Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (CT)/SEM-3/MS (CT)-301/2009-10

2009

SOLID STATE PHYSICS & CHEMISTRY

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

PART - I

Solid State Physics

(Full Marks : 35)

1. Answer in *Yes* or *No* for the following : 5 × 1 = 5

a) There are only four postulates in quantum mechanics.

b) Expectation value and max. probability are different.

c) Kinematic equivalence is not necessary in Quantum Mechanics.

d) Wronskian is used in band structure of solids.

e) Hilbert transform is not used in optical dispersion.

2. Answer any *three* questions : $3 \times 2\frac{1}{2} = 7\frac{1}{2}$

a) Write about different postulates in quantum mechanics.

b) Give a description of expectation value of electron in hydrogen atom.

c) Write three non-linear equations and their applications needed in Quantum Mechanics.

d) Describe the Singularity in case of Ferroelecricity in solid dielectrics.

e) How do you use Wronskian in the calculation of band structure ?

3. Answer any *three* questions : $3 \times 7\frac{1}{2} = 22\frac{1}{2}$

a) Choose two wave functions and show that they are orthogonal to each other.

b) Find expectation value with a probability curve as an example.

c) By showing the applicability of Born Criteria, describe the Quantum Mechanic Harmonic Oscillator by using Hermite Equations ?

d) Show the semi-classical technique for absorption of light in solids.

e) Write about the methodology for band structure of semiconductors.

PART - II
Solid State Chemistry
(Full Marks : 35)

1. Answer all the *five* questions : $5 \times 1 = 5$

   a) What is the mineral ilmenite ?

   b) What are the impurities present in fused alumina ?

   c) Write about the stable form of alumina.

   d) Write the names of different crystalline forms of silica.

   e) Write about a typical perovskite ?

2. Answer any *three* questions : $3 \times 2\ \frac{1}{2} = 7\ \frac{1}{2}$

   a) How density increase by adding zirconia to yttria is explained ?

   b) Describe polymorphic transformation of one ceramic solid.

   c) Organise : Zeolite, magnesia, titania, thoria, in terms of forming interstitial solid solution.

   d) With typical examples of Schottky and Frenkel defects in crystals, describe these defects.

   e) What are the derivative & superstructure of a solid.

3. Answer any *three* questions : $3 \times 7\frac{1}{2} = 22\frac{1}{2}$

a) Giving some examples, describe how to calculate lattice energy of a crystal.

b) Describe details about displacive & reconstructive transformations.

c) Describe the importance of Pauling's rule with examples for an ionic solid.

d) How is stiffness related in the energy against distance curve ?

e) What are the substitution rules ? Give example. Sketch Born Haber Cycle.