U218-153(T1)

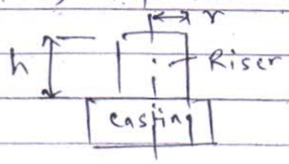
October 2018 (T1)

S.Y.B.Tech.(Mechanical Engg.)(Sem.-I) (Pattern 2017)

Course Name: Manufacturing processes (MEUA21173)

Solution & Marking scheme

Q.1(a) Top riser – r – radius of cylindrical riser



h – height of –"– –"–

SA – surface area $= 2\pi r h + \pi r^2$

V – volume $= \pi r^2 h \quad \therefore h = \frac{V}{\pi r^2}$

$SA = 2\pi r \left(V/\pi r^2\right) + \pi r^2 = \frac{2V}{r} + \pi r^2$ (1 mark)

For efficient working, the area of riser should be minim

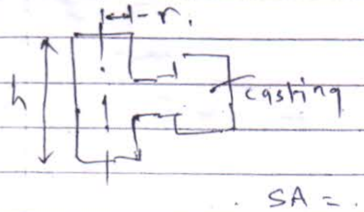
Hence $\frac{d(SA)}{dr} = 0$ gives $\frac{d}{dr}\left(\frac{2V}{r} + \pi r^2\right) = 0$

$-\frac{2V}{r^2} + 2\pi r = 0 \quad \therefore \frac{2V}{r^2} = 2\pi r$ or $V = \pi r^3$ (1 mar

However $V = \pi r^2 h$, Equating $\pi r^3 = \pi r^2 h$

gives $r = h$ or $\boxed{h = d/2}$ – (1 mark)

Side riser



$SA = 2\pi r h + 2\pi r^2$ – (1 mark)

$V = \pi r^2 h \quad \therefore h = V/\pi r^2$

$SA = 2\pi r . \frac{V}{\pi r^2} + 2\pi r^2$

$\therefore SA = \frac{2V}{r} + 2\pi r^2$

$\frac{d(SA)}{dr} = 0$ gives $-\frac{2V}{r^2} + 4\pi r = 0 \quad \therefore \frac{2V}{r^2} = 4\pi r$

$V = \pi r^2 h$ Equating $V = \pi r^2 h = 2\pi r^3$ – (1 mark)

gives $r = h/2$ or $\boxed{d = h}$ (1 mark)

Q.1 (b) sketch of Hot chamber die casting – (4 marks)
limitations of the process (Any three) – (2 marks)

Q.1 (c) wood being used as a pattern material
Advantages (Any four) – (2 marks)
limitations — (2 marks)

Q.2 (a) $T_{TS\,cube} = 170\,sec = C_m (V/A)^2$

Volume of cube = $50 \times 50 \times 50 = 125000$ (1 mark)

~~SA~~ surface Area 'A' = $6 \times (50 \times 50) = 15000$ (1 mark)

$170 = C_m \left(\frac{50 \times 50 \times 50}{6 \times (50 \times 50)} \right)$ $\therefore C_m = \underline{\underline{2.448}}$ (1 mark)

$T_{TS\,cylinder} = C_m (V/A)^2$.

Volume of cylinder = $\pi r^2 h = \pi (25)^2 \times 50 = 98125$ (1)

surface area of cylinder = $2\pi r h + 2\pi r^2$

$= 2\pi [(25 \times 50) + 25^2] = 11775$. (1 mark)

$\therefore T_{TS\,cylinder} = 2.448 \left(\frac{98125}{11775} \right)^2 = \underline{\underline{170\,sec}}$. (1 mark).

Q.2 (b) ~~Expla~~ ~~Hot~~ Explain ~~Four~~ Three defects - each carries ~~1.5~~ 2 marks
(2 ~~1.5~~ × 3 defects) = 6 marks

Q.2 (c) sketch of permeability test (2 marks)
Explain — " — (2 marks).

Q.3 (a) If $\sigma_d > $ yield strength, local deformation in the die takes place (1 mark).

In ideal case $\sigma_d = \bar{Y}_f$ (Neglecting friction) (1 mark)

$\sigma_d = \bar{Y}_f \ln(A_0/A_f)$

However, ~~as~~ $\sigma_d = \bar{Y}_f$ in ideal condition, substituting,

$\bar{Y}_f = \bar{Y}_f \ln(A_0/A_f) \quad \therefore \ln\left(\frac{A_0}{A_f}\right) = 1$ (1 mark)

i.e. $\frac{A_0}{A_f} = e = 2.7183$ (1 mark)

$\therefore$ the maximum possible reduction is

$r_{max} = \frac{A_0 - A_f}{A_0} = \frac{A_0/A_f - 1}{A_0/A_f} = \frac{e-1}{e}$ (1)

$\therefore r_{max} = \frac{2.7183-1}{2.7183} = 0.632 = 63.2\%$ (1).

Theoretical max. reduction possible in a single draw is 63.2%.

(b) $D_0 = 45$ mm, $h_0 = 88$ mm, $h = 66$ (25% of 88) mm.

$\mu = 0.15$, $K = 425$ MPa, $n = 0.15$.

$\varepsilon = \ln\frac{h_0}{h} = \ln\frac{88}{66} = 0.2876$ — (1 mark)

$Y_f = K \cdot \varepsilon^n = 425(0.2876)^{0.15} = 352.53$ MPa (1 mark)

~~To~~ find 'd', equating volume before and after remaining same →

$\frac{\pi}{4}(45)^2 \times 88 = \frac{\pi}{4} d^2 \times (66) \quad \therefore d = 51.96$ mm

K_f = shape factor $= 1 + \frac{0.4\mu d}{h}$.

$K_f = 1 + \frac{0.4 \times 0.15 \times 51.96}{66} = 1.0472$

(1 mark)

$F = \cancel{\gamma_f} \cdot k_f \cdot \gamma_f \cdot A$

~~$F = 1.0472 \times 352.53 \times \frac{\pi}{4}(51.96)^2$~~

~~$F = 782453.06$ N~~

or $F = \underline{782.453 \text{ kN}}$. (1 mark).

(c). Obtain relation

Contact length 'L' $= \sqrt{R \cdot d}$; or $\sqrt{R(t_0 - t_f)}$ - (2 mark)

~~max. draft 'd' $= \mu^2 R$ — (2 mark)~~.

Q.4. (a) $r = 240$ mm, $t_0 = 18$ mm, $t_f = 14$ mm, $R = 240$ mm

$N = 125$ rpm

$L = \sqrt{R \cdot d}$ $\quad d = t_0 - t_f = 18 - 14 = 4$ mm.

$L = \sqrt{240 \times 4} = 30.18$ mm. — (1 mark)

$\gamma_{avg} = \frac{78.44 + 242.35}{2} = 160.395$ MPa (1 mark)

$F = \gamma_{avg} \times 240 \times 30.18 = 1192.56 \times 10^3$ N. (1 mark)

Torque/roll $= 0.5 F L = 1192.56 \times 10^3 \times 0.5 \times \frac{30.18}{1000} =$

$T = \underline{18442.75}$ Nm (1 mark).

$P = \frac{2\pi F N L}{60 \cancel{\times 1000}} = \frac{2\pi \times 1192.56 \times 10^3 \times 125 \times 30.18}{60 \quad 1000}$

$P = 483.37 \times 10^3$ watt

$P = \underline{483.37 \text{ kW}}$ (2 marks).

(b) ~~The~~ Two defects with schematic (2x2 = 4 marks)

(c). Two points of difference with sketch (2x2 marks).