

Ph.D. Course offered by the Department of Post Harvest Engineering

PHE 701 Advances in Post Harvest Engineering and Food Engineering 4(3+1)

Size reduction: principles, types of technique, application and energy requirement laws. Mixing: objectives, equipment for solid, liquid mixing energy requirement, mixing index. Thermal processing: Death rate kinetics, thermal process calculation, methods of sterilization and equipments involved, latest trend in thermal processing. Evaporation: Properties of liquid, heat and mass balance in single effect and multiple effect evaporator, aroma recovery, equipments and applications. Drying: Rates, equipments for solid, liquid and semisolid material and their application, theories of drying, novel dehydration techniques, Freezing: Freezing curves, thermodynamics, freezing time calculations, equipment, freeze drying, principle, equipments. Separation: Mechanical filtration, membrane separation, centrifugation, principles, equipments and applications, latest development in separation and novel separations techniques. Extrusion: Theory, equipments, applications. Distillation and Leaching: Phase equilibria, multistage calculations, equipments, solvent extraction.

PHE 702 Biomass and Agricultural By-product Utilization 4(3+1)

Classification, characteristics and conversion methods of biomass and solid wastes. Biomass combustion: Principle and mechanism furnace and their design, chemical conversion of biomass and agricultural waste into pulp, paper, various other products and chemicals. Conversion of agricultural waste into energy chemicals. Utilization of milling by-products of cereals, pulses and oil bearing materials for food, feed and chemicals production.

PHE 751 Instrumentation and Process Control 3(2+1)

Different types of measuring instruments their working principles, construction and operating features for measurement of temperature, pressure, moisture, humidity, flow, viscosity, concentration and composition of materials. Generalized static and dynamic performances characteristics of instruments: calibration, accuracy, precision, bias. Zero, first and second order instruments and their response to different input signals (steps, ramp etc). Chemical process control: Characteristics, modeling of static and dynamic behavior, state variables and state equations. Linear and non-linear systems. Transfer functions and input and output models. Dynamic behavior of first and second order system. Introduction to feed back control Stability analysis and frequency response. Design of feed back control system using frequency response control system for multivariable processes and introduction to plant control.

PHE 752 Advanced Process Equipment Design 3(2+1)

Design of machine elements and their selections, designing of conveying, elevating, cleaning, separation. Conditioning /parboiling, milling, grinding, drying and mixing equipment. Material and energy balance, calculation for estimation of plant capacity and equipment sizes, material of construction for process equipment, design of storage and pressure vessels. Selection of fans and blower, design consideration for location of food processing units.

PHE 801 Advances In Drying and Dehydrations 3(2+1)

Water activity and its relations with shelf life of grains and other biomaterials, equilibrium moisture content and latent heat of evaporation, equipments for movement and heating of air, resistance to air flow in granular bed. Drying characteristics of cereals, pulse, oil seeds, spices and other biomaterials. Advances in drying theory and simulations of drying process. Heated air dryers- heat requirement and thermal efficiency of drying systems. Aeration: tempering and dry aeration. Operations of dryers and their control, dehydration of crops by microwave and dielectric and irradiation- recent dehydration techniques, operations. Packaging of dried grain products and other biomaterials.

PHE 802 Advanced Storage Engineering 3(2+1)

Analysis of grain storage eco-system, climatograph and under aerated and non-aerated system, quality analysis and sensing of stored produce, warning systems, bag storage, warehouses, classification, stack arrangement for various capacities and commodities, warehouse managements. BIS standard storage system for fruits and vegetables. Ventilated, refrigerated, frozen and controlled atmosphere storage, pre-cooling, chilling and freezing time calculations, nutrition loss design of cold storages and measures of energy conservation.

PHE 851 Advances in Packaging Technology of Food 3(3+0)

Functions of package: packaging materials, their structural qualities and performances including moisture and gas transmission, methods of package testing and performances evaluation design of packaging systems for food products, aseptic processing of food. Continuous flow pasteurization plants for homogeneous food. Heating and cooling of particulate food-physical principles. Pasteurization of particulate food stuffs with liquid phase. Destruction kinetics of microorganism on packaging materials. Evaluation criteria for aseptic filling and packaging systems. Packaging materials for aseptic packaging. Carton laminates and plastic laminates for aseptic packaging. Aseptic packaging system. Aseptic processing and packaging of foods in cans.

PHE 852 Computational Methods in Process Engineering 3(3+0)

Mathematical Models: Mathematical classification of equations (linear, elliptic, parabolic and hyperbolic). Finite difference equations for nodes using Taylor's series. Boundary Conditions for conduction, convection and radiation heat transfer surfaces. Selection of grid. Discretization: control volume method, differential equation methods, solving of differential equations by explicit scheme, implicit scheme and Crank-Nicholson scheme, stability, analysis. SIMPLE algorithm SIMPLEc algorithm. Application of computational methods to different modes of heat transfer and different flow condition.

PHE 999 Seminar-III 1(1+0)
PHE 790 Ph.D. Thesis Research