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

PAPER ID : 3990 Roll No. | | | | | | | | | | |

**B. Tech.**

(SEM. IV ) THEORY EXAMINATION 2010-11

**MANUFACTURING SCIENCE –I**

*Time : 3 Hours* *Total Marks : 100*

**Note :** Attempt **all** questions.

1. Attempt any **four** of the following : **(4×5=20)**

   (a) What is the role of mass-manufacture in raising the standard of living of human beings ?

   (b) Write down the names of material and manufacturing processes used in manufacture of

   (i) Pistons for two wheelers

   (ii) Electrical conductors

   (iii) Plastic buckets

   (iv) Crockery, and

   (v) Plain washers.

   (c) Differentiate between hot working and cold working. A work piece made of mild steel is heated to 400°C and mechanical work is being done on it. Is it an example of "hot working" or "cold working" ?

   (d) State Tresca's and Von Mises' criteria for plastic deformation. Show that according to Von Mises'-criterion,

$K = \frac{\sigma_y}{\sqrt{3}}$ ; where $\sigma_y$ is tensile yield strength of the material.

(e) A metal workpiece has the size 200 mm×100 mm×150 mm (b×h×w). Assuming plane strain forging under sticking friction condition, calculate the peak pressure. The material has a yield stress in uniaxial tension of 160 MPa.

(f) A metal workpiece having size of b×h×w is undergoing open die forging under mixed friction condition. Size w does not change. Draw a graph showing pressure distribution Vs breadth b of the block. If the value of coeff. of friction increases, will the distance from centre of workpiece to where sticking ends increase or decrease ? Explain why ?

2. Answer any **two** parts : **(2×10=20)**

(a) From first principles, derive the formula

$$\frac{\sigma_{xb}}{2k} = \left(\frac{1+B}{B}\right)\left[\left(\frac{Db}{Da}\right)^{2b} - 1\right]$$

for extrusion of a wire with friction; where $\sigma_{xb}$ refers to the stress in wire at inlet to the die, Db and Da are the inlet and outlet diameters of the wire, $B=\mu \cot \alpha$ ( $\mu$ is coeff. of friction and $\alpha$ is half die angle) and k is the critical shear stress.

(b) (i) Write a note on rolling defects indicating the defects, their causes and remedies.

(ii) Calculate the bite angle when rolling 15 mm thick plates using rolls of 400 mm diameter. Final thickness of plates 12 mm.

(c) Describe the process of wire-drawing. What is the material of drawing dies ? Why is "in-process" annealing done ? Give an idea of wire drawing speeds.

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

(a) Show that during deep drawing of a cup, the radial stress $\sigma_r$ at radius r is given by

$$\frac{\sigma_r}{2k} = \frac{\mu F_h}{2\pi K r_j t} + \log_e \frac{r_j}{r}, \text{ where}$$

$F_h$ is the blank holding force, $r_j$ is initial blank radius, t = plate thickness and $\mu$=coeff. of friction K is the shear yield strength.

Also prove that to prevent tensile fracture at the bottom of the cup,

$$\left[\frac{\mu F_h}{2\pi K r_j t} + \log \frac{r_j}{r_d}\right] e^{\mu \pi/2} \leq 1, \text{ where } r_d \text{ is die radius.}$$

(b) Explain "shearing process" in detail and explain the terms shearing force, penetration and clearance. Draw a shearing force vs thickness curve and explain how this can be used to determine the energy required in shearing. How can the maximum shearing force be reduced ?

(c) (i) Describe the processes of "Air bending" and V-bending. What is meant by "spring back" and how is it compensated ?

(ii) What precautions are necessary in bending a tube ? How is the initial length required for making a bent tube component worked out ? What kind of defects can occur while bending a tube ?

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

(a) Bring out the difference between a jig and a fixture. Describe with neat sketches, any three type of clamping

devices used for clamping the work piece on to a fixture. A fixture was designed for machining castings of a component sourced from Foundry 'A'. If the source for obtaining castings of the same component is changed to Foundry B, will any changes in the fixture be necessary ? Comment, why ?

(b) How are powder-metallurgy components manufactured ? Discuss various steps involved.

(c) (i) Describe the explosive forming method.

(ii) What is the difference between thermoplastics and thermosetting plastics ? Describe three common methods of producing parts made of plastic. How can coloured plastic parts be manufactured ?

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

(a) What are the raw material fluxing agent and fuel used in a cupola to produce Grey C.I. castings ?

(b) What is "dendritic" structure ? Explain briefly.

(c) Draw a sketch showing various elements of a gating system. Label all the elements shown.

(d) Show that for a bottom gating system, time taken to fill up the mould cavity is given by

$$t = \frac{A_m}{A_g} \cdot \sqrt{\frac{2}{g}} \left( \sqrt{H} - \sqrt{H - h_m} \right)$$, where $A_m$ and $A_g$ refer to the Cross section area of mould and gate respectively. H represents the height of liquid in pouring basin above the gate and $h_m$ is the height of mould.

(e) Discuss CAINE's method for design of a riser.

(f) Describe some non destructive inspection methods for castings.