UNIVERSITY OF JOHANNESBURG

PROGRAM	:	BACHELOR OF ENGINEERING TECHNOLOGY: MECHANICAL
SUBJECT	:	MECHANICAL MANUFACTURING2A (WKSMIA2)
		SSA WINTER EXAMINATION 2019
DATE	:	JULY 2019
DURATION	:	3 hours
TOTAL MARKS	:	100 100 Marks = 100%

ASSESSOR	:	MR. MD MUKHAWANA
MODERATOR	:	DR. FK TEKWEME
NUMBER OF PAGES	:	4 PAGES (INCLUDING FORMULA SHEET)

REQUIREMENTS	:	DRAWING INSTRUMENTS TO BE SUPPLIED BY STUDENTS.

INSTRUCTIONS TO STUDENTS

1. READ THE QUESTIONS CAREFULLY.
2. ANSWER ALL THE QUESTIONS
3. SHOW ALL CALCULATIONS
4. NUMBER YOUR ANSWERS STRICTLY ACCORDING TO THE QUESTIONS.
5. ALL ANSWERS, BOTH INTERMEDIATE AND FINAL, MUST HAVE THE CORRECT UNITS
6. 100 MARKS = 100 PERCENT.
7. ALL SKETCHES ARE TO BE DRAWN IN PENCIL AND TO GOOD PROPORTION.
8. UNTIDY WORK WILL BE PENALISED.
9. GRAVITATIONAL ACCELERATION = 9.81 m/s^2

QUESTION 1

1.1) Discuss four disadvantages of casting compared to other processes. (4)

1.2) What does the term "foundry-men" refer to when it comes to metal casting. (1)

1.3) Explain the difference between hot chamber and cold chamber machine of permanent mold casting. (4)

1.4) Use neat sketches to illustrate difference between close and open mound in sand casting. (8)

1.5) Casting experiment of certain metal has been conducted in metallurgy workshop. Based on the previous experiment the mold constant in Chvorinoy's rule is known to be 5 min/mm^2. The casting is a rectangular shape whose length = 100 mm, width = 50 mm, and height = 5 cm. Determine how long it will take for the casting to solidify. (6)

[23]

QUESTION 2

2.1) Explain what characterize Good weld? (3)

2.2) Discuss any five advantages of a resistance welding (5)

2.3) Discuss components in resistance spot welding (5)

2.4) Briefly explain the rotary friction welding (5)

2.5) The power source in a particular welding operation generates 135 kJ/min, which is transferred to the work surface with heat transfer factor = 0.8. The melting point for the metal to be welded = 982 ^oC and its melting factor = 0.5. A continuous fillet weld is to be made with a cross-sectional area = 0.25 cm2. Determine the travel speed at which the welding operation can be accomplished (in cm/min) (5)

[23]

QUESTION 3

3.1) With the aid of sketch illustrate five types of rolling mills configurations. (5)

3.2) Use a neat sketch to describe indirect extrusion (6)

3.3) Describe the conventional powder metallurgy production sequence in powder metallurgy (6)

3.4) What do you understand about mesh count in powder metallurgy? (2)

3.5) A 90 mm long and 45 mm in diameter bar is reduced by direct extrusion to a 18 mm diameter. The Johnson equation has a = 0.8 and b = 1.4, and the flow curve for the work metal has a strength coefficient of 800 MPa and strain hardening exponent of 0.13. Determine:

the extrusion ratio; (2)

the true strain (homogeneous deformation); (2)

the extrusion strain; (2)

the ram pressure; and (4)

the ram force. (2)

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QUESTION 4

4.1) With the aid of sketch illustrate difference between a blacking and a punching? (4)

4.2) Explain what you understand about spring back in sheet metal works. (2)

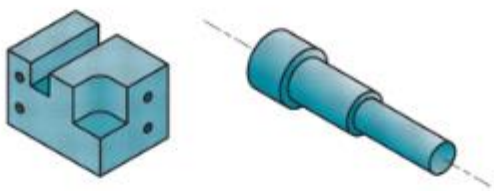
4.3) Explain the following process in sheet metal work.

a) Stretch forming (2)

b) Roll forming (2)

c) Spinning (2)

4.4) What types of machines can be used to produce the work pieces shown below. (3)



4.5) Describe five processes that can be performed using drilling machine. (10)

[25]

TOTAL = 100 Marks

Useful Information

$$H = \rho V\{C_s(T_m - T_o) + H_f + C_l(T_p - T_m)\} \quad T_{TS} = C_m\left(\frac{V}{A}\right)^n \quad v = \sqrt{2gh} \quad T_{MF} = \frac{V}{Q} \quad Q = v_1 A_1 = v_2 A_2$$

$$g = 9.81\frac{m}{s^2} = 981\frac{cm}{s^2} \quad K = 3.33 \times 10^{-6} \quad H_w = f_1 f_2 H \quad U_m = KT_m^2 \quad H_w = U_m V$$

$$R_{Hw} = U_m R_{WV} \quad R_{Hw} = f_1 f_2 R_H = U_m A_w v$$

$$d = t_o - t_f \quad d_{max} = \mu^2 R \quad r = \frac{d}{t_o} \quad s = \frac{v_f - v_r}{v_r} \quad \epsilon = \ln\frac{t_o}{t_f}$$

$$t_o w_o v_o = t_f w_f v_f \quad t_o w_o L_o = t_f w_f L_f \quad \overline{Y}_f = \frac{K\epsilon^n}{1+n} \quad F = \overline{Y}_f wL \quad L = \sqrt{R(t_o - t_f)}$$

$$T = 0.5\,FL \quad P = 2\pi NFL$$

$$V = Ah \quad V = \frac{\pi D^2 h}{4} \quad \epsilon = \ln\frac{h_o}{h} \quad K_f = 1 + \frac{0.4\,\mu D}{h} \quad Y_f = K\epsilon^n \quad F = K_f Y_f A$$

$$r_x = \frac{A_o}{A_f} \quad \epsilon = \ln r_x = \ln\frac{A_o}{A_f} \quad \overline{Y}_f = \frac{K\epsilon^n}{1+n} \quad \epsilon_x = a + b\ln r_x \quad p = \overline{Y}_f \epsilon_x$$

$$P = Fv \quad F = pA_o \quad p = \overline{Y}_f\left(\epsilon_x + \frac{2L}{D_o}\right) \quad K_x = 0.98 + 0.02\left(\frac{C_x}{C_c}\right)^{2.25} \quad p = K_x \overline{Y}_f\left(\epsilon_x + \frac{2L}{D_o}\right)$$