

SYLLABUS :-

Fundamentals of heat transfer, conduction shape factor, variation of thermal conductivity with temperature, multidimensional and unsteady heat conduction, heat transfer through fins - frost formation, convection heat transfer - concepts of boundary layer, convection heat transfer in tube flow and over flat plate, basics of radiation heat transfer- multilayer insulation, storage of cryogenic liquids. Heat transfer in two phase flow, flow regimes - Baker diagram, pressure drop in two phase flow - Lockhart Martinelli correlation, homogeneous flow model, boiling heat transfer - critical heat flux, forced convection boiling, condensation - inside and outside tubes, freezing at cryogenic temperature, slush flow, heat transfer at near critical region. Heat transport in liquid helium-II, phase diagram of helium, superfluid helium, thermal and transport properties of liquid helium-II, heat transport in liquid helium II -static liquid and forced convection heat transport, Kapitza conductance- phonon radiation model and acoustic mismatch model, film boiling in liquid helium-II. Introduction to cryogenic mass transfer processes, Vapor-liquid equilibrium in cryogenic distillation, Vapor-solid equilibrium in cryogenic adsorption separation, Molecular diffusion and Estimation of diffusivity coefficient in cryogenic mixtures, Convective mass transfer flux and estimation of mass transfer coefficients in cryogenic mass transfer processes, Mass transfer analysis for cryogenic distillation, Mass transfer analysis in cryogenic adsorption, Mass transfer analysis in cryosurgery and cryopreservation, Mass transfer analysis of boil-off during storage of cryogenic liquids, vacuum by getter, and evaporative cooling.