

II B.Tech. I Semester Supplementary Examinations, May -2005
CERAMIC SCIENCE AND TECHNOLOGY
(Metallurgy & Material Technology)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. Give a detailed account of the ceramics used for
 - (a) structural functions and
 - (b) magnetic functions
2. (a) Give a detailed account of
 - i. superconducting and
 - ii. opto-electronic ceramics.
(b) Name the ceramic(s) for use in
 - i. prosthetics
 - ii. heart valves
 - iii. semi-conductors
 - iv. thermal coatings
 - v. transducers.
3. (a) Define nature of ceramic materials.
(b) Describe spinel structure and graphite diamond structures of ceramics.
4. (a) Draw the $\text{MgO} - \text{Al}_2\text{O}_3$ phase diagram, to scale on a graph paper. Label the important points, lines and phases in it.
(b) Explain how the phase diagrams are useful in studying the properties of various ceramics.
5. What do you mean by ultra structure processing? What are the various processing techniques available to obtain such a structure? Explain them in detail.
6. Write an essay on the properties of plasma sprayed oxide coatings.
7. (a) Explain the effect of process variables in dry pressing.
(b) Describe powder flow during die filling and pressing.
8. Explain the following with respect to the principle of operation; applications and limitations
 - (a) Tape casting
 - (b) Calendaring process
 - (c) Microwave processing.

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1. Discuss in detail the different classes of ceramic materials with three examples for each class.
2. (a) Explain the important properties of the following ceramics:
 - i. ferrites
 - ii. calcium titanate
 - iii. yttrium-barium copper oxide and
 - iv. hydroxy apatite(b) Discuss the importance of high temperature ceramic coatings with examples and typical applications.
3. (a) What do you understand by the term polymorphism?
(b) Explain polymorphism in ceramic materials.
4. (a) Draw the $\text{MgO} - \text{Al}_2\text{O}_3$ phase diagram, to scale on a graph paper. Label the important points, lines and phases in it.
(b) Explain how the phase diagrams are useful in studying the properties of various ceramics.
5. List the powder preparation techniques for advanced ceramics and explain them briefly.
6. Write short note on the following:
 - (a) Low pressure plasma spraying
 - (b) Vacuum plasma spraying
 - (c) Controlled environment plasma spraying.
7. (a) Derive an equation for ideal extrusion pressure.
(b) Explain the effect of speed of deformation and friction on extrusion pressure.
8. Explain how the tape casting properties can be assessed both qualitatively and quantitatively.

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1. (a) Give examples for crystalline and non-crystalline ceramics.
(b) Compare the mechanical properties of ceramics with metals.
(c) What are structural ceramics? Give examples.
2. (a) Explain the important properties of the following ceramics:
 - i. ferrites
 - ii. calcium titanate
 - iii. yttrium-barium copper oxide and
 - iv. hydroxy apatite
(b) Discuss the importance of high temperature ceramic coatings with examples and typical applications.
3. (a) How do you compare ceramics and non ceramic phases?
(b) Describe silicon-oxygen tetrahedron (SiO_4) structure and double poly-tetrahedron structures of ceramics.
4. (a) Define the terms Stoichiometric and Phase Boundary.
(b) Draw a neat sketch of Al_2O_3 - SiO_2 Equilibrium Diagram and explain.
5. Explain how $\text{Y Ba}_2 \text{Cu}_3\text{O}_7$ and Ytria doped ThO_2 are produced by denitration of metal Nitrate by chemical reaction using glycerol as the reducing agent. Also give the necessary chemical reactions.
6. Explain the following:
 - (a) Plasma sprayed stabilized Zirconia coatings.
 - (b) Plasma sprayed Titanium Diboride coating.
7. Describe the different stages in Hot Isostatic Pressing (HIPing) for producing ceramic products. What are its merits and demerits?
8. (a) Explain microwave processing of ceramics.
(b) What are the advantages and limitations of microwave processing?

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1. (a) What ceramic materials will you use for
 - i. grinding
 - ii. thermal insulation
 - iii. magnets and
 - iv. reaction vessels/ crucibles ?(b) What are fine ceramics? What are their advantages over conventional ceramics? Explain with examples.
2. (a) List three bioceramics for use in human body. Give their advantages, disadvantages and applications.
(b) How are bioceramics classified? Explain with examples.
3. (a) How do you compare ceramics and non ceramic phases?
(b) Describe silicon-oxygen tetrahedron (SiO_4) structure and double poly-tetrahedron structures of ceramics.
4. (a) Define the terms Phase and Isotherms.
(b) Draw a neat sketch of BaO - TiO_2 Equilibrium Diagram and explain.
5. Explain the advantages of sol-gel process over other methods. Write an essay on the sol-gel process for the production of various advanced ceramic powders; silica fibres and glasses.
6. (a) What are the two important powder production routes. Explain important features of the above techniques.
(b) Explain the following:
 - i. Carbothermic process
 - ii. Vacuum synthesis.
7. (a) Describe injection molding with neat diagrams.
(b) Discuss the advantages and draw backs of injection moulding.
8. (a) Describe Doctor Blade method.
(b) What are the advantages and draw backs of Doctor Blade method?
