 LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

**M.Sc.** DEGREE EXAMINATION - **PHYSICS**

THIRD SEMESTER – **APRIL 2012**

# PH 3951/4957 – CRYSTAL PHYSICS

Date : 25-04-2012 Dept. No. Max. : 100 Marks

Time : 1:00 – 4:00

**PART – A**

**Answer ALL questions: (10x2=20)**

1. Briefly explain the processes of nucleation.
2. Using a dilatometer, how will you measure the induction period of a sample?
3. Schematically explain the procedure for “preparation of seed crystals”.
4. Draw the apparatus for controlling nucleation in gel technique.
5. State the conditions for achieving growth of crystal by hydrothermal method.
6. Distinguish between the physical vapour and chemical vapour transport mechanisms.
7. Give examples for linear and non-linear optical activities.
8. Mention the advantages of the Kurtz-Perry powder SHG method.
9. Draw the circuit for measuring the photo/dark current of a crystalline sample.
10. Highlight the application areas involving the different types of thermal analysis.

**PART – B**

**Answer any FOUR questions: (4x7.5 = 30)**

1. With the help of a diagram, explain the concepts of equilibrium stability and metastable state. Mention the favorable conditions for growing crystals.
2. Explain the structure of silica gel and the mechanism of gelation.
3. Explain the crystal pulling technique with Czochralski geometry.
4. Discuss the experimental procedure for measuring the dielectric constant and dielectric loss of a sample.
5. Explain the principle and applications of UV-Vis-NIR Spectroscopy.

**PART – C**

**Answer any FOUR questions: (4x12.5 =50)**

1. With block diagrams, discuss the instrumentation and working principle of the equipments for TGA and DSC.
2. With suitable diagrams discuss theoretically the phenomenon of nonlinear optics.
3. (a)Mention the advantages of high temperature crystal growth techniques. (3.5)

(b)Schematically explain the Bridgman-Stockbarger melt method and discuss   
the role of furnace design, rate of pulling and shape of crucible. (9)

1. (a) List the advantages of low temperature solution growth technique. (3.5)

(b)Highlight the various criteria for optimizing solution growth parameters to grow high quality crystals. (9)

1. On the basis of nucleation concepts, develop the expressions for induction period, interfacial tension, energy of formation and radius of nucleus.

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