**Major Exam CH751: Multicomponent Mass Transfer May7, 2007**

**Maximum Marks 100 + EC40** **Maximum Time: 2 hr**

1. State the four major assumptions used in deriving Fick's second law for binary diffusion. Compare them with corresponding assumptions for multicomponent (MC) systems. Which assumption (of the eight assumptions) is never going to be honored and why? **(4 + 4 + 4 + 4)**
2. What is the source of coupling in MC diffusion problems? How are these equations decoupled? Explain by an example. **(4 + 4)**
3. How can one use the solution of binary problems to get solutions for MC diffusion problems. Explain by an example. **(4)**
4. What is the major problem in solving coupled equations with more than one square matrix. **(4)**
5. Why is one forced to allow lattice sites to contain more than one molecule in Lattice theory? **(4)**
6. Derive the lattice theory mass diffusivity by two different approaches. **(4+4)**
7. Derive the entropic and enthalpic components of the solid diffusivities by Lattice theory. Why should even MS type binary pair solid phase diffusivities be always concentration dependent in MC systems. What is a good choice for lattice size in gases? **(4 + 4 + 4)**
8. Name the two quantities, which define the mass transfer coefficient (MTC) **(4)**.
9. Name a situation where a MTC based approach is easier than the diffusivity based approach. Name another situation where it becomes absolutely necessary to use a MTC based approach? What is the major flaw in the MTC based approach, which has to be taken care of before it can be applied to these situations? **(4 + 4 + 4)**
10. What is the need to define a "zero-flux MTC"? How can one estimate it by experiments? **(4 + 4)**
11. What is the major problem in getting MTC matrix in MC systems? Suggest a method to estimate the MTC matrix in MC systems. **(4 + 4)**
12. Why is absolute flux preferred over diffusive fluxes in MTC approach? What is the major problem in computing absolute fluxes from diffusive fluxes? **(4 + 4)**
13. Why should one work with a modified concentration difference for estimating overall MTC in interphase mass transfer problems? **(4)**

EC1. Derive the binary pair MS diffusivity for a gaseous system for the following phenomenological equation:

Driving force = $(\text{flux})^2$ / diffusivity

Derive the MC diffusivity matrix also. **[EC 20 + EC 20]**

Best of luck