**PH 542: Science and Technology of Thin Films (3-0-0: 3)**

**Thermodynamics of Evaporation**

Kinetic theory of gases, effusion, Hertz Knudsen equation; mass evaporation rate; Knudsen cell, directional distribution of evaporating species, evaporation of elements, compounds, alloys, Raoult's law. **[8L]**

**Physical Vapor Deposition**

Thermal, e-beam, pulsed laser and ion beam evaporation, glow discharge and plasma, sputtering - mechanisms and yield, dc and rf sputtering, bias sputtering, magnetically enhanced sputtering systems, reactive sputtering. **[8L]**

**Chemical Vapor Deposition**

Gas flow system, reaction chemistry and thermodynamics of CVD; thermal CVD, laser & plasma enhanced CVD. Chemical techniques - spray pyrolysis, electrodeposition, sol-gel and LB techniques.

 **[8L]**

**Nucleation & Growth**

Elastic scattering, sticking coefficient, mechanisim of thin film formation, 2D & 3D growth, rate of nucleation. Epitaxy - homo, hetero and coherent epilayers, lattice misfit and imperfections, epitaxy of compound semiconductors, scope of devices and applications. **[8L]**

**Substrate Preparation and Thickness Measurement**

Contamination and cleaning process, chemical etching, physical etching, and etching induced damage. Thickness measurement by Talystep, quartz crystal microbalance, and optical methods. **[4L]**

**Text Books and References**

1. K. S. S. Harsha, “Principles of Physical Vapor Deposition of Thin Films”, Elsevier.
2. D. L. Smith, “Thin- Film Deposition: Principles and Practices”, McGraw-Hill Education.
3. M. L. Hitchman and K. F. Jensen, “Chemical Vapor Deposition: Principles and Applications”, Academic Press.
4. D. Kashchiev, “Nucleation: Basic Theory with Applications”, Butterworth-Heinemann.
5. H. H. Gatzen, V. Saile and J. Leuthold, “Micro and Nano Fabrication: Tools and Processes”, Springer.