Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	MANUFACTURING PROCESS
COURSE CODE	:	BEH 41303
PROGRAMME CODE	:	BEJ
EXAMINATION DATE	:	DECEMBER 2019/JANUARY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

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THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 (a) Today's manufacturing can be defined into two ways. Explain both of them.
(4 marks)

(b) Manufacturing industries can be classified as primary, secondary and tertiary industries. Explain these classifications together with examples of the industry.
(6 marks)

(c) Manufacturing operation can be divided into two types which are Processing Operations and Assembly Operations. State the differences between these operations.
(4 marks)

(d) In a Brinell hardness test, a 2055 kg load is pressed into a specimen using a 25 mm diameter hardened steel ball. The resulting indentation is 15% size of the steel ball.

(i) Calculate the Brinell Hardness Number (BHN) for the metal.
(4 marks)

(ii) Investigate the load required, F if the BHN is 50% less than BHN in **Q1(d)(i)**.
(2 marks)

Q2 (a) A copper wire fails Tensile test at an engineering stress, σ_e= 253.75 N/mm^2 and true stress σ = 1750 N/mm^2. Analyze the following items:

(i) The percentage of area reduction, A_r.
(5 marks)

(ii) The true strain at failure, ε.
(5 marks)

(iii) The length of the copper wire at failure, L_f if the initial length, L_o=184.88 mm.
(5 marks)

(b) During a tensile test, a metal has a true strain = 0.20 at a true stress = 40,000 N/mm^2. Later, at a true stress = 65,000 N/mm^2 and true strain = 0.45. Determine:

(i) The strain-hardening exponent, n.
(3 marks)

(ii) The strength coefficient, K.
(2 marks)

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Q3 (a) Identify **FOUR (4)** manufacturing processes involved in producing the Proton X70 Car Door as shown in **Figure Q3(a)**.

(8 marks)

(b) Name the **FOUR (4)** basic bulk deformation processes.

(4 marks)

(c) Name and briefly describe **THREE (3)** general defects encountered in casting processes.

(3 marks)

(d) With the aid of a diagram, state the differences between sand casting and die casting processes.

(5 marks)

Q4 (a) The foreman in the injection molding department says that a PVC part produced in one of the operations has greater shrinkage than the calculations indicate it should have. The important dimension of the part is specified as 53.25 ±0.25 mm. However, the actual molded part measures 52.95 mm.

(i) Point out **TWO (2)** adjustments in process parameters could be made to reduce the amount of shrinkage.

(4 marks)

(ii) Suggest a new material which can be produced within the required tolerance to replace PVC by referring to **Table Q4(a)**.

(6 marks)

(b) The technique of blow molding is used to produce mineral water bottle as illustrated in **Figure Q4(b).** With the aid of a diagram, construct the working operation of blow molding of mineral water bottle.

(6 marks)

(c) Although the workpiece in a wire drawing operation is obviously subjected to tensile stresses, with the aid of a diagram explain how compressive stresses also play a role in the process.

(4 marks)

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Q5 (a) In a turning operation on stainless steel with hardness = 275 HB, the cutting speed = 157.24 m/min, feed = 0.55 mm/rev, and depth of cut = 0.35 cm. The cutting force, F_c = 1500 N.

(i) Calculate the metal removal rate.

(3 marks)

(ii) Examine the gross power, P_g if it's mechanical efficiency, $E = 92.50\%$.

(4 marks)

(b) A 4,000 W heat source transfers heat to the surface of a metal part. The heat affects the surface in a circular area, with intensities varying inside the circle. Analyze the percentage of power transferred within a circle of diameter, d = 0.65 cm when the power density in this region is 75.50 W/mm^2.

(5 marks)

(c) Modern inspection technologies include contact and non-contact sensing devices. List **THREE (3)** example of modern inspection devices and explain **TWO (2)** of the devices.

(5 marks)

(d) State **THREE (3)** problems encountered when 100% inspection is done manually.

(3 marks)

-END OF QUESTIONS –

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Figure Q3(a)

TABLE Q4(a)

Typical Values of Shrinkage for Moldings of Selected Thermoplastics.

Plastic	Shrinkage, mm/mm (in/in)
ABS	0.006
Nylon-6,6	0.020
Polycarbonate	0.007
Polyethylene	0.025
Polystyrene	0.004
PVC	0.005

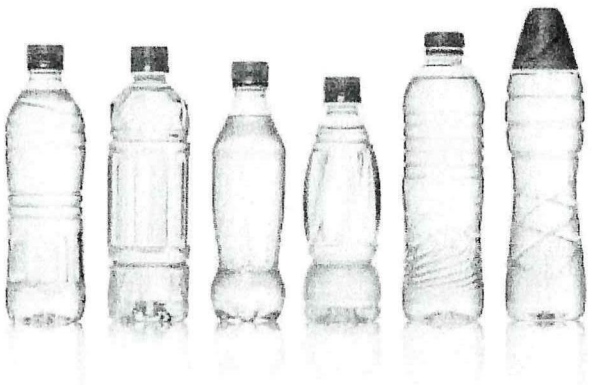

Figure Q4(b)

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Brinell Hardness Number Formula

$$HB = \frac{2F}{\pi D_b(D_b - \sqrt{D_b^2 - D_i^2})}$$

Engineering Stress-Strain Formula

$$strain, e = \frac{h - h_o}{h_o} \qquad stress, \sigma_e = \frac{F}{A_o} \qquad shortening, s = \frac{h_s - h_o}{h_o}$$

$$Hooke's\ Law, \sigma_e = Ee$$

$$where, E = modulus\ of\ elasticity$$

True Stress-Strain Formula

$$strain, \varepsilon = ln\frac{L}{L_o} \qquad stress, \sigma = \frac{F}{A}$$

Chvorinov's Rule

$$T_{TS} = C_m\left(\frac{V}{A}\right)^n$$

Compensation for Shrinkage

$$D_c = D_p + D_pS + D_pS^2$$

Material Removal Rate Formula

$$R_{MR} = vfd$$

Power and Energy Relationship Formula

$$Cutting\ power, P_c = F_cv \qquad Gross\ power, P_g = \frac{P_c}{E}$$

Power Density Formula

$$PD = \frac{P}{A}$$

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