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No. of Printed Pages—5 ME-033

B. TECH.

EIGHTH SEMESTER EXAMINATION, 2003–2004

ADVANCED WELDING TECHNOLOGY

Time : 3 Hours *Total Marks : 100*

Note : Attempt all SIX questions. There may be choices within. Question 1 carries 10 marks, other questions carry 18 marks each; marks are also indicated therein. Answer briefly and neatly. No negative marking.

1. Answer, briefly, (in one word or in one line) the following :— (1×2×5=10)

   (*a*) Write approximately :

   (*i*) Melting Point of Mild Steel

   (*ii*) Temperature of Electric Arc

   (*b*) Write typical composition of :

   (*i*) Stainless Steel

   (*ii*) Solder Alloy

   (*c*) Write full form of :

   (*i*) MASER (Like LASER)

   (*ii*) TNT (explosive)

   (*d*) (*i*) For welding thin plates, which one is used : Gas welding/Arc welding ?

   (*ii*) Tata pipes are welded with such a method that the weld appears to be without seam or joint. What is the welding method ?

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(*e*) State whether True or False :

(*i*) Melting point of eutectic-alloy is lower than melting points of its consituent elements.

(*ii*) Pre-heating is necessary for welding of cast-iron.

2. Answer any TWO of the following :— (9×2=18)

(*a*) What do you understand by polarity in DC arc welding ? How can this be advantageously utilized ? What is arc-blow ? Also compare AC welding to DC welding.

(*b*) Write and explain the purpose of flux-coating over electrodes. Enlist a few fluxes for ferrous and non-ferrous electrodes. Also enlist the effect of alloying elements in electrode, on weld-property.

(*c*) Describe, very briefly, with sketches :

(*i*) MIG and TIG weldings, and

(ii) Resistance welding.

3. Answer any TWO of the following :— (9×2=18)

(*a*) What is an arc ? How does the arc differ from plasma-arc ? Describe, with sketches, the principle and working of Plasma Arc Welding and mention its advantages.

(*b*) Describe, with sketches, the principle and working of Electron Beam Welding and mention its advantages and applications. Explain how electrons penetrate very deep into narrow welds.

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(c) Explain the principle of LASER and write uses/applications of LASER. Describe, with sketches, the principle and working of Laser Beam Welding and mention its advantages.

Answer any TWO of the following :— (9×2=18)

(a) Describe, with neat sketches, the mechanism of Explosive Welding and explain the importance of re-entrant jet. Also, briefly write about weld-interface and welding parameters. Enlist the applications/uses of explosive welding.

(b) What do you understand by Underwater Welding ? What are the problems in underwater welding ? Explain how additional coating over electrode improves the arc-stability. Also mention the effect of salinity and *p*H value of the water on arc-stability. Could there be any other use of underwater welding ?

(c) Describe, with neat sketches, the principle and working of Spray-welding (or metallizing). Explain how this could be used for reclamation of worn-out part and also for hard-facing.

Answer any TWO of the following :— (9×2=18)

(a) Enlist weld-defects. Explain cracking specially hot-cracking and cold-cracking with reasons and remedies.

(b) Why does distortion occur after welding and how to prevent it specially for pressure-vessel welding ? Also describe, with sketch, ultrasonic testing of weld.

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(c) From machine-design point of view, write down the steps for design of a welded joint (select a simple problem of your choice; such as a lap-joint, carrying a tensile load, welding on edges). Then, either draw a flow-chart or write a computer program in C for it.

6. Answer any TWO of the following :— (9×8)

(a) The heat input $Q(=CVI)$ is used up for melting and maintaining the weld width with heat transfer considerations are given semi-empirically by :

$$Q = 8.k.\theta_m.h\left(\frac{1}{5}+\frac{vw}{4\alpha}\right),$$

where k is thermal conductivity, h the plate thickness, θ_m melting point, v welding speed, w weld width, α thermal diffusivity $\left(\alpha=\frac{k}{\rho_c}\right)$, ρ density, c specific heat.

In a butt-welding process, using arc welding, the arc power is found to be 3 kVA. Determine the maximum possible welding speed. Assume that arc is on for 90% of time, weld width 4 mm and plate thickness 3 mm.

Given $\alpha = 1{\cdot}2\times10^{-5}\ m^2/s$, $k = 44$ w/m.c melting point of steel 1530 °C and room temperature 30 °C.

(b) Explain, what do you understand by 'Weld-Decay' in HAZ of stainless-steel weld. Suggest remedies/solution to this problem.

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