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B-Tech 5th Semester Final Examination November-2022

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)Explain why a material with fine grain microstructure is better suited for the blanking than a coarse grained material ?

(b) Differentiate between TIG and MIG welding?

(c)What is fluidity of molten metal? Which characteristics of molten metal and casting parameters influence the fluidity of molten metal in casting process?

(d) How can you tell whether a certain part is forged or cast? Describe the features to be investigated.

(e) Explain why powder metal parts are commonly used for machine elements requiring good frictional and wear characteristics and for mass production parts..

(2x5=10)

Q.No.2 (a) The solidification time of casting is proportional to $(VA)^2$, where V is the volume of the casting and A is the total casting surface area losing heat. Two cubes of the same material and size are using a sand-casting process. The top face of one of the cubes is completely insulated. What is the ratio of the solidification time for the cube with top face insulated to that of the other cube ?

(b)The desired volume flow rate of the molten metal into a mold is 0.01 m^3/min. The top of the sprue has a diameter of 20 mm and its length is 200 mm. What diameter should be specified at the bottom of the sprue in order to prevent aspiration? What is the velocity and Reynolds number at the bottom of the sprue if the metal being cast is aluminum and has a viscosity of 0.004 N-s/m^2? The density of aluminum is 2700 kg/m^3. (Assume that pressure at the top and bottom of the sprue is atmospheric and Ignore the frictional losses in the system). (5x2=10)

Q.3(a) A circular disc of lead of radius 150 mm and thickness 50 mm is reduced to a thickness of 25 mm by open dial forging. If the coefficient of friction between the job and the die is 0.25, determine the maximum forging force. The average shear yield stress of lead can be taken as 4 N/mm^2.

(b) A 30-mm-thick plate made of low carbon steel is to be reduced to 25 mm in one pass in a rolling operation. As the thickness is reduced, the plate widens by 4%. Yield strength of the steel = 174 MPa,

(54)

and tensile strength = 290 MPa. The entrance speed of the plate = 77 m/min. Roll radius = 300 mm, and rotational speed = 45 rev/min. Determine (a) the minimum required coefficient of friction that would make this rolling operation possible, (b) exit velocity of the plate, and (c) forward slip.

(5x2=10)

Q.N.4(a) A cup-drawing operation is performed in which the cup's inside diameter = 80 mm and its height = 50 mm. Stock thickness = 3.0 mm, and blank diameter = 150 mm. Punch and die radii = 4 mm. Tensile strength = 400 MPa and yield strength = 180 MPa for this sheet metal. Determine (a) drawing ratio, (b) reduction, (c) drawing force, and (d) blank holder force.

(b) A cylindrical billet is 150 mm long and 75 mm in diameter. It is reduced by indirect extrusion to a 30 mm diameter. Die angle = 90. In the Johnson equation, a = 0.8 and b = 1.4. In the flow curve for the work metal, strength coefficient = 800 MPa and strain hardening exponent = 0.15.Determine (a) extrusion ratio, (b) true strain (homogeneous deformation), (c) extrusion strain,(d) ram pressure, and (e) ram force.

(5x2=10)

Q.No.5(a) Resistance spot welding of two steel sheets is carried out in lap joint configuration by using a welding current of 3 kA and a weld time of 0.2 s. A molten weld nugget of volume 20 mm^3 is obtained. The effective contact resistance is 200 micro-ohms. The material properties of steel are given as (i) latent heat of melting 1400 kJ/kg, (ii) density 8000 kg/m^3, (iii) melting temp 1520°C (iv) specific heat 0.5 kJ/kg°C. The ambient temp is 20°C. Find Heat (in Joules) used for production of weld nugget (assuming 100% heat transfer efficiency) ?

(b) Two mild steel plates of similar thickness, in butt-joint configuration, are welded by gas tungsten arc welding (GTAW) or TIG process using the following welding parameters:

Welding voltage 20 V ;
Welding current 150 A ;
Welding speed 5 mm/s

A filler wire of the same mild steel material having 3 mm diameter is used in this welding process. The filler wire feed rate is selected such that the final weld bead is composed of 60% volume of filler and 40% volume of plate material. The heat required to melt the mild steel material is 10 J/mm^2. The heat transfer factor is 0.7 and melting factor is 0.6. Find the feed rate of the filler wire in mm/s.

(5x2=10)