DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE – RAIGAD -402 103
Mid Semester Examination – October - 2017

Branch: M.Tech (Manufacturing Engineering) **Sem.:- I**

Subject with Subject Code :- MMF103 **Marks: 20**

Date:- 10/10/2017 **Time:- 1 Hr.**

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Instructions:- Draw suitable figures if required

(Marks)

Q.No.1 Attempt any one of the following (8 X 1 = 8) **(08)**

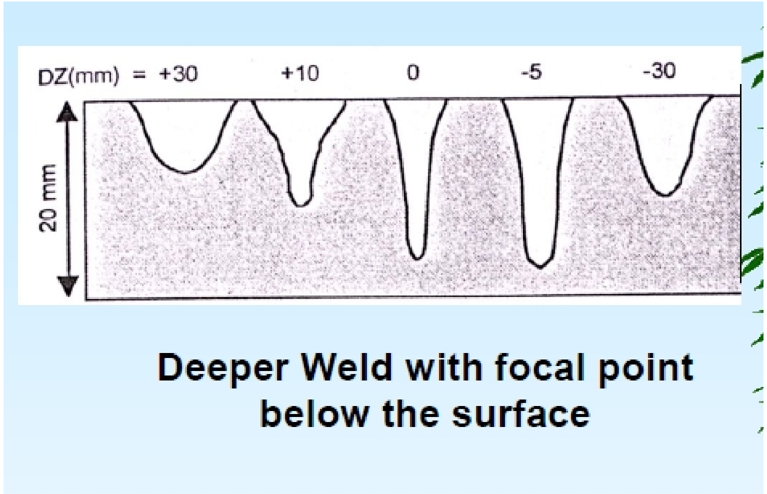
a.) Differentiate between laser conduction welding and keyhole welding process. (any three points 1X3 = 3)

Conduction	Keyhole
Joining of thin metal sheets. At these power density	Thicker sheets (>3mm):
require relatively low laser power densities less than 5x105 W/cm^2	Higher Laser Power At intensities about 106 W/cm^2, a small amount of metal vaporizes and plasma is formed.
the two metal surfaces melt and full thickness is also melted due to heat conduction from the top hot surface.	Escaping vapour exerts a recoil pressure on the molten pool creating a hole of impinging beam diameter. Laser beam is absorbed in the hole and is transmitted to the work-piece through the walls of the hole.
depth to width aspect ration is about 1.5	Aspect ratio in Keyhole welding = 3-5

a.) How do the shielding like Ar and He affect the plasma formation and weld depth during LBW. (any three points 1X3 = 3)

He	Ar
High Ionization potential	Low Ionization potential
Less intense plasma	More intense plasma
Less Laser power shielding	Strong Laser power shielding
Deeper weld	Wide & Shallow weld

Explain with neat sketch, what is the effect of change in focal point position of laser beam on the weld profile during LBW. (3+3+2)



b.) Estimate the penetration depth of electron beam accelerated at 100 kV impinging in steel having density of 7.6 gm/cm^3. (2 marks)

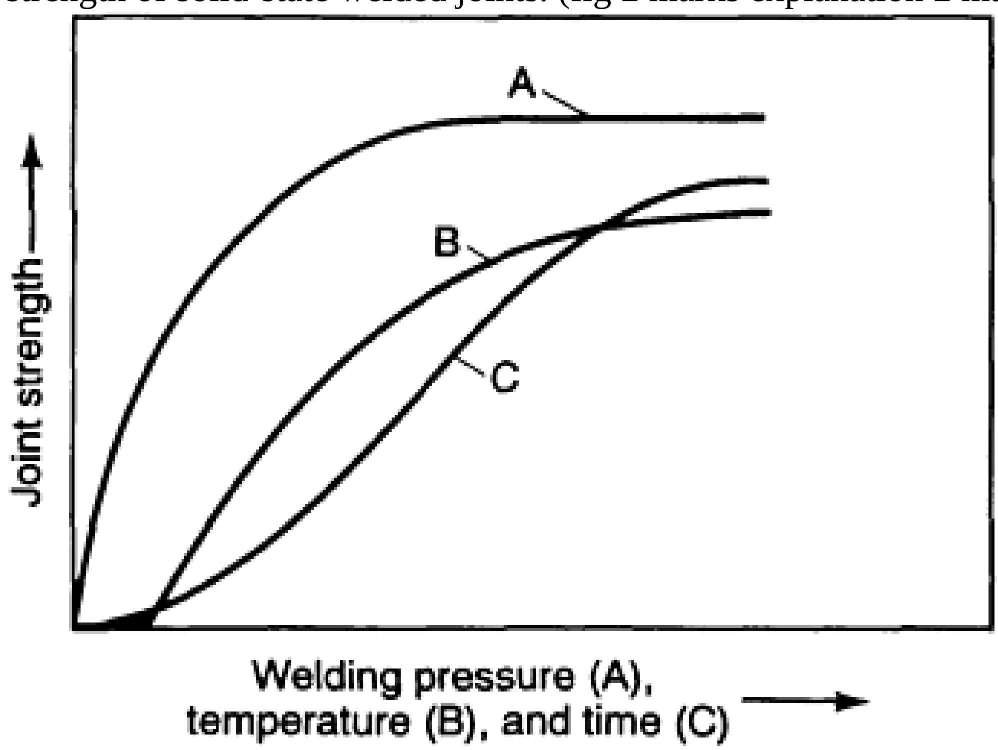
$\delta = 2.6 \times 10^{-17}(V^2/\rho)$ mm,   V in Volts & ρ in kg/mm^3

$\delta = 0.034 \mu m$

List the four parameters affecting actual focal spot size of electron beam in EBW. (2 marks)

(a) e-beam divergence
(b) Mutual repulsion between electrons
(c) Spherical aberration of lens and
(d) Spread in electron velocity.

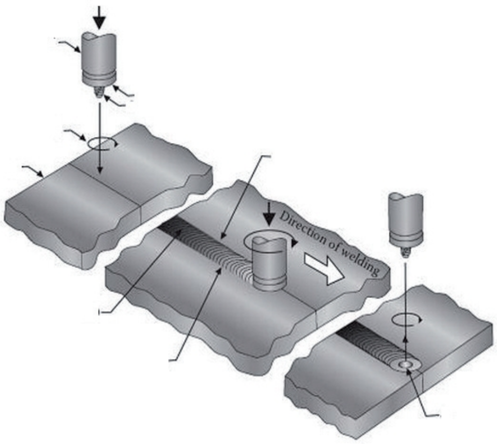
Explain the influence of welding pressure, temperature and time on joint strength of solid-state welded joints. (fig 2 marks explanation 2 marks)



Q.No. 2 Attempt any two of the following (6 X 2 = 12) (12)

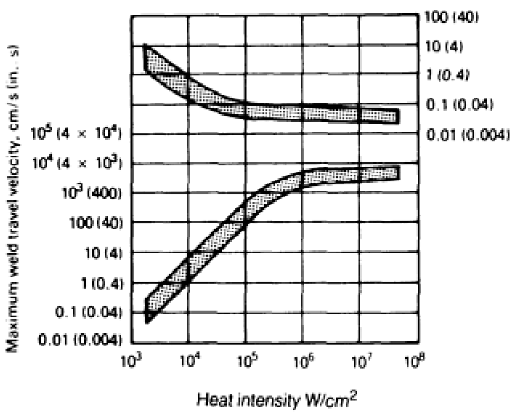
a.) Explain with neat sketch the friction stir welding process happening through four distinct phases. Also list the important welding parameters affecting FSW process.

Fig 2 marks, each phase 1 mark (1 x 4 = 4)

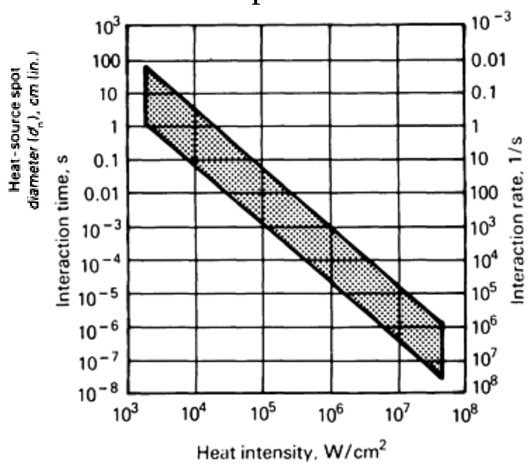


(1) plunging phase,
(2) dwelling phase,
(3) welding phase, and finally
(4) exit or retract phase.

b.) Show and explain the variation of weld travel velocity and interaction time (time for melting) during welding with increase in power intensities.



(2 marks)



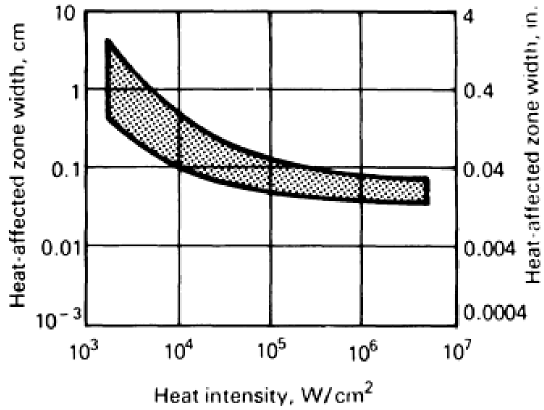
(2 marks)

Show also the position of laser beam welding and electro-slag welding as per their power densities in the figure. (2 marks)

Ans: - power densities that are of the order of 1000 W/cm^2, such as electroslag welding, require interaction times of 25 s with steel, whereas laser and electron beams, at 1 MW/cm^2, need interaction times on the order of only 25 μs.

c.) What is HAZ? (1 mark)

With the help of graphical relationship explain the variation of HAZ with increasing heat intensities. (3 marks)



Why HAZ width becomes roughly constant for higher power densities? (2)

Ans : -

At levels above approximately 10^4 W/cm^2, the HAZ width becomes roughly constant. This is due to the fact that the HAZ grows during the heating stage at power densities that are below 10^4 W/cm^2, but at higher power densities it grows during the cooling cycle. Thus, at low power densities, the HAZ width is controlled by the interaction time, whereas at high power densities, it is independent of the heat-source interaction time. In the latter case, the HAZ width grows during the cooling cycle as the heat of fusion is removed from the weld metal, and is proportional to the fusion zone width.