Department of Post Harvest Technology, Faculty of Horticulture

Courses for Ph. D. Programme

1st Semester			
1.	PHT-701	Advances in Post Harvest Physiology and Biochemistry of Horticultural Crops	(3+0)
2.	PHT-702	Post Harvest Loss Reduction Biotechnology of Perishables	(3+0)
3.	PHT-703	Value addition in Ornamental Crops	(1+1)
4.	PHT-749	Seminar - I	(1+0)
2nd Semester			
5.	PHT-751	Principles and Practices of Food Handling and Packaging	(2+1)
6.	PHT-752	Nutritive Value and Quality Evaluation of Fresh and Processed Fruits and Vegetables	(2+1)
7.	PHT-753	Advances in Food Processing and quality Management	(2+0)
3rd Semester			
8.	PHT-801	Food Chemistry	(2+1)
9.	PHT-802	Dehydration Technology	(1+1)
10.	PHT-849	Seminar – II	(1+0)
4th Semester			
11.	PHT-851	Fruit and Vegetable Fermentation Technology	(2+1)
6th Semester			
12	PHT-999	Seminar – III	(1+0)

Courses for Ph. D. Programme

FIRST SEMESTER

PHT-701: Advances in Post Harvest Physiology and Biochemistry of Horticultural Crops (3+0)

Theory : Introduction, Environmental factors influencing senescence, ripening and post harvest life of fruits, flowers and vegetables. Molecular mechanism of senescence and ageing. Physiological, biochemical and molecular aspects of senescence and fruit ripening. Senescence associated genes and gene products. Functional and ultra structural changes in chloroplast membranes, mitochondria and cell wall during ripening and senescence. Ethylene biosynthesis, perception and molecular mechanism of action; regulatory role of ethylene in senescence and ripening, biotechnological approaches to manipulate ethylene biosynthesis and action. Alternate post harvest methodology and quality attributes. Scope for genetic modification of horticultural crops for better post harvest life. Uses of GM crops and ecological risk assessment.

PHT-702: Post Harvest Loss Reduction Biotechnology of Perishables (3+0)

Introduction, An overview of post harvest food losses, assessment of post harvest losses, chemical, biochemical, microbial and mechanical causes of food deterioration, post harvest physiology and biochemistry of fruits, vegetables and flowers. Transpiration, water loss and deterioration in quality. Respiration, maturation, ripening, senescence and biochemical changes affecting quality and marketability. Ethylene effect – application and control. Temperature effect – heat, chilling and freezing injury. Harvesting, handling and storage. Marketing and management. Biology and control of post harvest disease and insects. Simple processing methods – drying and dehydration, salt or sugar preservation. Fermentation, heat preservation and freezing.

PHT-703: Value addition in Ornamental Crops (1+1)

Theory : Introduction, Importance, opportunities and prospects of value addition in floriculture; national and global scenario; production and exports, supply chain management. Dry flower making including pot pourries, their uses and trade; extraction technology, uses sources and trade in essential oils; aromatherapy; pigment and natural dyes extraction technology, sources, uses and trade Pharmaceutical and neutraceutical compounds from flower crops; petal embedded handmade paper making and uses, preparation of products like gulkand, rose water, gulroghan, attar, pankhuri; Floral craft including bouquets, garlands, flower arrangements etc. tinting (artificial colouring) of flower crops; Women empowerment through value added products making.

Practicals : Dry flower making including pot pourries; extraction technology, uses, sources and trade in essential oils. Pigment and natural dyes extraction technology; pharmaceutical and nutraceutical compounds from flower crops; preparation of products like gulkand, rose water, gulroghan, attar, pankhuri; petal embedded handmade paper making, floral craft including bouquets, garlands, flower arrangements etc.; tinting (artificial colouring) of flower crops.

PHT-749: Seminar - I (1+0)

SECOND SEMESTER

PHT-751: Principles and Practices of Food Handling and Packaging (2+1)

Theory : Introduction, Handling requirements and equipment for agricultural products involved at various stages of total food chain; packaging and transport of semi processed, processed and frozen food produce. Packaging materials, their structural qualities and performance including moisture and gas transmission; selection of packaging materials for various food products; methods and equipment for filling and packaging of liquid, semisolid and solid foods. Design and testing of packages; newer concepts in packaging – edible film, modified/controlled atmosphere, aseptic, barrier film and retortable plastic packaging; package labeling tools and techniques. Active and intelligent packaging, and their techniques. Packaging-flavour interactions. Factors affecting flavor absorption, role of the food matrix, role of different packaging materials. Packaging needs for marketing of fresh fruits and vegetables, heat processed refrigerated and frozen foods and fruit juice. Bulk packaging, specification and quality control. Package management.

Practical : Demonstration of different packaging system. Evaluation of different packing of fresh fruit and vegetables and their products. CA & MA storage, design considerations, handling equipments, package testing. Visit to packaging fabrication industries. Visit to market and super market for familiarization with existing packages and innovative trends.

PHT-752: Nutritive Value and Quality Evaluation of Fresh and Processed Fruits and Vegetables (2+1)

Theory : Introduction, Nutritional standard, nutritional requirements, naturally occurring antinutritional components and their significance. Effect of processing operation viz. washing, blanching, thermal processing, dehydration, sterilization, chemical preservation, fermentation, storage and additives on nutritive value. Problem of pesticide residue in fruits and vegetable products. Problem of food adulteration and remedies. Quality evaluation. Objective and importance, functions and method of quality assessment of fruits and vegetable products. Specification of finished products. Food laws and regulation. Principle and techniques of chemical analysis of fruits and vegetable products. Interpretation of laboratory analysis in relation to product quality. Chemical and physical nature of food assitives, organoleptic evaluation of food. Estimation of food additives. Colour evaluation with respect to hue, value and chrome. Texture, tenderness and consistency evaluation. Laboratory examination of canned products – drained weight vaccum measurement, head spaces, pressure, water activity, acidity, pH, vitamin and microbial quality.

Practical : Measurement of vacuum, head spaces, fill weight, drained weight, cut-out pressure and chemical additives. Estimation of chemical constituent like pH, acidity, TSS, total sugar, vitamins and SO_2. Evaluation of typical products according to food laws, visit to a processing factory/cannery.

PHT-753: Advances in Food Processing and quality Management (2+1)

Theory : Introduction, Introduction to quality, importance of quality, management principles, estimation of quality parameters, quality and business environment. Quality management standards, ISO/BIS, PFA, AGMARK and QMS standards, quality system components and their requirements., Food safety and standards, hazard analysis and critical control points (HACCP),

codex alimentarius, total quality management (TQM), statistical process control, quality auditing. Recent advances in processing technologies, aseptic processing, individual quick freezing and cryogenic freezing, high pressure technology, heat and ultrasound, high voltage pulse technology, irradiation, membrane technology, microwave heating, enzymes, natural antimicrobial agents, food additives, fermentation, minimal processing. Principles of food biotechnology, genetic modification of microorganisms in the food industry (lactic acid bacteria, yeasts and moulds), production of high valued food products by microorganisms viz. enzymes, organic acids, SPC, antibodies, nutritional additives, flavors, pigments.

Practicals : Testing and evaluation of quality attributes of raw and processed foods; detection and estimation of food additives and adulterants; quality assurance procedure, GMP, GAP documentation. Preparation of quality policy & documentation, application of HACCP to products, preparation of HACCP chart; preparation of documentation & records, visit to units with ISO systems; visit to Units with HACCP certification; visit to units implementing GMP, GAP; mini-project on preparation of a model laboratory manual.

THIRD SEMESTER

PHT-801: Food Chemistry (2+1)

Theory : Introduction, Basic knowledge on major food components and their chemical reactivity with reference to carbohydrates, lipids, amino acids, proteins. Enzymes, minerals, phenolics, flavonoids, colourants, flavours, chemical additives, food contamination and toxic substances. Interaction of constituents in food systems; changes during storage and processing; browning reactions in foods. Chemistry of fruits, vegetables, and spices; essential nutrients- sources, functions, deficiency diseases; requirements and recommended dietary allowances.

Practicals : Determination of peroxidase and catalase activity. Comparison of different methods for moisture determination in food samples. Test for presence of carbohydrates, and proteins. Identification of gums. Estimation of minerals by atomic absorption, spectrophotometer, estimation of minerals by flame photometer. Determination of fat and protein content, determination of NEB, determination of total carotenoids; determination of reducing and total sugars, determination of extent of rancidity in fats.

PHT-802: Dehydration Technology (1+1)

Theory : Introduction, Introduction, importance and scope of drying, equilibrium relative humidity, water activity and food stability, methods of drying and equipments. Commercial drying of fruits and vegetables. fruit juice concentration and powders. Foam mat, osmotic and reverse osmotic drying, freeze drying, machinery required. Affect of drying on product quality and storability, FPO and ISI specification for dry product.

Practical : Drying of some important fruits and vegetables. Drying rates and dehydration ratio. Determination of water activity. Evaluation of dried product. Visit to dehydration industry.

PHT-849: Seminar – II (1+0)

FOURTH SEMESTER

PHT 851: Fruit and Vegetable Fermentation Technology (2+1)

Theory: Introduction, Introduction, history, Importance and scope, role of fermentation in preservation, nutrient value of wines and distilled liquors. Yeast and its requirement, general method of fermentation, type and method of preparation of wine, beer, cider, brandy, vermouth and their importance in human health. Vinegar and lactic acid fermentation technology for waste treatment equipment and machinery used in a brewery or alcohol manufacturing plants. Quality attributes of alcoholic and other fermented products. Spoilage of fermented products, biochemical changes initiated by natural and inoculated microflora.

Practical: Isolation and culture of yeast and lactic acid microflora. Preparation of wines, brandy, cider, pickles and vinegar. Analysis for alcohol, acidity, pH, sugars and sensory attributes. Practices on fruits and vegetable fermentation.

SIXTH SEMESTER

PHT-999: Seminar – III (1+0)