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**UNIVERSITI SAINS MALAYSIA**

First Semester Examination  
Academic Session of 2005/2006

November 2005

**EBB 523/3 - Ceramic Processing**

Time : 3 hours

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Please make sure that this examination paper consists of **THREE** printed pages before you begin with the exam.

This paper is made up of **SIX** questions.

Answer any **FIVE** questions. If a candidate answers more than five questions, only the first five answered will be examined and awarded marks.

Answer to any question must start on a new page.

All questions can be answered in Bahasa Malaysia or English.

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1. Ceramic injection moulding process is given the last priority as ceramic production technique in ceramic industry. However, this technique could reduce a tremendous production cost when involved with high volume production. Discuss in detail about this technique. Provide the various limitations that this technique is being given the last priority compared to other techniques.  
(100 marks)
2. One of the most important ceramic processing techniques in the ceramic industry is extrusion. This technique not only widely use in clay-based ceramics but also for advanced ceramics. Discuss in detail about the raw materials preparation required for this technique. Why this technique not able to produce a complex shape? If you compare to other techniques, what are the various important points that you think this technique more beneficial?  
(100 marks)
3. One of the important techniques in the synthesis of ceramic raw materials is via polymeric ceramic precursors derived from various silanes and silazanes groups. Discuss in detail with appropriate examples about this technique and provide its special advantages.  
(100 marks)
4. Briefly describe the following ceramic materials processing techniques:-
  - (i) Gelcasting of advanced ceramic products
  - (ii) Joining ceramics and metals
  - (iii) Ceramics as the reinforcement component in MMC
  - (iv) Advantages of the tape casting technique  
(100 marks)

5. [a] Explain what are characteristic properties and behavioural properties, providing suitable examples.

Discuss the common approach on relationship between processing variables, characteristic properties and behavioural properties.

In your opinion, is there other suitable relationship between the processing variables, characteristic properties and behavioural properties. Justify your answer.

(60 marks)

- [b] Processing of ceramics should be considered by studying the characteristic properties at each and every stage of processing. Discuss this uniformity concept.

(40 marks)

6. [a] Explain the wet bag and dry bag in a cold isostatic process. What are the advantages and disadvantages of both the process.

(30 marks)

- [b] Discuss two (2) common problems encountered in dry pressing of ceramics. Discuss the possible causes of these problems and how are they overcome?

(30 marks)

- [c] Binders (hard and soft) are commonly used in processing of advanced ceramics products such as  $\text{BaTiO}_3$  and  $\text{Al}_2\text{O}_3\text{-ZrO}_2$  composites. Discuss the use of binders and their effects on properties of ceramics.

(40 marks)