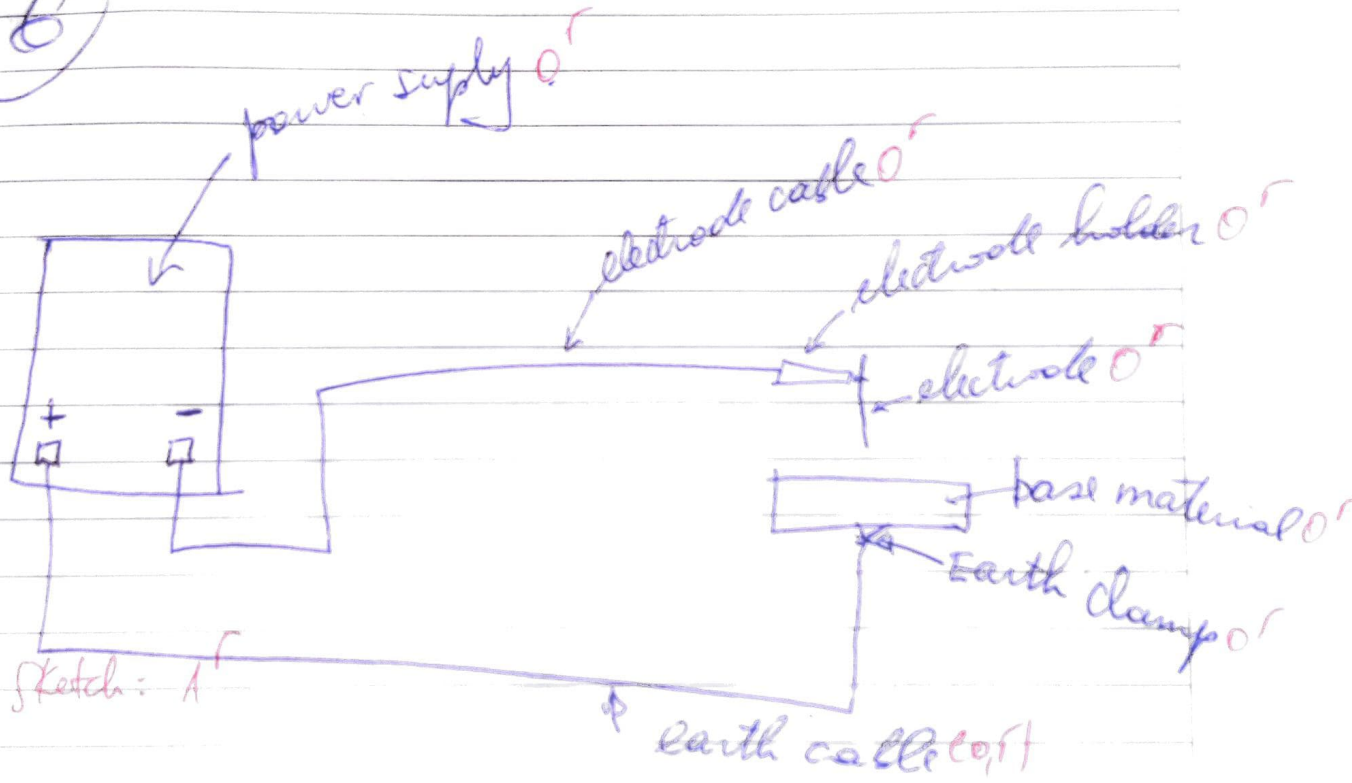
- \* It helps in easy arc striking!
- \* It helps in maintaining proper arc gap
- \* It helps to give good appearance and penetration to the weld
- \* It makes the welding in all position easy
- \* ~~Both~~ it stabilizes the arc
- \* It protect the molten weld pool against atmospheric reaction.

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# 5) Shielded metal Arc welding (SMAW)

is an arc welding process in which the fusing of metals is produced by the heat from an electric arc that is maintained between the tip of a consumable covered electrode and the surface of the base metal in the joint being welded.  
/5 marks

6



7) E 70 X X  
 ↓  
 Electrode  
 UTS (ultimate tensile strength)  
 type of flux coating  
 welding position  
 5 marks



## 8) five types of visual defects

- \* Porosity
- \* Cracks / Craters
- \* Distortion
- \* Burn through
- \* Undercut
- \* Lack of penetration
- \* Lack of fusion

1 mark / each.

## 3 different methods of cleaning

- \* Rusting 2 marks
- \* Removal of dirt 1 mark
- \* Chemical spraying 1 mark

(1) Yes it is necessary to clean welded surface  
you can clean the welded surface before and  
(1) after by using cleaning tools and equipments.

10) a) a bill of quantity (BOQ) : is a document which is especially used in tendering in the construction industry, supplies or other works in which materials, parts, and food too (and their costs) are itemized or described in detail. /2 marks

b) Serial number : is a unique, identifying number or group of numbers and letters assigned an item. /2 marks

11) a) Electrode dry oven : is a high-quality welding rod heater made of stainless steel enabling it to be used in tough environments for drying electrodes for the purpose of removing and/or preventing moisture or wetness in electrode coatings. 3 marks.

b) Two classes of electrode.

⊕ E60 series 1 mark

⊕ E70 series 1 mark

12) Parts of angle grinder.

+ Safety guards

+ trigger switch

+ handle

+ grinding/cutting wheel

+ power cord

1 mark/each.

## Section II

13) a) causes of lack of penetration

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- \* improper joint penetration preparation
- \* improper weld technique
- \* insufficient heat input
- \* wrong current setting
- \* wrong electrode angle
- \* fast travel speed
- \* wrong selection of electrode

2<sup>5</sup>/<sub>10</sub> marks each

2 answers are enough

b) \* make sure edge preparation is done on material too thick.

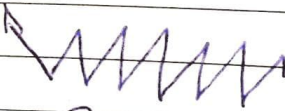
\* Reduce travel speed

\* Increase amperage

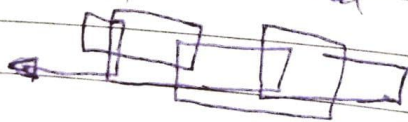
2 marks each

2 answers are enough.

14) a) weaving: is a welding technique in which the energy source is oscillated transversely as it progresses along the weld path. 2 marks

b) 1. Zigzag  zigzag pattern is used as coverpasses in the flat and vertical positions. 2 marks

2. Box weave: this is also good for most 1G (flat) welds but can also be used for vertical 3G positions.

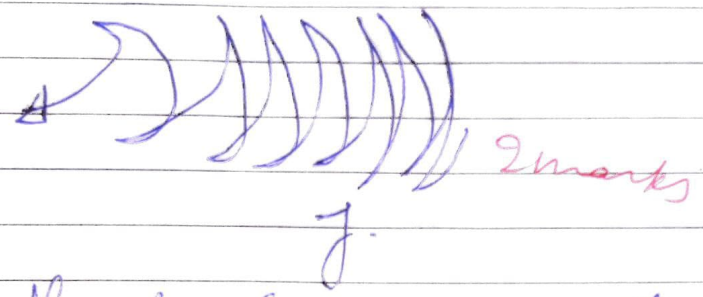


square

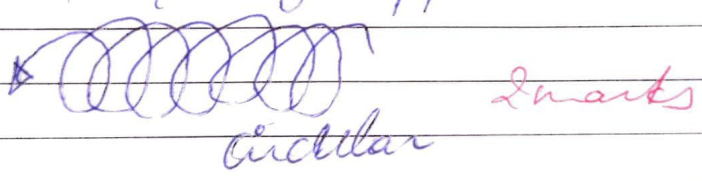
2 marks

3. Double J: The J pattern works well on flat (1F) lap joint, all vertical 3G joint, and horizontal (2G) butt and lap & F (weld)

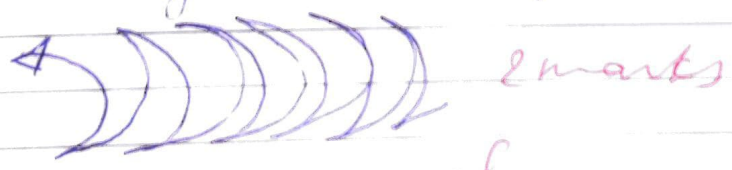
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4) Circle: The circular weave pattern is often used for flat position welds on butt, tee and outside corner joint, and for build up or surfacing application



5) Crescent: The crescent pattern (C) is good for most 1G (flat) welds but can also be used for vertical 3G position.



4 answers are enough.

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15) a) i) distortion is contraction of weld metal during welding that forces base metal to move.

1 mark

two possible causes of excessive heat input  
of improper tack weld  
of excessive current setting  
of travel speed too slow

1 mark

1 mark

ii) slag inclusion is the entrapment of slag or other impurities in the weld.

1 mark

two possible causes: slag from previous runs not being cleaned away  
of insufficient cleaning of the base metal.

1 mark

1 mark

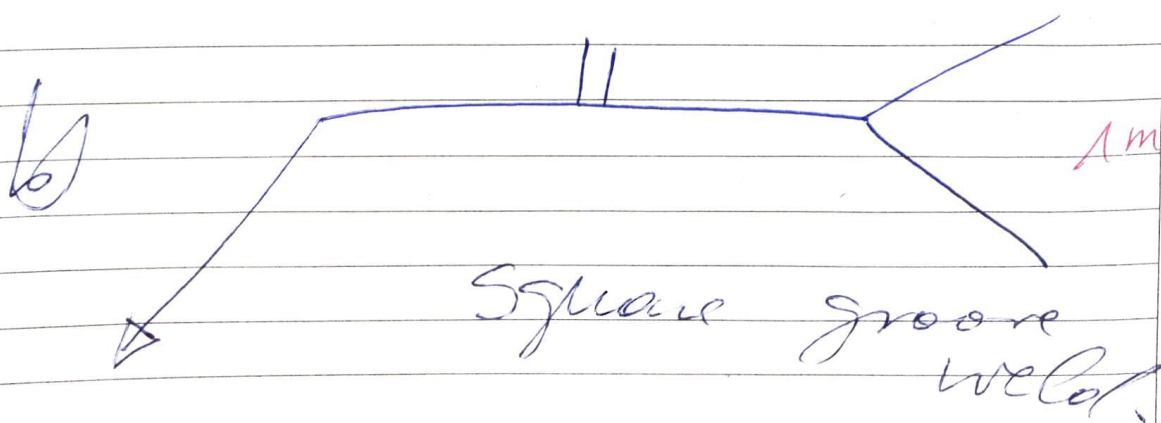
ii) Undercut: these are grooves or slots along the edges of the weld.

1 mark

two possible causes: of too fast a travel  
of bad welding techniques  
of excessive heat build up.

1 mark

1 mark



1 mark

## Remedies

16) a) i) porosity:  $\rightarrow$  Remove chemical in metal Do not write in this margin  
 $\rightarrow$  prevent dampness of the metal  
 $\rightarrow$  slow the cooling of the metal 1 mark

ii) Lack of fusion:  $\rightarrow$  reduce welding travel speed 1 mark  
 $\rightarrow$  use correct welding techniques 1 mark  
 $\rightarrow$  use sufficient heat 1 mark

iii) Cracking/craters:  $\rightarrow$  use suitable parent metal 1 mark  
 $\rightarrow$  use proper welding techniques 1 mark

b) 4 application of edge preparation

- $\rightarrow$  flange making 1 mark/each.
- $\rightarrow$  plate welding
- $\rightarrow$  joining of pipe (pipe welding)
- $\rightarrow$  Metal alignment
- $\rightarrow$  Gap filling

17) a) types of weld: bead weld  $\uparrow$   
groove weld  $\uparrow$  fillet weld  $\uparrow$

- b)
- ① root opening  $\uparrow$
  - ② root face  $\uparrow$
  - ③ ~~root~~ groove face  $\uparrow$
  - ④ Bevel angle  $\uparrow$
  - ⑤ groove angle  $\uparrow$
  - ⑥ groove weld size  $\uparrow$
  - ⑦ thickness of metal (plate thickness)  $\uparrow$

18) a) welding: is a process for joining two similar or dissimilar metals by fusion, with or without the application of pressure and with or without the use of filler metal.

10 marks

of bolting: it is the temporary metal joining process in which two or more pieces may be fixed together by means of bolts and nuts.

of Seaming: is a metal working process that uses a ~~seam~~ seam to join two layers.

of Riveting: is a forging process that may be used to join parts together by way of a metal part called rivet.

of Soldering: is a method of joining similar or dissimilar metals by heating them to a suitable temperature and by means of a filler metal, called solder, having liquidus temperature not exceeding  $450^{\circ}\text{C}$  and below the solidus of the base materials.

of Brazing: is the process of joining metals in which, during or after heating molten filler metal is drawn by capillary action into the space between closely adjacent surfaces of the parts being joined.