UNIVERSITY OF JOHANNESBURG

PROGRAM	:	NATIONAL DIPLOMA *ENGINEERING : MECHANICAL* *ENGINEERING : INDUSTRIAL*
SUBJECT	:	**MECHANICAL MANUFACTURING ENGINEERING II**
CODE	:	**IMV2211**
DATE	:	END-YEAR SSA EXAMINATION 2014 4 DECEMBER 2014
DURATION	:	11:30 – 14:30
WEIGHT	:	40 : 60
TOTAL MARKS **FULL MARKS**	: :	110 100

ASSESSOR	:	MRS R. STEENKAMP AND MR P VAN PLETZEN
MODERATOR	:	MR A KESCHNER
NUMBER OF PAGES	:	PAGES 5 (INCLUDING FORMULA SHEET)

REQUIREMENTS : DRAWING INSTRUMENTS TO BE SUPPLIED BY STUDENTS.

INSTRUCTIONS TO STUDENTS

1. PLEASE ANSWER ALL QUESTIONS
2. NUMBER YOUR ANSWERS **STRICTLY ACCORDING TO THE QUESTIONS**
3. SHOW ALL THE CALCULATIONS.
4. ALL ANSWERS, BOTH INTERMEDIATE AND FINAL, MUST HAVE THE CORRECT UNITS
5. ALL SKETCHES ARE TO BE DRAWN IN PENCIL AND TO GOOD PROPORTION.
6. ANY DATA NOT PROVIDED; STUDENTS ARE EXPECTED TO MAKE REALISTIC ASSUMPTION

QUESTION 1

1.1 Name the three classifications of Industries. (3)
1.2 What impact does product variety have on product quantity (1)
1.3 Name the two basic groups of metals (2)
1.4 Define an assembly operation and name the two categories of assembly operations (4)

[10]

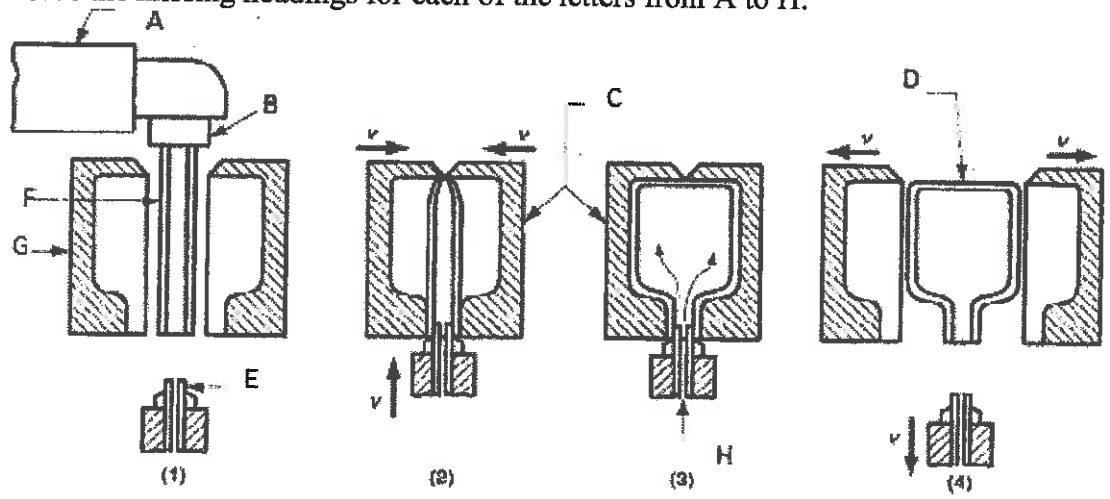
QUESTION 2

2.1 Define the term casting (3)
2.2 Name four of the advantages or capabilities of the casting process (4)
2.3 Determine the total solidification time of a cylinder with a diameter of 10 cm and a length of 20cm. The mold constant for the metal used is $C_m=3.5s/cm^2$ (5)
2.4 A Volume of 2575cm3 of a eutectic alloy is heated from room temperature (25°) to a pouring temperature of 850°, melting temperature is 700°. The alloy's density is $8g/cm^3$ specific heat in solid state is 0.84J/g°C and specific heat for a liquid state is 0.74J/g°C and the heat of fusion is 125J/g. How much heat must be added to get metal to pouring heat, assuming no losses? (5)

[17]

QUESTION 3

3.1Polymer melts exhibit several unique properties and characteristics, name two of the properties. (2)
3.2. Describe the Extrusion process. (4)
3.3 Extrusion is one of the most widely used plastic shaping operation name three design considerations for conventional extrusion and briefly discuss each. (6)
3.4 Give the missing headings for each of the letters from A to H.



(8)

[20]

QUESTION 4

4.1. A cylindrical part is warm upset forged in an open die. The following data is given

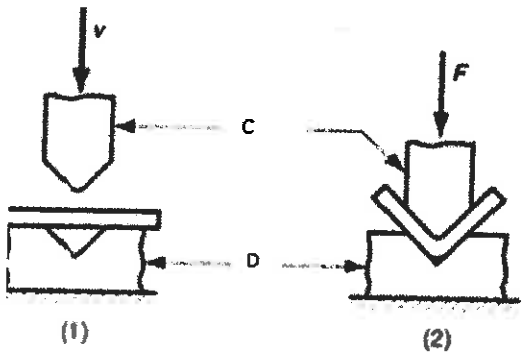
Diameter = 20cm;
Height = 30cm
Height after forging =20cm
Coefficient of friction at the die-work interface is 0.20
The yield strength of the work material is 285 MPa
The flow curve is defined by strength coefficient of K= 600 MPA
Strain-hardening exponent of 0.12

Determine the force in the operation just as the yield point is reached (yield at strain = 0.002), (7)
4.2. Briefly describe hot and cold extrusion of metal parts (2)
4.3. What is the difference between wire and bar drawing and Extrusion (2)
4.4. Rod stock that has an initial diameter of 3.5 cm is drawn through a draw die with an entrance angle of 20°. The final diameter of the rod is = 2 cm. The metal has a strength coefficient of 275 MPa and a strain hardening exponent of 0.20. Coefficient of friction at the work-die interface = 0.2. Determine (a) area reduction. (5)
4.5 What is the purpose of flash in impression die forging (2)

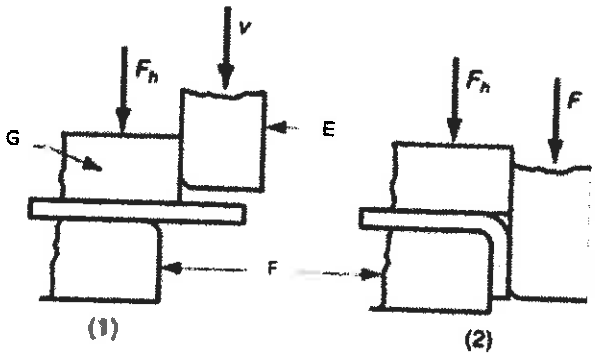
[18]

QUESTION 5

5.1 The commercial importance of sheet metal working is significant name three products made by this process and name and name two characteristics of sheet metal parts. (5)
5.2 Give the missing headings from A to G. (7)



A-



B

5.3. What is bend allowance? (3).

[15]

QUESTION 6

6.1 A screen with 20 mesh count has wires with a diameter of 0,004 cm, Determine:
6.1.1. The maximum particle size that will pass through the wire mesh. (2)
6.1.2. The proportion of open space in the screen. (5)

6.2. Name four reasons why Powder Metallurgy is important. (4)

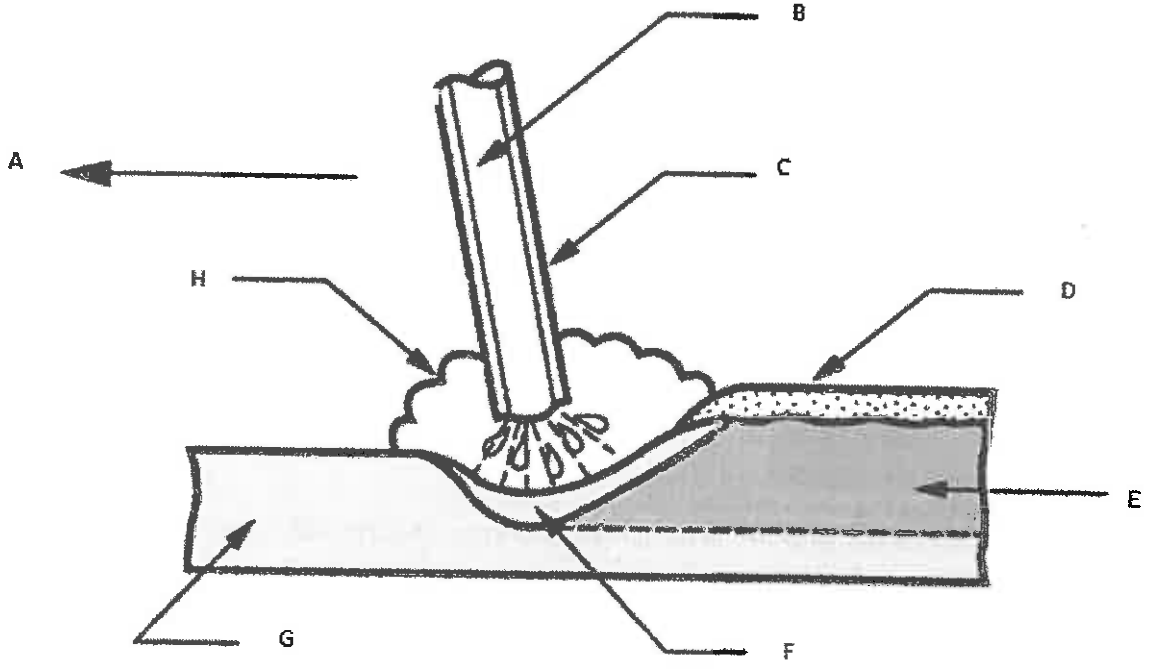
6.3. Define bulk density and true density for metallic powders. (2)

[13]

QUESTION 7

7.1 Define Flux. Flux is usually formulated to serve several other functions name two. (3)

7.2 Give the correct labels for the shielded metal arc welding process as shown below. (8)



7.3 Name two design considerations for arc welding. (2)

[13]

TOTAL = 106

Useful Equations

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$F = S.t.L.$

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

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

$T_{MF} = V/Q$

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

$Q_d = 0.5vdw$

$U_m = K(T_m)^2$

$Q_x = Q_d - Q_b$

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

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