PROCESSING AND FOOD ENGINEERING

Course Contents

PFE501 TRANSPORT PHENOMENA INFOODPROCESSING 2+1

Objective

To acquaint and equip the students with the principles of heat and mass transfer and its applications in food processing.

Theory

UNIT I

Introduction to heat and mass transfer and their analogous behaviour, steady and unsteady state heat conduction, analytical and numerical solution of unsteady state heat conduction equations, use of Gurnie-Lurie and Heisler Charts in solving heat conduction problems. Applications in food processing including freezing and thawing offoods.

UNIT II

Convective heat transfer in food processing systems involving laminar and turbulent flow heat transfer in boiling liquids, heat transfer between fluids and solid foods. Functional design of heat exchangers: Shell and tube, plate and scraped surface heat exchangers, Jacketedvessels.

UNIT III

Radiation heat transfer and its governing laws, its applications in food processing.

UNIT IV

Molecular diffusion in gases, liquids and solids; molecular diffusion in biological solutions and suspensions molecular diffusion in solids, unsteady state mass transfer and mass transfer coefficients, molecular diffusion with convection and chemical reaction, diffusion of gases in porous solids and capillaries, mass transfer applications in food processing.

Practical

Solving problems on steady and unsteady state conduction with or without generation; numerical analysis; problems in natural and forced convection; radiation; designof heatexchangers;performingexperimentson heat conduction, convection and radiation heat transfer.

Suggested Readings

Benjamin G. 1971. *Heat Transfer*. 2nd Ed. Tata McGraw Hill.

Coulson JM & Richardson JF. 1999. *Chemical Engineering*. Vol. II, IV. The Pergamon Press.

Earle RL. 1985. *Unit Operations in Food Processing*. Pergamon Press. EcKert ERG &Draker McRobert1975. *Heat and Mass Transfer*. McGraw Hill.

Geankoplis J Christie 1999. *Transport Process and Unit Operations*. Allyn &Bacon.

Holman JP. 1992. *Heat Transfer*. McGraw Hill.

Kreith Frank 1976. *Principles of Heat Transfer*. 3rd Ed. Harper & Row. McCabe WL & Smith JC. 1999. *Unit Operations of Chemical Engineering*. McGraw Hill.

Treybal RE. 1981. *Mass Transfer Operations*. McGraw Hill.

Warren Gredt H. 1987.*Principles of Engineering Heat Transfer*. Affiliated East-West Press.