Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER I
SESSION 2020/2021

COURSE NAME	:	ENGINEERING MATERIALS SELECTION
COURSE CODE	:	BDA 20402
PROGRAMME CODE	:	BDD
EXAMINATION DATE	:	JANUARY / FEBRUARY 2021
DURATION	:	2 HOURS
INSTRUCTION	:	ANSWER **ALL FOUR (4)** QUESTIONS

THIS QUESTION PAPER CONSISTS OF FOUR (4) PAGES

Q1 (a) Show the importance of materials in design by using "hammer" as the subject of discussion.

(10 marks)

(b) Analysis the advantages and disadvantages of composite materials in a passenger car. Limit your answer to any exterior parts of a car.

(15 marks)

Q2 (a) How to design a kitchen stove based on alternative thinking?

(10 marks)

(b) Mineral water can be packed in glass, metal or plastic containers. Based on interrelated constraints, compare all three materials for the application.

(15 marks)

Q3 (a) Sketch $M = \frac{E^{1/4}}{C_{R\rho}} \geq 2$ (GPa/Mgm^3) in the suitable chart and propose all the possible materials in this case.

(10 marks)

(b) Fiber from palm oil was used as materials for furniture (as fiber board). By using your knowledge on the strategy for materials selection, criticize the use of fiber for the furniture in term of screening and ranking, supporting information, local condition and property limit.

(15 marks)

Q4 (a) By using the suitable materials selection chart, sketch the search region for $E > 10$ GPa and $M = \frac{{K_{IC}}^2}{E}$ for $M > 10$ (MPa m$^{1/2}$/GPa). Show your answer with a sketch on the selection chart.

(10 marks)

(b) The diaphragm in a differential pressure gauge deflects proportionally with the pressure difference across it. This deflection, δp, is used to measure the pressure difference. To operate well, the material must not fail under the loading, and it should have a large deflection in order to increase the sensitivity of the

measurement. The equations below for maximum stress and deflection of a circular diaphragm (**Figure Q4(b)**) of fixed radius are important to answer this question. The diaphragm thickness is t, E is Young's modulus, and ν is Poisson's ratio.

$$\sigma_{max} = \Delta p \frac{a^2}{2t^2}$$

$$\delta = \frac{3\Delta p a^4 (1 - \nu^2)}{16 E t^3}$$

Using the information above, explain how you would determine in different way the M value for this design. Be explicit without doing the algebra.

(15 marks)

- END OF QUESTION –

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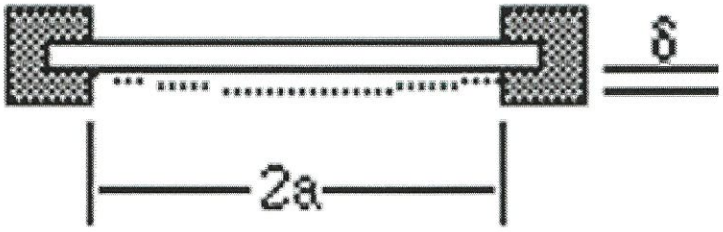

Figure Q4(b)