

II B.Tech I Semester Supplementary Examinations, November 2006
CERAMIC SCIENCE AND TECHNOLOGY
(Metallurgy & Material Technology)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. Discuss in detail the different classes of ceramic materials with three examples for each class. [16]
2. (a) Give two examples each for [9]
 - i. bio ceramics
 - ii. superconducting ceramics and
 - iii. electronic ceramics.(b) What are bio-ceramics? What are the important characteristics required of a bioceramic? Give typical applications for bioceramics. [7]
3. (a) Define glass ceramics and cermets. [4]
(b) Discuss grouping of ions and Pauling's rules. [12]
4. (a) Define the terms Phase and Isotherms. [4]
(b) Draw a neat sketch of BaO -TiO₂ Equilibrium Diagram and explain. [12]
5. Explain the following:
 - (a) Sol-gel microsphere pelletisation route. [5]
 - (b) Thermal decomposition of Zirconia from Zircon [5]
 - (c) Thermal decomposition of Th (C₂O₄)₂ for the preparation of ThO₂ powders. [6]
6. Explain the following:
 - (a) Plasma sprayed stabilized Zirconia coatings. [8]
 - (b) Plasma sprayed Titanium Diboride coating. [8]
7. (a) Describe injection molding with neat diagrams. [8]
(b) Discuss the advantages and draw backs of injection moulding. [8]
8. (a) Explain what is piezoelectric effect? List various types of natural and synthetic piezoelectric crystals. [8]
(b) What is tape casting? What are various processing agents used in tape casting process? Explain them. [8]

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1. Write short notes on: [16]
 - (a) clay and white wares
 - (b) refractories
 - (c) abrasives
 - (d) glasses.
2. Write detailed notes on [8+8]
 - (a) piezo electric ceramics and
 - (b) conducting ceramics. [16]
3. (a) How do you compare ceramics and non ceramic phases? [6]
(b) Describe silicon-oxygen tetrahedron (SiO_4) structure and double poly-tetrahedron structures of ceramics. [10]
4. (a) Define the terms Stoichiometric and Phase Boundary. [6]
(b) Draw a neat sketch of Al_2O_3 - SiO_2 Equilibrium Diagram and explain. [10]
5. Define the term 'sol'. What is a sol-gel process? Explain the process with specific [4]
 - (a) Alumina based abrasives [6]
 - (b) Calci stabilized zirconia. [6]
6. (a) What are the two important powder production routes. Explain important features of the above techniques. [8]
(b) Explain the following:
 - i. Carbothermic process [4]
 - ii. Vacuum synthesis. [4]
7. Describe the different stages in Hot Isostatic Pressing (HIPing) for producing ceramic products. What are its merits and demerits? [16]
8. (a) What is a sandwich transducer? Why it is used in ultrasonic machining process. [7]
(b) What do you mean by 'acoustic head' in ultrasonic machining process. With the help of a neat sketch explain its working principle in detail. [9]

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1. (a) Discuss in detail the non-oxide ceramics with examples and applications [8]
(b) What are fine ceramics? How are they advantageous over conventional ceramics with suitable illustrations. [8]
2. Write short notes on:
 - (a) dielectric ceramics [5]
 - (b) ceramics for magnetic functions and [6]
 - (c) ceramics for conducting functions. [5]
3. (a) Explain nature of ceramic materials. [6]
(b) Describe spinel structure and graphite diamond structures of ceramics. [10]
4. Draw a neat sketch of $\text{MgO-Al}_2\text{O}_3 - \text{SiO}_2$ three component systems Phase Diagram and explain. [16]
5. List the powder preparation techniques for advanced ceramics and explain them briefly. [16]
6. Write an essay on the properties of plasma sprayed oxide coatings. [16]
7. (a) Explain the behavior of powder during compaction. [8]
(b) Describe the die wall effects on compaction. [8]
8. (a) Explain microwave processing of ceramics. [9]
(b) What are the advantages and limitations of microwave processing? [7]

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1. (a) Compare traditional and fine ceramics with reference to characteristic features and applications [6]
(b) Classify the following into traditional / fine/ structural ceramics
 i. silicon nitride
 ii. zirconia
 iii. silicon carbide
 iv. silicon nitride
 v. alumina
 vi. glass
(c) List any two porcelain ceramics and their applications. [10]
2. Write detailed notes on [8+8]
(a) piezo electric ceramics and
(b) conducting ceramics. [16]
3. (a) What are the developments of ceramics? [6]
(b) Describe frame structure and vitreous structure of ceramics. [10]
4. (a) Distinguish fully between equilibrium cooling and non-equilibrium cooling. What is their affect on the properties of final phases. [10]
(b) What is Gibb's phase rule? Explain it's importance. [6]
5. List the powder preparation techniques for advanced ceramics and explain them briefly. [16]
6. (a) What are the two important powder production routes. Explain important features of the above techniques. [8]
(b) Explain the following:
 i. Carbothermic process [4]
 ii. Vacuum synthesis. [4]
7. (a) Derive an equation for ideal extrusion pressure. [8]
(b) Explain the effect of speed of deformation and friction on extrusion pressure. [8]

8. (a) Explain ultrasonic machining. [6]
(b) Compare ultrasonic machining with conventional methods. [10]
