

Name of the Examinations:
B.E. METALLURGICAL ENGINEERING
FOURTH YEAR SECOND SEMESTER EXAM 2025
Subject: JOINING OF METALS

Time: 3hrs.

Full Marks: 100

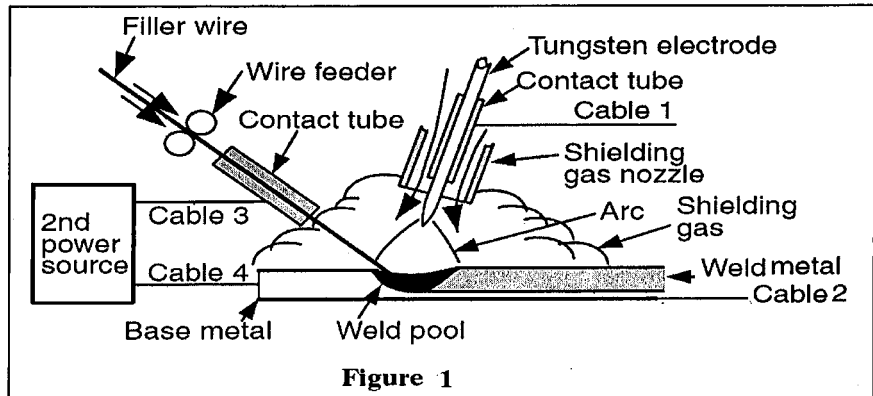
CO1: Compulsory- Answer any One

- (a) What is arc? Explain the power source and use of DC characteristics for the SMAW process. Explain the mechanism to build of an arc column with suitable sketch. What is function of plasma in an arc?

(b) The diameter of the electrodes to be used in SMAW depends on factors such as the workpiece thickness, the welding position, and the joint design. Large electrodes, with their corresponding high currents, tend to produce large weld pools. When welding in the overhead or vertical position, do you prefer using larger or smaller electrodes and why? 2+6+5+2+5=20
- Explain through the Maxwell-Boltzmann equation that electrons carry the current in an arc. The degree of ionization is related to welding arc, what will be your suggestion, -Justify 12+8=20

CO2: Compulsory- Answer any One

- What is the function of core wire? What is spatter? How will you control it? Do you prefer using an oxidizing or reducing flame in gas welding of high-carbon steels? Explain why or why not. What is nonmetallic backing strip? 4+3+4+6+3=20
- In the hot-wire GTAW process, shown in Figure P 1, the tip of the filler metal wire is dipped in the weld pool and the wire itself is resistance heated by means of a second power source between the contact tube of the wire and the workpiece. In the case of steels, the deposition rate can be more than doubled this way. Do you prefer using an AC or a DC power source for heating the wire and why? Do you expect to apply this process to aluminum and copper alloys? 10+10=20

**CO3: Compulsory- Answer any Two**

- Experimental results show that in EBW the penetration depth of the weld decreases as the welding speed increases. Explain why. Under the same power and welding speed, do you expect a much greater penetration depth in aluminum or steel and why? 10
- (a) Centerline cracking is often observed in deep-penetration electron or laser beam welds. Explain why. 5+5=10

(b) What is projection welding? What are the advantages of projection welding? 5+5=10
- Explain principle and operation of LASER beam welding with a neat sketch and also discuss its advantages, limitations. 10

[Turn over

CO4: Compulsory- Answer any Two

8. What is diffusion welding? Explain the effect of rate of stable nuclei and temperature on diffusion welding. Why does brazing require temperature above 450 °C? 2+4+4=10
9. Explain the Thomas Young phenomenon for soldering metal droop? Is it applicable for brazing? Justify your answer. 5+5=10
10. Explain the basic principle of ultrasonic welding and ultrasonic testing in case of welding. What are the similarity between ultrasonic welding and FSW welding? 6+4=10

CO5: Question no 14 is compulsory and any Two from Question number 11 to 13

11. (a) Suppose you are interested in studying the solidification structure of the weld metal and you wish to calculate the temperature distribution in the weld pool. Do you expect Rosenthal's equations to provide reliable thermal information in the pool? Why or why not? 4+4=8
12. (a) Will decreasing welding speed help reduce weld porosity in gas-tungsten arc welds of aluminum if the source of hydrogen is on the workpiece surface?
- (b) What about if the source of hydrogen is in the shielding gas? Explain why or why not. 4+4=8
13. (a) Experimental results show that the depth-width ratio of stainless steel welds decreases with increasing arc length. Explain why.
- (b) Equiaxed grains can often be found in the crater of a weld that exhibits an essentially purely columnar grain structure. Explain why. 4+4=8
14. Explain the welding symbols (**any Two**) 2X2=4

