Dr S. R. Chauhan 20/11/2023

National Institute of Technology Hamirpur (H.P.)-177005
Mechanical Engineering Department
B-Tech 5th Semester Final Examination November-2023
Subject: Mfg. Science and Technology-I (ME-312)

Max.marks:50 *Time Allowed: 3.0Hrs*

Attempt All questions. All questions carry equal Marks.

Q.No.1. Answer briefly.

(a) What do you understand by Isostatic Pressing? Differentiate between hot and cold Isostatic Pressing.
(b) What is thermit welding? Which metal powder is used in thermit welding? Explain using simple chemical reaction.
(c) What is fluidity of molten metal? Which characteristics of molten metal and casting parameters influence the fluidity of molten metal in the casting process?
(d) In welding a mild steel sheet using an oxyacetylene flame, the total amount of acetylene consumed was **8** liters what is the oxygen consumption from cylinder during this process and Why?
(e) What is the role of clearance in blanking and punching operations? How are clearance provided on punch and die?
(2x5=10)

Q.No.2 (a) Gray cast iron block of size100mmX50mmX10mm with a central spherical cavity of diameter 4mm is manufactured using sand casting process at the room temperature condition of 30 °C. The shrinkage allowance for the pattern is 3%. Determine the ratio of volume of casting to pattern.
(b) A 100mm circular hole is to be produced in a casting of 200mm in length. The weight density of core material used is 0.0873N/cm^3 and density of molten metal used is 0.0441 N/cm^3. What is the core print area required to support the core (in cm^2)?
C) A sand-casting process has a mold constant of 2S/mm^2 and solidification exponent of 2. If the solidification time is doubled for a given unit volume of material. Determine the corresponding reduction in the cast surface area in percentage.
(d)) An aluminum alloy is hot extruded at 400 °C through square dies without lubrication from 135 mm diameter to 45 diameter. The extrusion speed is 48 mm/s. The flow stress of the material at the above temperature is 250 MPa. The length of the billet is 400 mm. Determine the extrusion load. Take $\mu = 0.1$.
(e) During TIG welding process the arc current and arc voltage were 50 and 60 volts respectively. When the welding speed was 150 mm/min, in another process the TIG welding carried out at a welded speed of 120 mm/min at the same arc voltage and heat input to the material so that weld quality remains the same. What is the welding current in amp in this process?
(2x5=10)

Q.3(a) Determine the size of riser used for solidification of casting shown (all dimensions in mm) in **Figure 1**. Given that shrinkage is 2.6% of volume of casting and height of riser is 90 mm.

(b) For the given diagram shown in **Figure 2** find the time required to fill the mould cavity along with riser in seconds. (5x2=10)

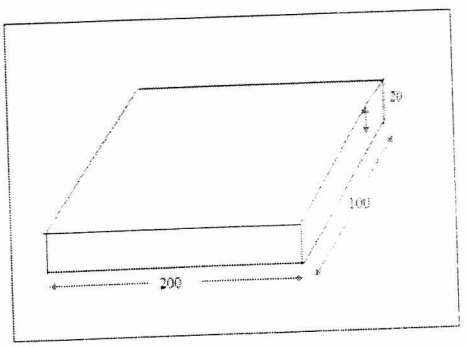

Figure 1

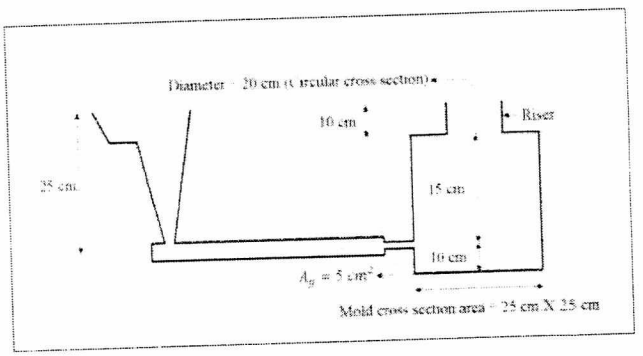

Figure 2

Q.N.4(a) A hole of 100 mm diameter is to be punched in a steel sheet plate of 6 mm thickness. The material is cold rolled carbon steel for which shear strength is 400 N/mm^2. Normal radial clearance is 10% of strip thickness. Cutting completes at 50% penetration.

(i) Find suitable punch and die diameters.

(ii) Find press load capacity (in tons) with flat face punch.

(iii) Show how inclined face punch (i.e. with shear angle) the same work can be done with a lower capacity press say with 30 ton press, then find shear angle.

(b) A steel wire is drawn from an initial diameter of 14 mm to a final diameter of 12 mm at a speed of 1.5 m/s. The die angle is 12°. The coefficient of friction at the workpiece-die interface is 0.1 and K = 150 MPa. Calculate the drawing force and power. (5x2=10)

Q.No.5(a) In a spot pulsed laser welding of aluminum plates (density = 2700 kg/m^3), specific heat = 896 J/kg. Melting temperature = 933K, Latent heat of melting = 398 KJ/Kg at a temperature of 30°C, pulse with energy of 0.5 J is focused on to an area of 0.05 mm^2. If the entire energy is coupled into the material, what will be the depth of weld assuming the cross-section area of the weld is circular and is uniform throughout its depth and only condition is in the direction of penetration.

(b) A weld is made using a MIG welding process with the following welding parameters.

Current: 200A; Voltage: 25 V

Welding speed: 18 cm/min.

Wire diameter: 1.2 mm

Wire feed rate: 4 m/min.

Thermal efficiency of the process: 65%

(1) Determine the heat input per unit length of the weld in KJ/cm?

(2) Find the area of cross-section of weld bead in mm^2. (5x2=10)