



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2017/2018**

COURSE NAME : INJECTION MOULD DESIGN
COURSE CODE : BDD 40903
PROGRAMME CODE : BDD
EXAMINATION DATE : DECEMBER 2017/ JANUARY 2018
DURATION : 3 HOURS
INSTRUCTION : ANSWERS FIVE (5) QUESTIONS
FROM SIX (6) QUESTIONS

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THIS QUESTION PAPER CONSISTS OF SIX(6) PAGES

Q1 (a) Injection moulding is one of the most efficient processes in plastic component for mass production. Defend this statement.

(6 marks)

(b) Ribs are used in a design to increase the bending stiffness of a part without adding thickness. Ribs increase the moment of inertia, which increases the bending stiffness. Propose a new design by using ribs to reduce the thickness of the wall and the circular section based on **Figure Q1 (b)**.

(6 marks)

(c) There is a critical problem for a designer to select a mold base for high quality thermoplastic product. Propose to your management base on your justification for standard mold selection.

(8 marks)

Q2 (a) Based on the information stated in **Table Q2**, distinguish the best material for a mould with 5,000,000 cycles and 500 cycles.

(4 marks)

(b) The goal of the mold layout design stage is to develop the physical dimensions of the inserts and mold so as to enable procurement of these materials. Schedule the mold layout design procedures for developing a standard mold base of thermoplastic product.

(6 marks)

(c) The parting line is the plane in which the two halves of the mold meet. To the extent possible, all features should be oriented perpendicular to the parting line to facilitate removal from the mold. Normally, the parting line is transferred to the surface of the part as a witness line, an unavoidable result of two mating mold members. Support a checklist as a guide to make suitable choice for the right plastic injection mold parting line.

(10 marks)

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- Q3** (a) With the aid of figure, employ the function and the recommended design for a cold slug in a runner system. (6 marks)
- (b) A mould designer was assigned to choose a runner for a mould. Support a checklist as a guide to make suitable choice for the runner design. (8 marks)
- (c) The runner system is transforming the molten material from the sprue to the gate. Differentiate the advantages and disadvantages of the cold runner compared to the hot runner. (6 marks)
- Q4** (a) The function of gate is to allow the molten plastic to be injected into the cavity of the injection mold. You are a mould designer was assigned to choose a proper gate locations for automatic degating of three plate mold base. Support at least **EIGHT (8)** guidelines for your proper gate locations selection. (8 marks)
- (b) Calculate the combine perimeter of all ejectors for a battery cover mould, if 10 ejector pins with the same diameter are to be used. Assume the yield stress of the chosen polymer is 50 MPa, the eject force is 4 kN and the given height of pin is 20 mm. (6 marks)
- (c) A cover, molded of PVC and ejected with 10 ejector pins. The injection force of 4700 N was used in the injector system. As for the pins, the material used was steel, with 200 GPa of modulus, and the length of 0.2m. Calculate the diameter of the ejector pin. (6 marks)

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- Q5** (a) As a mold designer, propose **FIVE (5)** methods to improve cooling efficiency.
(5 marks)
- (b) The nominal thickness of the lid is 2mm, the nominal of the cup is 3mm and the diameter of the primary runner is 6.25mm. Assuming that the material is ABS with melt, cooling and ejection temperature of 239, 60 and 96.7 °C. The mass of the two moldings totals 62.6g.
- (i) Estimate the cooling time for the two cavity family mold used to produce the cup and the lid.
(6 marks)
- (ii) Estimate the cooling time for a molding that is 3mm in thickness.
(3 marks)
- (iii) If an ABS material is processed at mid-range temperature, analyse the power required to cool the cup and lid family mold.
(6 marks)
- Q6** (a) During the injection molding process, the production quality assurance found that the product has the surface appearance that looks like an under surface craze and resembles the skin of an orange.
- (i) As a mould design engineer, explain the possible cause.
(4 marks)
- (ii) Solve the problem without redesign or replacing the mold.
(6 marks)

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(b) During an injection molding process, suddenly the molded parts starts to come out with a blackened area along the parting line, where the mold halves come together. The usual smells of material changed to “sour” and “burned”. Then, you hear a “clunk” sound every time the mold closes.

(i) As a production engineer, judge the condition based on the statement given.

(2 marks)

(ii) You had performed visual inspection on the injection molding machine. Support a check list for the items that you need to inspect.

(8 marks)

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–END OF QUESTIONS –

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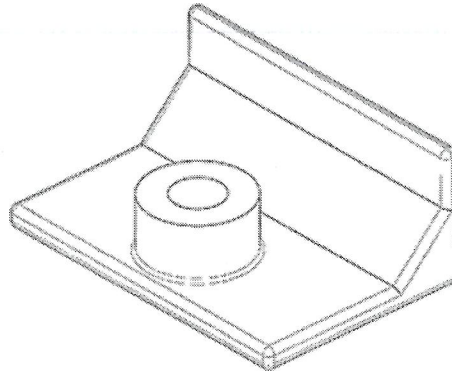
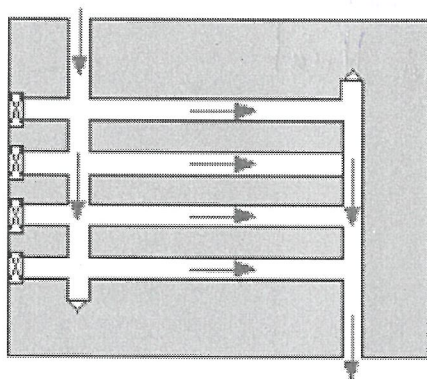


Figure Q1 (b): Plastic Part Rib Design

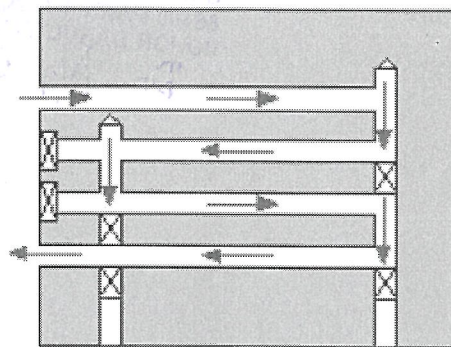
Table Q2: Common mold materials by applications

Table 4.1: Common mold materials by application

	Low number of cycles ($n_{cycles} < 10,000$)	Moderate number of cycles	High number of cycles ($n_{cycles} > 1,000,000$)
Non-abrasive melt with low molding pressures	Al alloys	Al or Cu alloys	Cu alloys, P20, SS420
Slightly abrasive melt or moderate molding pressures	Al or Cu alloys or 1045	Cu alloys, P20, 4140, S7	SS420, S7, D2, A6
Highly abrasive melt	P20, S7	D2, A6, H13	H13
High molding pressures	1045, 4140, P20	P20, S7	D2, A6
Highly corrosive melt	P20, SS420	SS420	SS420



Parallel Cooling Channels



Serial Cooling Channels

Figure Q5 (b): Cooling Channels

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