

## Minor I Examination: CLL 252. Mass Transfer I

Max. Marks: 20

Max. Time: 1 Hour

**Q. 1.** (1 mark each for questions 1a – 1j listed below)

- a. What single factor separates a mass transfer operation from other unit operations? **Change of composition**
- b. What is the essential mechanism which is always present in a mass-transfer operation? **Diffusion**
- c. Which are the two situations in which bulk movement does not contribute to molar flux of a component A in a binary mixture when seen from the perspective of generalized Fick's law?
- d. Can we use differences in diffusivities of components for their separation in practice in general? Give reason(s) for your answer.
- e. What is the fundamental driving force for diffusion?
- f. Can diffusion of a component occur against its concentration gradient? Under what circumstances?
- g. How does diffusion coefficient vary with temperature for a binary gas mixture?  $\sim T^{1.8}$
- h. How does diffusion coefficient vary with temperature for a binary liquid mixture?  $\sim T^1$
- i. What are indirect and direct mass-transfer operations? Which one is preferred, if there is a choice?
- j. Which exceptional mass-transfer operations involve separation wherein the phases are immediately in equilibrium?

**Q. 2.** (10 marks)

For gas (A) absorption into a liquid (B), a falling-film contactor is proposed to be used in a laboratory. To theoretically analyse this problem, (only) **formulate** the relevant equations and boundary conditions so that the problem is well posed. Provide all relevant diagrams, conventions used, and assumptions involved. You do not need to **solve** the problem to obtain the average concentration of gas A dissolved and diffused into the film of liquid B!