Introduction to Soft Materials
Major Exam April, 2008, Maximum Marks: 350 , Maximum Time: 2 hours

1. Which assumption are taken to derive the following equation?

$$\frac{\partial \phi}{\partial t} = D\frac{\partial^2 \phi}{\partial x^2}$$

Which assumption(s) is(are) almost always valid in the case of phase transfer in soft materials?
Why will this equation in its present form NEVER work for spontaneous phase transfer processes?
Will this equation in its present form work for nucleated phase transfer processes?
This equation is derived in two steps and both involve ϕ. In which step(s) should one replace ϕ by something else to make the equation work for phase transfer in soft materials.
10 + 20 + 10 + 10 + 10

2. Which term in the Cahn-Hilliard equation is least accessible and why? 10 + 20

3. Why should not the barrier provided by interfacial energy be ever considered for terming any phase transfer process to be spontaneous? 30

4. What are the twin benefits of seeding in nucleation? 20

5. What is the major assumption in mixing-demixing example?
What is the major pitfall with assumptions in the given example? 20 + 20

6. Explain the molecular models for ideal solutions, regular solutions and complete mixing. 10 + 10 + 20

7. How is the MEAN FIELD THEORY used in evaluation of entropy and enthalpy of mixing in mixing-demixing example. 20 + 20

8. What is the least understood component of enthalpy considerations in shapes of molecules. 20

9. Why is the Cahn-Hilliard equation mostly fourth-order?
When will it be sixth/seventh order? 10+20

10. What are critical and dominant wavelengths in Rayleigh-Taylor instability? 20 + 20

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Best of Luck