

**End Semester Examination**

B. Tech. (Metallurgical Engineering)/M. Tech. (Physical Met)

**(MT-421/PY-514) Ceramic Engineering**

**Time: 3 Hours]**

**[Max. Marks: 50**

Instructions to candidates:

- 1) **All Questions are compulsory.**
- 2) Focus on covering all main points in your answer rather than the length.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Use of non-programmable electronic pocket calculator is permitted.

- Q. 1** Solve **any 2** of the following:
- (a) Discuss the various mechanisms which are made use of, while designing the ceramics for high temperature applications. [5]
  - (b) What is Spray Pyrolysis? With suitable examples discuss the effect of various processing parameters therein. [5]
  - (c) State and explain the main stages involved in conventional ceramics route of processing the advanced ceramics. [5]
- Q. 2** Solve **any 2** of the following:
- (a) Describe the various ways by which zirconia can be toughened. [5]
  - (b) Illustrate with suitable examples the various methods of colouring of glass. [5]
  - (c) What is Weibull modulus? Calculate the same for  $Al_2O_3$  which gave a modulus of rupture (MoR) value ranging between 400-600 MPa in a 3-point bend test and a tensile strength ranging between 225-325 MPa during tensile testing. [5]
- Q. 3** Discuss the mechanisms involved and important reactions with suitable examples in manufacturing of ceramic powders by following methods (**any 02**): [10]
- i. Sol-gel processing of nanomaterials
  - ii. Precipitation method
  - iii. Polymer pyrolysis
- Q.4** (a) Identify the various thermodynamic and kinetic factors critical in formation of glass. [5]
- (b) What are glass-ceramics? Compare the compositions, properties and applications of any two types of glass-ceramics? [5]
- Q.5** Solve **any 2** of the following:
- (a) Discuss the role played by pore-grain boundary interactions during sintering. [5]
  - (b) Describe the method of production of  $Si_3N_4$  by reaction sintering. [5]
  - (c) Give a brief outline of various densifying and non-densifying sintering mechanisms. [5]

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