November 30, 2006   Major Exam   Sem. I, 2006-2007

CHL296 Nano Engineering of Soft Materials

Maximum Time: 2 hrs   Maximum Marks: 200 + EC 60

Answer all questions. Any confusion is deemed to be by design.

1. Why are the equations which describe the dynamics of nano-domains of soft materials stiff? What major problem does this stiffness present? How is it countered in practice? $(10 + 5 + 5)$

2. Present the lengthscales, timescales and sequence of morphological change during breakup of a nano/micro domain of soft material on a homogeneous flat solid surface? $(10 + 10 + 10)$

3. What effects does slippage at the solid-soft material interface have on the answer to Q2? (20)

4. What effects, in general, does chemical heterogencity on the substrate has [a small size] on the answer to Q2? What changes are brought to the answer by increasing size of the heterogeneity? $(10 + 20)$

5. What do you understand by the term "Sweeping of depressions/holes"? What role do "defect induced breakup" and "nonlinearity in the force field" play in this? $(10 + 10 + 10)$

6. What changes are likely to occur in the morphological evolution of Q2 if van der Waals forces are given by $\Delta G \propto 1/h$ instead of $1/h^2$? (20)

7. What is the major error in using successive central differencing technique to solve the dynamics of soft nano/micro domains in a conservative form? How is this error taken care off? $(20 + 10)$

8. Why is the area on the side of the rim away from the growing hole is more likely to break into holes? (20)

Extra Credit

EC1 Present three ways each of controlling vertical and horizontal movement of the soft material during reorganization of micro/nano domains. Feel free to use your imagination, It is of no consequence to your marks if these ways are not technically realizable at present? (EC60)

Best of Luck

Reminder: Marks earned depend on the correctness of the answer and not its length.