(e) Describe the general characteristics and typical applications of any three of the following plastics. Acrylics, cellulosics, fluorocarbons and polyethylenes.

(f) Explain "Injection moulding" and "blow moulding" methods of processing plastics.

5. Attempt any ***four*** parts :— **(4×5=20)**

(a) What is a pattern ? Name the various allowances given on the pattern and why are they provided ?

(b) Describe, step by step, the procedure for making a mould with a two piece split pattern.

(c) What are the requisite properties in a good foundry sand ?

(d) Draw a properly labelled sketch of a cupola and write a brief account of its operation.

(e) Describe the effect of addition of ferrosilicon and rate of cooling on the properties of cast iron.

(f) Enumerate some common casting defects and their causes.

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 3990 **Roll No.**

B. Tech.

(SEM. IV) THEORY EXAMINATION 2011-12

MANUFACTURING SCIENCE—I

Time : 3 Hours *Total Marks : 100*

Note :—(1) Attempt ***all*** questions.

(2) They carry marks shown against each.

1. Attempt any ***two*** parts of the following :— **(2×10=20)**

(a) What is meant by "cold working" and "hot working" ? Explain the difference between the two. What is meant by anisotropy ? Explain. Further explain how the effect of cold working of metals and alloys removed.

(b) Show that in forging a strip of cross-section b × h under mixed friction condition, x_s, the distance from the centre of this strip where sticking friction ends is given by :

$$x_s = \frac{b}{2} - \frac{h}{2\mu} \log_e \frac{1}{2\mu},$$

where μ is the coefficient of friction and h is the height of strip. State clearly, assumptions made if any in deriving the expression for x_s. What will be the value of forging pressure at x_s ?

(c) What are the criteria commonly used for plastic deformation ? State these criteria and show that according

to Tresca's criterion, critical shear stress is $\frac{\sigma_y}{2}$, where σ_y is the tensile yield stress of the material.

2. Attempt any ***two*** parts of the following :— **(2×10=20)**

(a) In a wire drawing operation, initial wire diameter is 6 mm and final diameter is 5 mm. Die angle is 20°, find the drawing stress considering $\mu = 0.1$ and $k = 18$ N/mm^2.

Also calculate the maximum reduction possible in one pass. Assume that there is no back pull.

(b) A strip with a cross section 150 mm × 45 mm is being rolled with 20% reduction of area using 450 mm diameter rolls. Find the angle subtended by the deformation zone at the roll centre, final strip thickness and the location of the neutral plane. Assume coefficient of friction to be 0.1.

(c) Describe briefly the hot and cold extrusion processes you know. What are the common extrusion defects and why are they caused ?

3. Attempt any ***two*** parts :— **(2×10=20)**

(a) Draw a sketch of a die-punch assembly. What is the function of the stripper plate ?

A hole of 100 mm diameter is to be punched in a metal sheet of 6 mm thickness. The ultimate shear stress of the metal is 400 MPa. Normal radial clearance is 10% of sheet thickness and cutting completes at 40% penetration. Find suitable punch and die diameters and the press capacity in metric tons, if a punch without shear is used.

(b) Show that in deep drawing of a cup, the limiting case for fracture at bottom is given by :

$$e^{-\mu\pi/2} = \frac{\mu F_h}{2\pi k\, r_j \cdot t} + \log_e \frac{r_j}{r_d}; \text{ where,}$$

F_h is the blank holding force, r_j is the initial blank radius, r_d is the radius of the die, k is yield shear strength, t is plate thickness and μ is coefficient of friction.

(c) Explain the processes of air bending and bottoming with the help of suitable sketches. What is "spring back" and how is it controlled ?

A piece of metal of 2.5 thickness is bent to an angle of 90° with and inner radius of 6.5 mm. What is the original length of metal which goes into the bend ?

4. Answer any ***four*** parts of the following :— **(4×5=20)**

(a) Why are jigs and fixtures used ? Differentiate between a jig and a fixture.

(b) Explain the process of Electromagnetic Forming. What are its advantages ? Indicate some typical applications.

(c) In powder-metallurgy process, some secondary operations are performed after sintering. What are these secondary operations and what is their object ? Explain briefly.

(d) What characteristic properties do polymers display ? Explain the meaning of "monomer molecules". What is a copolymer ?