

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.*

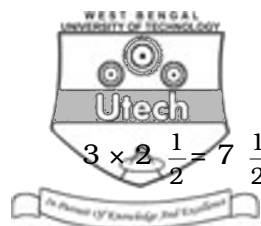
PART - I

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 :

- 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 Ferroelectricity 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)

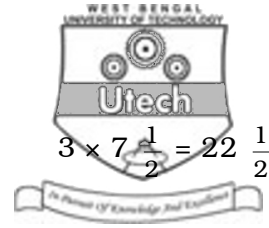
1. Answer all the *five* questions : $5 \times 1 = 5$

- 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.

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3. Answer any *three* questions :

- 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.
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