

Department of Chemical Engineering

Major Examination: CHL 807. Population Balance Modelling

Max. Time: 2 Hours

Max. Marks: 40

Instructions: You must return the question paper along with your answer book.

Q. 1.State whether true or false (1 mark each) (20 marks):

- i. In particulate systems, time is neither internal nor external coordinate
- ii. For highly irregular particles, characteristic sizes are finite in number.
- iii. Many important problems in the operation of industrial crystallizers could be seen as arising from CSD problem.
- iv. Supersaturation levels can alter the habit and/or purity of the product crystals.
- v. Changes in nucleation rate due to changes in dilution and/or temperature of a crystallizer can require a minimum recovery time to return to a stable CSD.
- vi. Very small crystals and a wide CSD result in minimal caking problems.
- vii. Particle measurement techniques like screening measure average particle size such that volumetric shape factor is six times the area shape factor.
- viii. Kurtosis contains only even moments about the mean size
- ix. In deriving the general form of population balance for particles in some fixed subregion of particle phase space, we take the Eulerian viewpoint.
- x. Macro-moment form of population balance is given by a partial-differential equation.
- xi. Use of moment-transformed equations necessarily means a loss of certain amount of information.
- xii. Fines removal narrows the stable region.
- xiii. Classified product removal results in poorer transient response characteristics.
- xiv. Volume excess free energy is a positive quantity proportional to the cube of radius of a particle.
- xv. Crystal-crystal contact produces more nucleation than crystal-rod contact.
- xvi. For many systems, nucleation rate is proportional to suspension density.
- xvii. Experimental results on secondary nucleation are consistent with Power's concept of fluidized layer, near crystal surface, that can be removed by fluid shear.
- xviii. For screw-dislocation growth, the growth rate is proportional to supersaturation.
- xix. For the Mier and Volmer models, instability was predicted at the lower threshold of nucleation at low supersaturations.
- xx. Basic dynamic population balance and mass balance equations for analyzing CSD transients and for CSD instability are the same.