UNIVERSITI SAINS MALAYSIA

First Semester Examination
2014/2015 Academic Session

December 2014 / January 2015

EBB 332/3 – Whitewares and Glasses
[Tembikar Putih & Kaca]

Duration : 3 hours
[Masa : 3 jam]

Please ensure that this examination paper contains EIGHT printed pages before you begin the examination.
[Sila pastikan bahawa kertas peperiksaan ini mengandungi LAPAN muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

This paper consists of SIX questions.
[Kertas soalan ini mengandungi ENAM soalan.]

Instruction: Answer **FIVE** questions. If a candidate answers more than five questions only the first five questions answered in the answer script would be examined.
*[**Arahan**: Jawab **LIMA** soalan. Jika calon menjawab lebih daripada lima soalan hanya lima soalan pertama mengikut susunan dalam skrip jawapan akan diberi markah.]*

The answers to all questions must start on a new page.
[Mulakan jawapan anda untuk semua soalan pada muka surat yang baru.]

You may answer a question either in Bahasa Malaysia or in English.
[Anda dibenarkan menjawab soalan sama ada dalam Bahasa Malaysia atau Bahasa Inggeris.]

In the event of any discrepancies in the examination questions, the English version shall be used.
[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah digunapakai.]

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1. [a] Mould making from plaster paris is one important aspect in whiteware forming or shaping methods. Discuss the making of working mould from a model for surgical glove formers.

Pembuatan acuan daripada plaster Paris adalah satu aspek penting dalam kaedah pembentukan tembikar putih. Bincangkan pembuatan acuan kerja daripada satu model untuk pembentuk sarung tangan pembedahan.

(30 marks/*markah*)

[b] Fill in the values of X, Y and Z for the following working moulds – justify your answer.

Isikan nilai X, Y dan Z bagi penghasilan acuan berikut – berikan sebab-sebab bagi jawapan anda

	Plaster	Water / *Air*
Slip casting (2 cast a day) *Tuangan Slip (2 tuangan sehari)*	100	X
Slip casting (3 cast a day) *Tuangan Slip (3 tuangan sehari)*	Y	100
Roller-head mould *Acuan sumbur reroda*	100	Z

(40 marks/*markah*)

[c] A company has been given 100 new sets of working moulds to produce their porcelain glove formers. After casting, their workers encountered many failed pieces of cast products such as product sticking to mould. In your opinion, what is the cause of this failure? How can this be overcome?

Sebuah syarikat telah diberikan 100 set acuan baru untuk penghasilan pembentuk sarung tangan porselin. Setelah melakukan penuangan slip, pekerja mereka mendapat banyak produk yang gagal seperti produk melekat ke dinding acuan. Pada pandangan anda, apakah punca kegagalan tersebut? Bagaimana ianya boleh diatasi?

(30 marks/*markah*)

2. [a] A slip was prepared for slip casting by mixing with clays, flux and fillers. The rheology was determined using a torsional viscometer. If the value of overswing before a deflocculant was added was 220, what would be the anticipated values for viscosity and thixotropy after the deflocculant was added. Explain your answer.

Satu slip untuk proses tuangan, telah dicampur menggunakan tanahliat, fluks dan pengisi. Sifat reologinya ditentukan menggunakan viskometer kilasan. Jika nilai sebelum ditambah penyahgumpal adalah 220 putarlampau, berapakah jangkaan nilai putarlampau bagi kelikatan dan tiksotropi selepas ditambah penyahgumpal tersebut? Jelaskan jawapan anda.

(30 marks/*markah*)

[b] Explain how does a deflocculant affects the rheology of a slip. Why is a small thixotropy important in slip casting?

Terangkan bagaimana penyahgumpal mempengaruhi reologi slip. Mengapakah nilai kecil tiksotropi penting dalam penuangan slip.

(30 marks/*markah*)

[c] Generally viscosity of a slip is affected by addition of water, choice of raw materials and addition of deflocculant. Which 2 (two) would influence more the viscosity? Justify your answer. Explain why a minimum viscosity of a slip is not acceptable for good slip casting?

Lazimnya, kelikatan satu slip dipengaruhi oleh penambahan air, pilihan bahan mentah dan penyahgumpal. Mana 2 (dua) di antara di atas yang lebih mempengaruhi nilai kelikatan? Jelaskan jawapan anda. Terangkan mengapa kelikatan minima tidak dikehendaki untuk penuangan slip yang baik?

(40 marks/*markah*)

3. [a] Workability of a plastic clay body is an important feature in making a large plate using roller-head process. How can the workability of the body be improved so as to minimise defects such as stretch face faults.

Kebolehkerjaan satu jasad plastik adalah penting dalam menghasilkan satu pinggan besar menggunakan kaedah sumbur reroda. Bagaimanakah kebolehkerjaan jasad ditambahbaik supaya kecacatan seperti permukaan cekang boleh diminimakan?

(30 marks/*markah*)

[b] Briefly explain single-ended pressing and cold-isostatic pressing. Compare and contrast their properties achieved (including potential defects) after firing the press product.

Perihalkan kaedah penekanan eka-arah dan penekanan isostatik. Bandingkan dan bezakan sifat-sifat yang diperolehi (termasuk kemungkinan kecacatan) setelah dibakar produk dihasilkan.

(30 marks/*markah*)

[c] Typically, sanitary products are glazed although they are fully-vitrified. One glaze formulation that was analyzed for a sanitaryware company is given below.

Lazimnya, produk sanitari adalah dilicaukan walaupun ianya vitrus sepenuhnya. Satu formulasi licau yang dianalisa daripada satu kilang sanitari diberikan seperti berikut:

0.314 MgO	1.120 Al_2O_3	10.300 SiO_2
0.140 CaO		
0.167 K_2O		
0.379 Na_2O		

Determine the recipe for the glaze, based on the following raw materials:

Tentukan resipi licau tersebut, berdasarkan bahan mentah berikut:

	Molecular weights *Berat molekul*
Kaolin ($Al_2O_3.2SiO_2.2H_2O$)	258
Potash feldspar ($K_2O.Al_2O_3.6SiO_2$) *Felspar Kalium ($K_2O.Al_2O_3.6SiO_2$)*	556
Soda Feldspar ($Na_2O.Al_2O_3.6SiO_2$) *Felspar Natrium ($Na_2O.Al_2O_3.6SiO_2$)*	525
Potash-mica ($K_2O.3Al_2O_3.6SiO_2$) *Mica-kalium ($K_2O.3Al_2O_3.6SiO_2$)*	796
Soda-mica ($K_2O.3Al_2O_3.6SiO_2$) *Mica-natrium ($K_2O.3Al_2O_3.6SiO_2$)*	764

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Flint (SiO_2) *Flin*	60
Wollastonite ($CaO.SiO_2$)	116
Mg carbonate ($MgCO_3$)	84
Whitening ($CaCO_3$) *Pemutih*	100
Alumina (Al_2O_3)	102

(40 marks/*markah*)

4. [a] State the reason why cullet is always added to a glass composition.

Nyatakan alasan mengapakah "cullet" seringkali ditambah di dalam suatu komposisi kaca.

(20 marks/*markah*)

[b] Describe how network formers and network modifiers could influence the glass making process. You may use a suitable sketch/diagram to answer the question.

Perihalkan bagaimana pembentuk rangkaian dan pengubah bentuk rangkaian boleh mempengaruhi proses penghasilan kaca. Anda boleh menggunakan lakaran/rajah sesuai untuk menjawab soalan ini.

(40 marks/*markah*)

[c] A soda lime glass contains 13 wt% Na_2O, 13 wt% CaO and 74 wt% SiO_2. Soda ash (Na_2CO_3) and limestone ($CaCO_3$) are used as sources of the Na_2O and CaO, respectively. As they are heated, CO_2 gas is evolved, leaving Na_2O and CaO. Calculate how many kg of each soda ash and limestone are required for 1000 kg of SiO_2. Given molecular weight of Ca (40.0 g/mol), Na (23.0 g/mol), Si (28.0 g/mol), O (16.0 g/mol), C (12.0 g/mol).

Suatu kaca kapur soda mengandungi 13 wt% Na_2O, 13 wt% CaO dan 74 wt% SiO_2. Abu soda (Na_2CO_3) dan batu kapur ($CaCO_3$) digunakan sebagai sumber Na_2O dan CaO masing-masing. Apabila pemanasan dilakukan, gas CO_2 terhasil meninggalkan Na_2O dan CaO. Tentukan berapa kg setiap abu soda dan batu kapur diperlukan untuk 1000 kg SiO_2. Diberikan berat molekul Ca (40.0 g/mol), Na (23.0 g/mol), Si (28.0 g/mol), O (16.0 g/mol), C (12.0 g/mol).

(40 marks/*markah*)

5. [a] Glasses can also be produced by a sol-gel methods as opposed to conventional melting process. Describe the process of producing glass by the sol-gel method.

Kaca juga boleh dihasilkan dengan kaedah sol-gel berbanding proses peleburan biasa. Perihalkan proses penghasilan kaca menerusi kaedah sol-gel.

(40 marks/*markah*)

[b] List the advantages and disadvantages of both glass making processes.

Senaraikan kelebihan dan kekurangan kedua-dua proses penghasilan kaca.

(20 marks/*markah*)

[c] Compare the heat treatment process in glass ceramic and glass making. Your evaluation must include the purpose of the process, heat treatment schedules, etc.

Bandingkan proses rawatan haba di dalam penghasilan kaca seramik dan kaca. Huraian perlu merangkumi tujuan proses, jadual olahan haba dan sebagainya.

(40 marks/*markah*)

6. [a] Normally, the actual strength of glasses is lower than the theoretical strength due to the flaws occurred. Discuss and give 6 factors that influence the strength.

Kekuatan sebenar bagi kaca selalunya adalah lebih rendah daripada kekuatan teori akibat dari wujudnya kecacatan dalam kaca. Bincangkan serta berikan 6 faktor yang mempengaruhi kekuatan tersebut.

(40 marks/*markah*)

[b] These days we often observe the use of glass for structural engineering purposes. For instance, we can see this in many of the big departmental stores and high-rise offices in Malaysia for example the Petronas Twin Tower. Another such example is the St. Pancras International Railway Station in London. Critically discuss the factors that are being incorporated in the design and choice of structural glasses.

Pada masa kini kita sering melihat kekerapan kaca digunakan sebagai bahan struktur kejuruteraan. Contohnya kita dapat memerhatikan penggunaan kaca di gedung-gedung membeli-belah dan bangunan-bangunan pejabat pencakar langit sebagai contoh Menara Berkembar Petronas. Satu lagi contoh adalah penggunaan kaca pada Stesen Keretapi St. Pancreas International di London. Bincangkan secara kritis faktor-faktor yang diterapkan dalam reka bentuk dan pemilihan kaca sebagai bahan struktur.

(60 marks/*markah*)

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