School of Metal Construction Skills

Session: 2020-21 (Summer Semester)

B. Voc. Program, III Semester,

2nd In-Sem. Examination

Course Code: MCS1304 **Time: 1 Hour**

Course Name: Advanced Welding **Max. Marks: 20**

Instruction:

1. Attempt all questions.
2. Use of Calculators is prohibited.
3. Section A contains 05 Questions. Each question carries 1 Mark.
4. Section B contains 03 Questions. Each question carries 2 Marks.
5. Section C contains 03 Questions. Each question carries 3 Marks.

Section – A

05X01 = 05 Marks

Q1. What is the correct identification number for the welding process submerged arc welding with solid wire as per ISO 4063?

(A) 122
(B) 185
(C) 121
(D) 142

Q2. What is the correct identification number for the welding process explosive welding as per ISO 4063?

(A) 441
(B) 121
(C) 311
(D) 52

Q3.What information does WPS contains?

(A) Welding current
(B) Heat input
(C) Welding process
(D) All of the above

Q4. Which of the following is a NDT process?

(A) Radiographic test
(B) Bend test
(C) Tensile test
(D) Macro examination

Q5. Which of the following is not a quantitative type DT process?

(A) Tensile test

(B) Impact test
(C) Bend test
(D) Hardness test

Section – B

03X02 = 06 Marks

Q6. What is pWPS?

Q7. What is PQR?

Q8. Write Short note on stainless steel and its types.

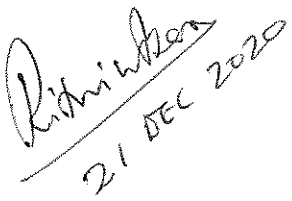
Section – C

03X03 = 09 Marks

Q9. What is clad steel? Write down the process of welding of clad steel.

Q10. Write down the Procedure for welding stainless steels to mild or low alloy steels.

Q11. What is aluminum bronze? What to avoid while welding aluminum bronze?



Set A
Answersheet.

School of Metal Construction Skills

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Section – A

05X01 = 05 Marks

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Q5. Which of the following is not a quantitative type DT process?

(A) Tensile test

(B) Impact test
(C) Bend test
(D) Hardness test

Section – B

03X02 = 06 Marks

Q6. What is pWPS?

Ans. **PRELIMINARY (PROPOSED) WELDING PROCEDURE SPECIFICATIONS (WPS)**

pWPS is essentially a guide for the person that is going to weld the PQR test coupon and it can also be used as a document to get in principal approval from the client. You give the client the change to review what you intend to do, ie. If I run the test like this and do this testing, will you be happy with it.

This is not always required, but it is specified in some standards. It can save heartache buy ensuring the client is happy with the WPS at the end.

Q7. What is PQR?

Ans. PROCEDURE QUALIFICATION RECORDS (PQR)

All WPSs start with a PQR. It is a record of the test. It **DOES NOT have any ranges**. It lists the actual values recorded during the welding of a test piece. It proves the welding process.

Then using the essential variables (ranges) from the relevant code/standard a WPS can be generated from this record of actual values.

PQR is essentially the 'actual' method that is used to create and test the welds to ensure they meet all applicable requirements.

The test procedures and final results are documented in the PQR. If the PQR meets the set standards of the welding world, then it will serve as the foundation on which one or more WPSs are drafted.

Even though a PQR eventually leads to a WPS, it is important for welders to have knowledge of both documents. In critical applications and in mechanized and automatic welds welders can refer to the PQR and replicate the actual values used in the test weld, this removes all the variation.

On face value, these documents look very similar but serve completely different purposes.

The best way to think of it is;

- PQR is an office document
- WPS is a workshop document

Both are necessary in most cases. The PQR supports the WPS as evidence of qualification.

Q8. Write Short note on stainless steel and its types.

Ans. Stainless steels are a group of high alloy steels that contain at least 12% chromium. In general, they are alloyed with a number of other elements that make them resistant to a variety of different environments. These elements also modify the microstructure of the alloy, which in turn has a distinct influence on their mechanical properties and weld ability. Stainless steels can be broadly classified into five groups as detailed below:

- Austenitic stainless steels, which contain 12–27% chromium and 7–25% nickel.
- Ferritic stainless steels, which contain 12–30% chromium with a carbon content below 0.1%.

- Martensitic stainless steels, which have chromium content between 12 and 18% with 0.15–0.30% carbon.
- Ferritic-austenitic (Duplex) stainless steels, which contain 18– 25% chromium, 3–5% nickel and up to 3% molybdenum.
- Martensitic-austenitic steels, which have 13–16% chromium, 5–6% nickel and 1–2% molybdenum.

Section – C

03X03 = 09 Marks

Q9. What is clad steel? Write down the process of welding of clad steel.

Ans. The use of a clad-material, consisting of a mild or low alloy steel backing faced with stainless steel, usually from 10 to 20% of

The total thickness, combines the mechanical properties of an economic backing material with the corrosion resistance of the more expensive stainless steel facing. This facing usually consists of austenitic stainless steel of the 18% chromium 8% nickel or 18% chromium 10% nickel types, with or without additions of

Molybdenum, titanium and niobium, or a martensitic stainless steel of the 13% chromium type.

The backing should be welded first, while making sure that the root run of the mild steel electrode does not come into contact with the alloyed cladding. This can be achieved in two ways, either by cutting the cladding away from both sides of the root, or welding with a closed butt preparation and a sufficiently large root-face.

After welding the mild steel side, the root run should be back grooved and the stainless clad side welded with a stainless electrode of matching composition. The use of a more highly alloyed electrode (e.g. Smooth arc S309) for the initial root run on the clad side is advisable. This applies particularly to preparations in which the back- cutting of the cladding makes pick-up from the mild steel difficult

To avoid. For the best resistance to corrosion, at least two layers of stainless weld metal on the clad side are recommended.

The welding of material that is clad or lined with 13% chromium (martensitic) steels usually requires a preheat of 250°C and the use of austenitic electrodes of appropriate type. Welding should be followed by a post-weld heat treatment, though satisfactory results can be obtained without these precautions if, during welding, heat dissipation is kept to a minimum. This will help to temper the heat-

Affected zone by utilizing the heat build-up from adjacent weld runs.

Q10. Write down the Procedure for welding stainless steels to mild or low alloy steels.

Ans. Situations frequently arise in which it becomes necessary to weld an austenitic stainless steel to a mild or low alloy ferritic steel. In

Selecting a suitable electrode, the effect of dilution of the weld metal by the base material must be considered. The weld metal may be diluted from 20 to 50% depending on the welding technique used, root runs in butt joints being the most greatly affected since all subsequent runs are only in partial contact with the base material and share dilution with neighboring runs. If a mild or low alloy steel electrode is used to weld stainless to mild steel, the pickup of chromium and nickel from the stainless

steel side to the joint could enrich the weld metal by up to 5 percent chromium and 4% nickel. This would result in a hard enable, crack-sensitive weld.

Austenitic stainless steel electrodes are therefore used for joining dissimilar metal combinations of stainless materials to mild and low alloy ferritic steels. However, the correct type, which has sufficient alloying to overcome the effects of dilution from the mild or low alloy steel side of the joint, must be selected because, if the weld metal does not start with an adequate alloy content, the final weld may contain less than 17% chromium and 7% nickel. Weld metal with lower chromium and nickel contents are crack sensitive. Also, if as a result of dilution the weld metal is incorrectly balanced with nickel and chromium, there may not be sufficient ferrite present in the weld metal to prevent fissuring and subsequent cracking.

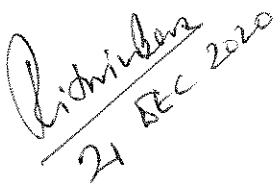
For these reasons, the austenitic stainless steel electrodes such as S309L etc. should be used, as their composition has been specially balanced to ensure that the total alloy content is

Adequate to accommodate dilution effects and their ferrite content is sufficient to provide high resistance to hot cracking.

Q11. What is aluminum bronze? What to avoid while welding aluminum bronze

Ans. Aluminum bronze

There are essentially two types of aluminum bronzes; single phase alloys containing between 5 to 10% aluminum, with a small amount of iron or nickel, and more complex, two phase alloys containing up to 12% aluminum and about 5%of iron with specific alloys also containing nickel, manganese and silicon. Gas shielded welding processes are preferred for welding this group of alloys. In TIG welding, the presence of a tenacious, refractory oxide film requires AC (argon), or DC with a helium shielding gas. Due to its low thermal conductivity, a preheat is not normally required except when welding thick section components. Avoiding weld imperfections Rigorous cleaning of the material surface is essential, both before and after deposition of each welding pass, to avoid porosity. Single phase alloys can be susceptible to weld metal and HAZ cracking under highly restrained conditions. It is often necessary to use matching filler metals to maintain corrosion resistance but a non-matching, two phase, filler can also reduce the risk of cracking. Two phase alloys are easier to weld. For both types, preheat and interpass temperatures should be controlled carefully to prevent cracking.



BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.: .....

School of Metal Construction Skills

Session: 2020-21 (Summer Semester)

B. Voc. Program, III Semester,

2nd In-Sem. Examination

Course Code: MCS1305 **Time: 1 Hour**

Course Name: Advanced Drawings **Max. Marks: 20**

Instruction:

1. Attempt all questions.
2. Use of Calculators is prohibited.
3. Section A contains 05 Questions. Each question carries 1 Mark.
4. Section B contains 03 Questions. Each question carries 2 Marks.
5. Section C contains 03 Questions. Each question carries 3 Marks.

Section – A

05X01 = 05 Marks

1. What Action Does The Home Command Perform?

   a) Returns to the default view.
   b) Undo the things
   c) Previous view
   d) None of these

2. SolidWorks is manly used for

   a) 3D modeling
   b) 2D
   c) 4D
   d) 1D

3. How can you UNDO the entity in solid works?
   a) Ctrl+A
   b) Ctrl+Y
   c) Ctrl+Z
   d) Shift+Ctrl+delete

4. How can you select all entity in solid works?
   a) Ctrl+Alt
   b) Ctrl+C
   c) Ctrl+V
   d) Ctrl+A

5. SolidWorks Corporation was founded in _____.
   a) Nov 1990
   b) Dec 1993
   c) Jun 1997
   d) May 2000

Section – B

03X02 = 06 Marks

Q6. Explain what is SolidWorks?

Q7. List out the major difference between the AutoCAD and SolidWorks?

Q8. List out the major or basic components of Feature Manager Design tree?

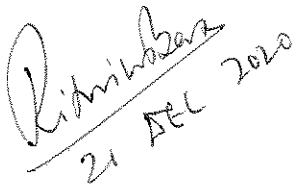
Section – C

03X03 = 09 Marks

Q9. Explain how you can engrave text to part in SolidWorks?

Q10. What Are The Commonly Used Tools In Solid Works Surface?

Q11. What Are The Types Of Pattern In Solid Works Assembly?



Set A Answersheet

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School of Metal Construction Skills

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B. Voc. Program, III Semester,

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Course Code: MCS1305 **Time: 1 Hour**

Course Name: Advanced Drawings **Max. Marks: 20**

Instruction:

1. Attempt all questions.
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3. Section A contains 05 Questions. Each question carries 1 Mark.
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Section – A

05X01 = 05 Marks

Q1. What Action Does The Home Command Perform?

a) Returns to the default view.
b) Undo the things
c) Previous view
d) None of these

Q2. SolidWorks is manly used for

a) 3D modeling
b) 2D
c) 4D
d) 1D

Q3. How can you UNDO the entity in solid works?

a) Ctrl+A
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Q4. How can you select all entity in solid works?

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b) Ctrl+C
c) Ctrl+V
d) Ctrl+A

Q5. SolidWorks Corporation was founded in _____.

a) Nov 1990
b) Dec 1993
c) Jun 1997
d) May 2000

Section – B

03X02 = 06 Marks

Q6. Explain what is SolidWorks?

Ans -SolidWorks is a computer aided design tool or software that runs on Microsoft Windows.

Q7. List out the major difference between the AutoCAD and SolidWorks?

Ans - The significant difference between the SolidWorks and AutoCAD is that

AutoCAD was designed and developed as a 2D package and later evolved into a 3D package while SolidWorks is developed as 3D.

Q8. List out the major or basic components of Feature Manager Design tree?

Ans- The basic components of Feature Manager Design tree includes

- Part
- Subassembly
- Flexible Subassembly

Section – C

03X03 = 09 Marks

Q9. Explain how you can engrave text to part in SolidWorks?

Ans- To engrave text in SolidWorks you have to

- Once you have created the parts or your design ready in SolidWorks you have to go to main menu bar
- Under main menu bar -> Select tools
- Tools -> click on Sketch Entities
- Sketch Entities -> Text
- Input the text into the text box
- To change the font – uncheck the use document font and set the font type and size
- To engrave the text click Features -> tap on Extruded Cut -> now under direction 1 Blind, set the D1, and then click Isometric from the lower left view menu

Q10. What Are The Commonly Used Tools In Solid Works Surface?

Ans-

- Extrude
- Revolve
- Sweep
- Loft
- Boundary Surface
- Offset
- Fill Surface
- Extend
- Trim
- Untrim
- Knit
- Planer
- Thicken

Q11. What Are The Types Of Pattern In Solid Works Assembly?

Ans-

a. Linear component pattern
b. Circular component pattern
c. Pattern driven component pattern
d. Sketch driven component pattern
e. Curve driven component pattern
f. Chain component pattern
g. Mirror

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School of Metal Construction Skills

Session: 2020-21 (Summer Semester)

B. Voc. Program, III Semester,

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Course Code: MCS1306 **Time: 1 Hour**

Course Name: Material Science **Max. Marks: 20**

Instruction:

1. Attempt all questions.
2. Use of Calculators is prohibited.
3. Section A contains 05 Questions. Each question carries 1 Mark.
4. Section B contains 03 Questions. Each question carries 2 Marks.
5. Section C contains 03 Questions. Each question carries 3 Marks.

Section – A

05X01 = 05 Marks

1. Body centered cubic (BCC) materials are harder than face centered cubic (FCC) materials. Which of the following reasons look appropriate?

(A) BCC has less number of slip systems

(B) BCC has more slip systems, but slip systems are not as closed pack as FCC

(C) BCC unit cells have less atoms than FCC

(D) None of the above.

2. The crystal structures of the following metals (a) Molybdenum (b) aluminum (c) copper and (d) tungsten are as follows

(A) (*a*) FCC, (*b*) BCC, (*c*) BCC and (*d*) FCC

(C) (*a*) BCC, (*b*) BCC, (*c*) FCC and (*d*) BCC

(C) (a) BCC, (b) FCC, (c) FCC and (d) BCC

(C) (*a*) BCC, (*b*) BCC, (*c*) FCC and (*d*) FCC

3. Which class of steels are used as cutting tool material?

(A) High strength steels (HSS)

(B) Alloy steels

(C) Plain carbon steel

(D) Stainless steel

4. The heat treatment used for relieving stress in steel is—

(A) Tempering

(B) Annealing

(C) Carburizing

(D) All

5. The kind of failure observed in FCC materials

(A) Ductile

(B) Brittle

(C) Mix

(D) None of the above

Section – B

03X02 = 06 Marks

Q6. Briefly explain the phenomena of stress corrosion cracking.

Q7. State the properties of stainless steel. Name two important grade of austenitic stainless steels.

Q8. Use a temperature-time diagram to explain the difference between the solidification process of a pure metal and an alloy.

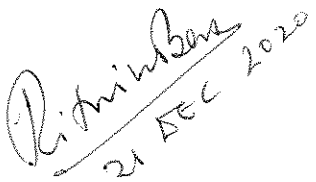
Section – C

03X03 = 09 Marks

Q9. Calculate the atomic packing factor of BCC material with a neat sketch.

Q10. Differentiate between normalizing and annealing in heat treatment of steels.

Q11. Draw with a neat diagram the microstructures of the different zones (clearly labeled) in fusion welded joints.



Set A
Answersheet

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Course Name: Material Science **Max. Marks: 20**

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Section – A

05X01 = 05 Marks

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(C) (*a*) BCC, (*b*) BCC, (*c*) FCC and (*d*) FCC

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(B) Annealing

(C) Carburizing

(D) All

5. The kind of failure observed in FCC materials

(A) Ductile

(B) Brittle

(C) Mix

(D) None of the above

Section – B

03X02 = 06 Marks

Q6. Briefly explain the phenomena of stress corrosion cracking.

Ans. Stress corrosion cracking (SCC) is the formation and growth of crack through materials subjected to tensile stress and a specific corrosive medium. It can lead to unexpected sudden failure of normally ductile metals. Metal-environment combinations susceptible to cracking are specific. This means that all environments do not cause SCC on all of the alloys.

Q7. State the properties of stainless steel. Name two important grade of austenitic stainless steels.

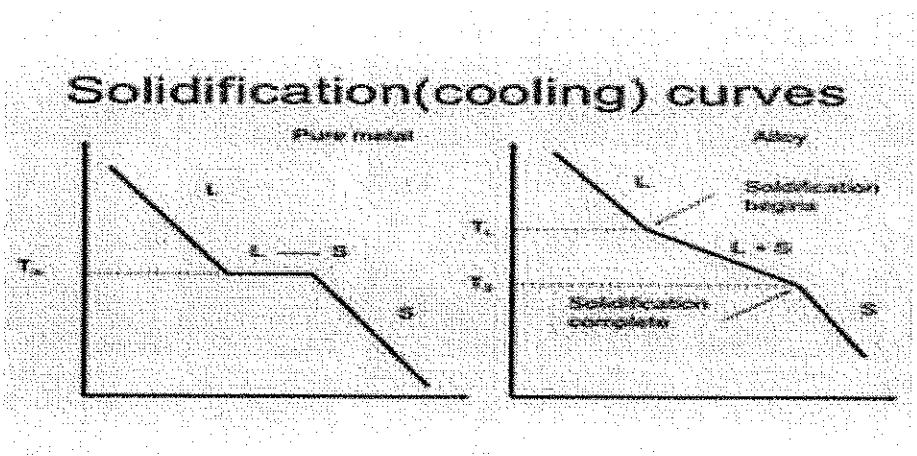
Ans. Properties of stainless steel—

- Higher corrosion resistance
- Higher cryogenic toughness
- Higher work hardening rate
- Higher hot strength
- Higher ductility
- Higher strength and hardness
- A more attractive appearance

The two important grade of austenitic stainless steel are – SS 304 and SS 316

Q8. Use a temperature-time diagram to explain the difference between the solidification process of a pure metal and an alloy.

Ans.



Section – C

03X03 = 09 Marks

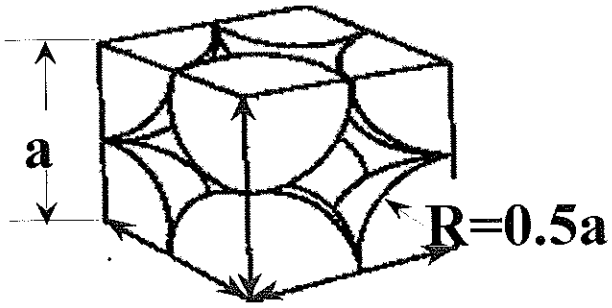
Q9. Calculate the atomic packing factor of BCC material with a neat sketch.

Ans. Atomic Packing Factor (APF)

$$APF = \frac{\text{Volume of atoms in unit cell*}}{\text{Volume of unit cell}}$$

*assume hard spheres

- **APF for a simple cubic structure = 0.52**



close-packed directions

$$APF = \frac{\text{atoms}}{\text{unit cell}} \times \frac{\text{volume}}{\text{atom}} = \frac{1 \cdot \frac{4}{3}\pi(0.5a)^3}{a^3}$$

volume unit cell

contains 8 x 1/8 =

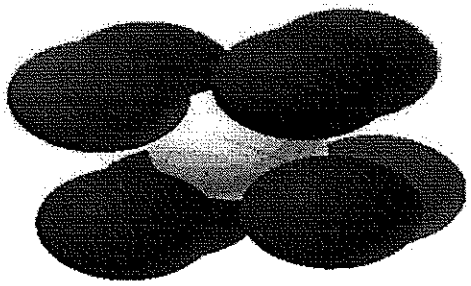
1 atom/unit cell

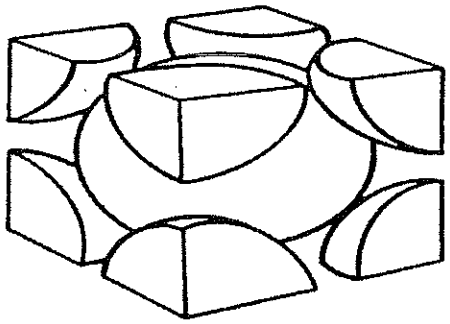
Body Centered Cubic Structure (BCC)

- **Close packed directions are cube diagonals.**

--Note: All atoms are identical; the center atom is shaded differently only for ease of viewing.

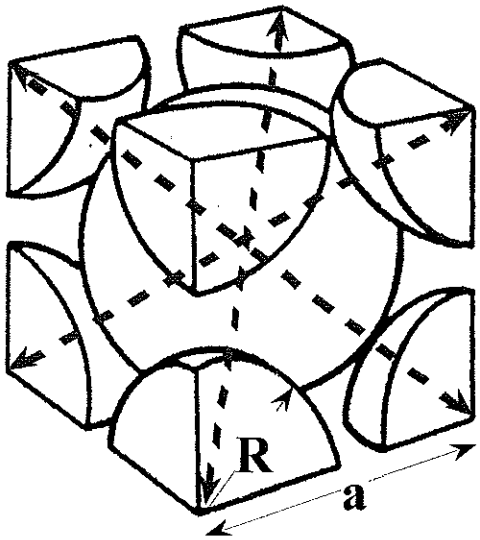
• Coordin





ation # = 8

APF of BCC



- APF for a body-centered cubic structure = 0.68

Close-packed directions: length = 4R = 3 a

Unit cell contains: 1 + 8 x 1/8

= 2 atoms/unit cell

$$APF = \frac{\text{atoms}}{\text{unit cell}} \cdot \frac{\text{volume}}{\text{atom}} \cdot \frac{\text{unit cell}}{\text{volume}} = \frac{2 \cdot \frac{4}{3}\pi(\sqrt{3}a/4)^3}{a^3}$$

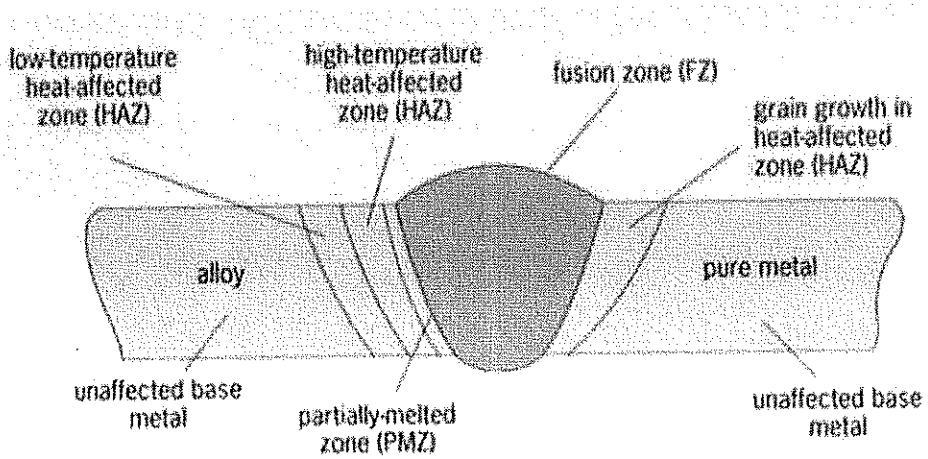
Q10. Differentiate between normalizing and annealing in heat treatment of steels.

Ans.

ANNEALING	NORMALISING
Low value for hardness, tensile strength, and toughness	Slightly more value for hardness, tensile strength, and toughness
Grain size distribution is more uniform	Grain size distribution is slightly less uniform
Internal stresses are least	Internal stresses are slightly more
Carried out under slow cooling- inside furnace	Carried out relatively under fast cooling- outside furnace, in air
To refine the crystalline structure and remove residual stresses. To increase its ductility by reducing hardness and brittleness	To get a refine grain structure before hardening. To reduce segregation in casting of forgings. To harden the steel slightly.

Q11. Draw with a neat diagram the microstructures of the different zones (clearly labeled) in fusion welded joints.

Ans.



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