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G. N. S. Institute of Technology

GILGITABAD

B. TECH.

FOURTH SEMESTER EXAMINATION, 2003-2004

MANUFACTURING SCIENCE-I

Time : 3 Hours

Total Marks : 100

Note : (1) Answer all SIX questions.

(2) Internal choices are within the questions. Marks are indicated therein.

(3) Symbols have their usual meaning. Assume missing data/information, if any.

1. (A) Answer briefly the following :— (2×5=10)

(a) Write material for

(i) Lathe bed, and

(ii) Connecting rod of engines.

(b) Write manufacturing process for

(i) Seamless tubes, and

(ii) I, T and L steel sections.

(c) Differentiate between

(i) Riser and Runner, and

(ii) 2-High and 3-High rolling mills.

(d) Write full form of

(i) HSS, and

(ii) TNT (Explosive).

(e) Write constituents of the following alloys :—

(i) Bronze, and

(ii) Inconel.

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- (a) Formability and machinability
- (b) Hot working and cold working
- (c) Extrusion and drawing
- (d) Jigs and fixtures
- (e) Core and core print
- (f) Thermoplastics and thermosetting polymers

2. Answer any TWO of the following:— (8×2=16)

- (a) What is Von Mises' yield criterion and how does it differ from Tresca's yield criteria? Using Von Mises' yield criteria, show that the shear yield stress τ_s of a material, can be expressed as —

$$\tau_s = \frac{\sigma_y}{\sqrt{3}},$$

where σ_y is tensile yield stress of the material.

- (b) A thin strip of section $b \times h$ is being cold forged between two parallel overhanging platens, show that the average forging pressure p_a is given by :

$$p_a = \sigma_y \left(1 + \frac{\mu b}{2h} \right),$$

where σ_y is tensile yield strength of material and μ is coefficient of friction between the platen and the work piece surface.

In case of strip rolling, if the friction condition for unaided entry of the work piece is satisfied, show that the maximum possible draft $(h_b - h_a)_{\max}$ can be expressed as —

$$(h_b - h_a)_{\max} = \mu^2 R,$$

where h_b and h_a are the thicknesses of strip before and after rolling, respectively, μ is coefficient of friction between roll and strip and R is the roll radius.

3. Answer any TWO of the following :— (8×2=16)

(a) Show that the drawing stress σ_{xa} in case of wire drawing with applied back tension σ_{xb} can be expressed as —

$$\sigma_{xa} = \sigma_y \left(\frac{1+B}{B} \right) \left[1 - \left(\frac{D_a}{D_b} \right)^{2B} \right] + \sigma_{xb} \left(\frac{D_a}{D_b} \right)^{2B},$$

where $B = \mu \cot \alpha$, μ being the coefficient of friction, α is semi-die angle, σ_y is yield strength of the wire material in tension, D_a and D_b are the diameters of the wire at exit and inlet of the die, respectively.

(b) Show that for a tube drawing using moving mandrel and without application of back tension, the drawing stress σ_{xa} can be expressed as —

$$\sigma_{xa} = \sigma_y \log_e \left(\frac{1}{1-r} \right),$$

where σ_y is the yield strength of the tube material and r is reduction ratio, assuming $\mu = 0$.

(b) Describe some common rolling and extrusion defects. Also, indicate remedial measures.

4. Answer any TWO of the following :— (8×2=16)

- (a) How does a compound die differ from a progressive die ? Giving a neat sketch, describe constructional feature and working of a compound die.
- (b) What is the role of clearance in blanking and piercing operations ? How are clearances provided on punch and die ? On what factors do the die and punch clearances depend ? Discuss them in brief.
- (c) A hole of 100 mm is to be punched in a cold rolled medium carbon steel plate of 5.6 mm thickness. The ultimate shear strength of plate material is 550 MPa. With normal clearance on the press tool, cutting is completed at 40% penetration of the punch. Calculate the diameters for the punch and die required for the purpose. If the shop has press of 30 tonnes capacity, calculate the shear angle to be provided on the punch in order to bring the work within the capacity of the existing press.

5. Answer any TWO of the following :— (8×2=16)

- (a) Show that the exit to inlet area ratio, R of a down delivery sprue for avoiding aspiration is given by,

$$R = \frac{A_3}{A_2} = \sqrt{\frac{h_2}{h_3}}$$

where A_3 and A_2 are the cross sectional area of the sprue at the sprue well and pouring basin ends, respectively and h_2 , h_3 are head of liquid metal at the pouring basin and sprue well, respectively.

- (b) Prove that the volume/area ratio for most compact economical cylindrical side riser of height h and diameter d is $\frac{d}{6}$ and $\frac{d}{h}$ ratio is 1.

OR

Calculate the size of a cylindrical riser with $\frac{d}{h}$ ratio 1, necessary to feed a steel slab casting $25 \times 25 \times 5$ cm. Assume the volume shrinkage on solidification is 3% for steel and that the volume of riser is three times that dictated by shrinkage considerations alone.

- (c) Describe the Investment Casting Process. Also, discuss its merits and limitations.

6. Answer any TWO of the following :— (8×2=16)

- (a) Describe, in brief, any *two* of the following :—

- (i) Diamond pin locator
- (ii) Heel pin clamp
- (iii) Drill bushes
- (iv) 3-2-1 principle of location

- (b) Briefly explain any *two* of the following :—

- (i) Pre-sintering
- (ii) Cermets
- (iii) Injection Molding
- (iv) Explosive Forming or Compaction

aktuonline.com Give causes and remedies of any *two* of the following casting defects :—

- (i) Blow holes
- (ii) Pin hole porosity
- (iii) Rat tails
- (iv) Hot tear