UNIVERSITY OF GHANA

SCHOOL OF ENGINEERING SCIENCE

BSc. (Eng) MATERIALS SCIENCE AND ENGINEERING

SECOND SEMESTER EXAMINATIONS 2014/2015

MTEN 316: ENGINEERING CERAMICS I (2 CREDITS)

TIME- 2 HRS

ATTEMPT ALL QUESTIONS

Question 1

a) State three major differences between traditional and technical ceramics? *(3 marks)*

b) List three properties of ceramics that make it suitable in aerospace industry.

(3 marks)

c) What are engineering ceramics? Give four examples.   *(5 marks)*

d) Differentiate between glasses and glass ceramics.   *(4 marks)*

e) What are the two prime assets of glasses?   *(2 marks)*

f) The ratio r_c/r_a gets bigger as coordination number increases. Explain. Hence show that the minimum r_c/r_a for an octahedral site with coordination number of 6 is 0.414.

(4 marks)

g) State the four shaping processes of traditional ceramics.   *(4 marks)*

h) With the help of a suitable diagram, discuss the relationship between water content and pressure required for the four ceramic shaping processes stated in question (1g).

(5 marks)

Question 2

a) Mention any three ceramic materials that can be used to produce ceramic armour.

(3 marks)

b) What are ceramic springs? State two reasons why ceramic springs are sometimes preferred over metallic springs.   *(6 marks)*

c) Graph the relationship between transverse strength and volume fraction of pores of a typical ceramic material. Comment on the graph.   *(6 marks)*

d) Discuss four methods that can be used to strengthen ceramic materials.   *(4 marks)*

Examiner: Dr. Anthony Andrews

e) On the same axis, sketch a typical stress – strain curve for Al_2O_3 refractory and Al metal. From the graph, briefly explain why advanced structural ceramics have limited applications. *(6 marks)*

f) Briefly discuss the mechanical properties of crystalline and non-crystalline phases at both low and high temperatures. *(6 marks)*

g) Comment on the coefficient of thermal expansion (CTE) of crystalline and non-crystalline phase below Tg. *(4 marks)*

h) The mean fracture strength of a batch of alumina components is measured to be 400 MPa. What size of defects would you expect to find in the material? (Take the fracture toughness of alumina to be 4 $MPam^{1/2}$ and Y to be 1.8). *(5 marks)*

END OF EXAM