University of Ruhuna- Faculty of Technology

Bachelor of Engineering Technology Honours Degree
Level 3 (Semester I) Examination, June 2023
Academic year 2021/2022

Course Unit: ENT 3172 Welding Techniques (Written) **Duration: 2 hours**

- Answer all **Five (05)** questions.
- All questions carry equal marks. The maximum marks attainable for the parts of the questions are indicated in brackets.

1) Welding is a process for joining two similar or dissimilar metals by fusion. It joins different metals/alloys, with or without the application of pressure and filler materials.

   a) Define the following terminological elements associated with welding process.
      i) Heat affected zone.
      ii) Reinforcement

   (04 marks)

   b) List four (4) most widely available edge preparation techniques with neat sketches.

   (04 marks)

   c) Briefly discuss the limitations associated with **vertical welding position** and **overhead welding position** with suitable sketches.

   (06 marks)

   d) After application of the welding processes, the properties of the weld joint are changed relative to the parent materials.
      i) Briefly explain how this property change occurs.
      ii) Write down two techniques that can be followed to get back the required properties.

   (06 marks)

2) In order to cater the need for joining a wide variety of materials in different ways, a large number of welding techniques are available.

   a) Write down two applications for each of the following welding types.
      i) Non consumable electrode arc welding
      ii) Thermal welding

   (02 marks)

   b) Briefly explain two (02) main advantages of welding fluxes.

   (04 marks)

c) In gas welding, three different welding flames can be obtained. Briefly explain the reasons for following statements considering features of these flames.

i) Carburizing flame can be used in surface hardening process.
ii) The most suitable welding flame for steel is neutral flame.
iii) Oxidizing flame can be used to weld cast iron pieces even though cast iron contains a high iron percentage.

(06 marks)

d) Identify the most suitable liquid state welding process for the following applications.
i) Repairing heavy castings and gears
ii) Welding of reactive metal such as Zirconium
iii) Welding of a steel vessel
iv) Welding of two tungsten plates

(08 marks)

3) Forge welding, friction welding and explosive welding are the main examples of solid-state welding types.

a) It is practically difficult to fulfill the requirement of solid-state bonding in solid state welding due to surface conditions of the material. List down two mechanisms to neutralize the effect of the surface conditions.

(02 marks)

b) Forge welding between similar materials is caused by solid state diffusion. With the aid of suitable sketches, state the key steps of solid-state diffusion.

(06 marks)

c) Write down the most suitable solid state welding process for the following applications.
i) Metal sheets (Steel)
ii) Thermoplastic piston rods
iii) Medical equipment
iv) Appliances such as vacuum cleaners

(08 marks)

d) State two (02) adverse health impacts of exposure to radiation, gases, and smoke during welding.

(04 marks)

4) Non-Destructive tests (NDT) are used to detect the internal defects and evaluate the properties of a component without causing damage.

a) State two engineering fields where NDT is applied.

(02 marks)

b) Write down the most suitable NDT method to detect the flaws in the following components/ samples.

i) Internal cracks of a steel pipeline
ii) Surface flaws of a butt welding
iii) A crack in the seal weld of a boiler tube
iv) Cracks in an alloy wheel fixed to a vehicle

(08 marks)

c) Sketch an expected ultrasonic test graph (Pulse Echo) for the following test sample.

Test sample – a 10 mm thick rectangular shape mild steel sample having internal cracks at 5 mm and 8 mm distances away from the surface that the probe was kept.

(05 marks)

d) Briefly explain the radiographic test.

(04 marks)

5) Heat treatment involves the use of heating or chilling, normally to extreme temperatures, to achieve the desired result such as hardening or softening of a material.

a) Write down the purpose of carrying out the stress relieving as a heat treatment?

(02 marks)

b) Briefly explain the normalizing process.

(06 marks)

c) Sketch the temperature vs time graph for hardening (Quenching) and tempering.

(06 marks)

d) Briefly explain two (02) advantages of surface hardening process.

(06 marks)

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