

## **Syllabus for Ph.D. –Course Work : PHYSICS**

### **Unit – I: Crystallization:**

Phase relation , Phase diagram – Vant Hoff Law and its application, Driving force for crystallization –free energy distribution, Growth kinetics, Growth on rough faces, Growth on singular faces, principle characteristics of Growth mechanisms.

### **Unit –II: Crystal Growth and Growth of thin films:**

**Crystal Growth techniques** – Conservative and non conservative, The Bridgmann and related methods, The Czochralski and related methods, Czochralski, Kyropoulos, Dendrite, Stepanov, Edge defined film-fed processes and methods, The verneil process, Floating zone process, Low temperature solution growth-Gel and flux mechanisms, Hydrothermal growth, chemical vapour transport and Direct vapour transport.

**Growth of thin films:** Growth Modes, Nucleation and Growth of Island: Island Number Density, Island Shape, Island Size Distribution, Vacancy Islands. Kinetic Effects in Homo-epitaxial Growth, Strain effects in Hetro-epitaxy, Surfactant Mediated Growth.

### **Unit-III: Solar Cells:**

Principle of solar cells, p-n junction solar cells, Classification of Solar cells, Dark and Illuminated characteristics, solar cell output parameters, efficiency, fill factor, series /shunt resistance, absorption co-efficient, efficiency limits, efficiency losses, efficiency measurement. Liquid junction solar cells (PEC), Comparison of p-n junction and PEC solar cells.

### **Reference Books:**

1. An introduction to Lattice Dynamics-A.K.Ghatak and L.S.Kothari, Addison-Wesley Publishing Co.
2. Surface Science –An Introduction By K Oura, V.G.Lifshits, A.A.Saranin, A.V.Zotav and M.Katayama (Springer)
3. Semiconductor materials and device characterization, By Schroder D. K. (John Willey)
4. Crystal Growth Processes-By J.C.Mullin.

5. Solar cells- By Chenming Hu and Richard M. White, MGH Company.
6. Photoelectro-chemical solar cells- By Gerdon and Breach Publication, New York.
7. Handbook of thin film technology-By Meisel and Glang (McGraw Hill)