UNIVERSITY OF JOHANNESBURG

PROGRAM	:	NATIONAL DIPLOMA *ENGINEERING : MECHANICAL* *ENGINEERING : INDUSTRIAL*
SUBJECT	:	**MECHANICAL MANUFACTURING ENGINEERING II**
CODE	:	**IMV2211**
DATE	:	SUMMER EXAMINATION 17 NOVEMBER 2014
DURATION	:	12:30 – 15:30
WEIGHT	:	40 : 60
TOTAL MARKS	:	115 (100 MARKS = 100%)

ASSESSOR	:	MR P VAN PLETZEN AND MRS H STEENKAMP
MODERATOR	:	MR A KESCHNER
NUMBER OF PAGES	:	5 (INCLUDING FORMULA SHEET)
INSTRUCTIONS	:	ONLY ONE POCKET CALCULATOR PER CANDIDATE MAY BE USED.
REQUIREMENTS	:	DRAWING INSTRUMENTS TO BE SUPPLIED BY STUDENTS.

INSTRUCTIONS TO STUDENTS

1. PLEASE ANSWER ALL QUESTIONS
2. SHOW ALL THE CALCULATIONS.
3. ALL ANSWERS, BOTH INTERMEDIATE AND FINAL, MUST HAVE THE CORRECT UNITS
4. 100 MARKS = 100 PERCENT.
5. ALL SKETCHES ARE TO BE DRAWN IN PENCIL AND TO GOOD PROPORTION.
6. UNTIDY WORK WILL BE PENALISED.

2/...

QUESTION 1:

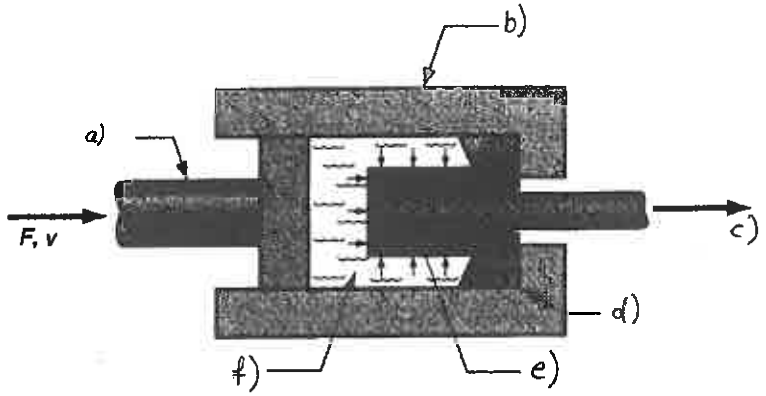
1.1 What causes an increase in the ram force for direct, cold extrusion? (1)

1.2 How is this problem aggravated during hot extrusion and how is this new problem addressed? (2)

1.3 An indirect extrusion process starts with an aluminium billet with a diameter of 40mm and a length of 75mm. The cross section of the extradite is square with sides of 20mm. The die angle is 90°. The strength coefficient (K) of the metal is 180MPa and the strain hardening exponent (n) is 0,2. For the Johnson extrusion strain equation a = 0,8 and b = 1,2.

Determine: a) The extrusion ratio. (3)
b) The true strain. (1)
c) The extrusion strain. (1)
d) The shape factor. (4)

1.4 Give the correct labels for the cross sectional side view of the hydrostatic extrusion process pictured below: (6)

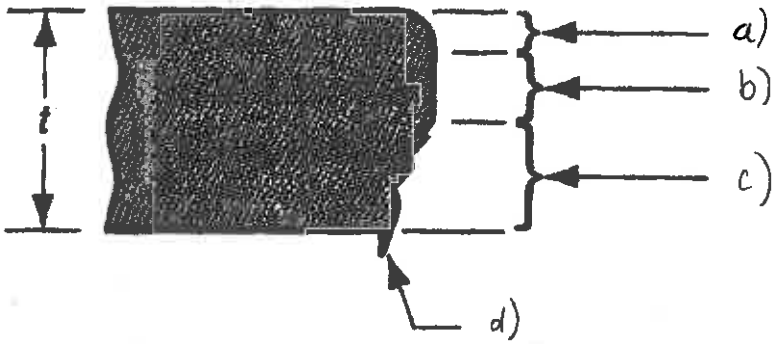


1.5 Name two materials used for cold extrusion. (2)

[20]

QUESTION 2:

2.1 Name the characteristic features of the sheared stress edges of a cutting operation as pictured below: (4)



2.2 Name three process parameters for sheet-metal cutting. (3)

2.3 A blank with a diameter of 75mm has to be punched out of 2mm thick, soft cold rolled steel. The clearance allowance (A_c) is 0.6.

Determine: a) The punch size. (2)
b) The blanking force required if the shear stress is 325MPa. (2)

2.4 Describe the following sheet-metal processes: a) Trimming. (2)
b) Shaving. (2)

2.5 Name two differences between V-bending and edge bending. (4)

[19]

QUESTION 3:

3.1 Name four causes of variations in powder sizes sorted by screening. (4)

3.2 How does friction between particles affect engineering powders? (2)

3.3 Describe a common method to measure interparticle friction. (2)

3.4 Determine the shape factor for metallic particles of the following shapes:
a) Spherical. (2)
b) Cubical. (4)

3.5 Name two things that influence the packing factor in powder metallurgy. (2)

[16]

QUESTION 4:

4.1 Name four limitations of arc welding. (4)

4.2 Give three reasons why flux is used during arc welding. (3)

4.3 A gas tungsten arc welding operation uses a current of 250 Amp and a voltage of 20V. The melting factor (f_2) is 0,55 and the heat transfer factor (f_1) is 0,7. The unit melting factor (U_m) for the metal is $10J/m^3$.

Determine: a) the power needed foe the operation. (1)
b) The rate of heat generation at the weld. (2)
c) Volumetric rate of metal welded. (2)

4.4 Name four general advantages of resistance welding. (4)

4.5 Name two disadvantages of resistance welding. (2)

4.6 Describe pressure gas welding. (3)

[21]

QUESTION 5:

5.1 Describe the function of a core as used in sand casting. (4)

5.2 Name and describe four different kinds of risers for sand casting. (8)

5.3 Name and describe four defects occurring in injection molding parts. (8)

5.4 Name two thermoforming processes. (2)

[22]

QUESTION 6:

6.1 Apart fro flat rolling, name four bulk deformation processes that use rolls to form a working part. (4)

6.2 Name three operations related to open-die forging. (3)

6.3 Explain the differences between swaging and radial forging. (4)

6.4 Describe the general shapes and sizes of:
a) A bloom. (2)
b) A slab. (2)
c) A billet. (2)

[17]

TOTAL = 115

Useful Equations

$V = \sqrt{2gh}$ $\quad g = 981 cm/s^2$

$\epsilon = \ln(h_0/h)$ $\quad F = K_f Y_f A$

$PS = 1/MC - t_w$ $\quad Q_x = K_s p$

$s = (v_f - v_r)/v_r$ $\quad K_f = 1 + 0.4\mu D/h$

$A = \tan^{-1}(p/(\pi D))$ $\quad v_r = 2\pi DN$

$Y_f = K\varepsilon^n$ $\quad Q_x = Q_{max} - (Q_{max}/p_{max})p$

$r = (A_0 - A_f)/A_0$ $\quad r_x = A_0/A_f$

$\varphi = 0.88 + 0.12(D/L_c)$ $\quad P_{max} = (6\pi DNL\eta \cot A)/d_c^2$

$L = (R \cdot d)^{0.5}$ $\quad K_f = 1 + (0.4\mu D)/h$

$Power\ P = 2\pi NT$ $\quad K_x = 0.98 + 0.02(C_x/C_c)^{2.25}$

$K_s = AD/V$ $\quad \epsilon_x = a + b \ln r_x$

$t_o w_o v_o = t_f w_f v_f$ $\quad L_c = (D_o - D_f)/2 \sin \alpha$

$e = \Delta l/l = (l_f - l_o)/l_o$ $\quad H = \rho V\{C_s(T_m - T_o) + H_f + C_l(T_p - T_m)\}$

$c = A_c t$ $\quad \sigma_d = fY(1 + \mu/\tan \alpha)\varphi(\ln A_o/A_f)$

$d_{max} = \mu^2 R$ $\quad R_{WV} = R_{HW} U_m$

$Q_b = \pi p D d_c^3 \sin^2 A/12\eta L$ $\quad A_b = 2\pi(\alpha/360)(R + K_{ba} t)$

$F = \bar{Y}_f w L F_h = 0.015 Y \pi (D_b^2 - (D_p + 2.2t + 2R_d)^2)$

$Q_d = 0.5\pi^2 D^2 N d_c \sin A \cos A$ $\quad R_{HW} = f_1 f_2 EI$

$P = IE$ $\quad R_{VW} = R_{HW}/U_M$

$Q = v_1 A_1 = v_2 A_2$ $\quad F = 0.7(TS)tL$

$F = S.t.L.$

$T_{TS} = C_m(V/A)^n$

$F = \pi D_p t(TS)(D_b/D_p - 0.7)$

$T_{MF} = V/Q$

$K_s = (\pi D_d^4)/128\eta L_d$

$Q_d = 0.5vdw$

$U_m = K(T_m)^2$

$Q_x = Q_d - Q_b$

$p = \bar{Y}_f\left(C_s + \frac{2I}{D_p}\right)$

$$\bar{Y}_f = \frac{K\epsilon^n}{1+n}$$