

POSTHARVEST TECHNOLOGY PROGRAM (INTERNATIONAL)

The division of postharvest technology offers graduate work leading to Master and Doctor of Science in Postharvest Technology with majors in postharvest technology of perishable crops, postharvest technology of cereal grains and grain legumes. With a major, the main areas of specialization are postharvest physiology of fresh produce and cut flowers, postharvest entomology, postharvest pathology and postharvest engineering. The facilities available for graduate training include laboratory of postharvest physiology and biochemistry, laboratory of postharvest enzymes and molecular biology, packinghouse and cooling system unit, postharvest quality control, postharvest handling, postharvest engineering, packaging system for fresh produce, physical properties of agricultural products, postharvest training and research sectors and others.

Graduate work in this division is designed to develop a high order of independent thought, broad knowledge and technical skills. The emphasis in graduate work is placed on research, supplemented by courses and seminars.

Master of Science Program in Postharvest Technology

CURRICULUM

Total program credit **32 credits**
Curriculum Component

A. Core Courses	17 credits
B. Electives in Postharvest Technology Courses	6 credits
C. Free Elective Courses	9 credits
D. Thesis	12 credits

1. Core Courses **17 credits**

PHT 601	Research Techniques in Postharvest Technology	3(2-3-7)
PHT 611	Postharvest Losses of Agricultural Products	3(3-0-9)
PHT 622	Postharvest Physiology and Technology of Perishable Crops	3(2-3-7)
PHT 631	Postharvest Handling System of Cereals and Grain Legumes	3(3-0-9)
PHT 691	Seminar in Postharvest Technology I	1(0-2-7)
PHT 692	Seminar in Postharvest Technology II	1(0-2-7)
PHT 698	Special Problem	3(0-3-9)

2. Electives in Postharvest Technology Courses **6 credits**

PHT 602	Statistics for Agricultural Research	3(2-3-7)
PHT 621	Postharvest Handling System of Perishable Crops	3(2-3-7)
PHT 623	Postharvest Handling System of Ornamental Plants	3(2-3-7)
PHT 632	Postharvest Technology of Seeds	3(2-3-7)
PHT 651	Engineering Application for Postharvest Technology	3(3-0-9)
PHT 652	System Designs of Postharvest Equipments and Storage Structures	3(3-0-9)
PHT 653	Produce Packaging System	3(2-3-7)
PHT 661	Postharvest Insect Pest of Agricultural Products	3(2-3-7)
PHT 662	Postharvest Pathology of Agricultural Products	3(2-3-7)
PHT 697	Selected Topics in Postharvest Technology	3(3-0-9)

3. Free Electives Courses **9 credits**

ET 683	Engineering Experimental Design and Analysis	3(3-0-6)
ET 647	Refrigeration and Air Conditioning	3(3-0-9)
ET 626	Drying of Foods and Cereal Grains	3(3-0-9)
FdE 501	Food Science Concepts I	3(3-0-9)
FdE 504	Technology of Food Preservation Technology	3(3-0-9)
FdE 541	Drying of Foods	3(3-0-9)
FdE 543	Packaging Technology	3(3-0-9)
FdE 622	Physical and Engineering Properties of Foods and Biomaterials	3(2-3-4)
MTH 672	Statistical Analysis I	3(3-0-9)
MTH 661	Biotechnology	3(3-0-9)

4. Thesis **12 credits**

PHT 699	Thesis	12(0-24-48)
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STUDY PLAN

◆ **First Year
First Semester**

PHT	601	Research Techniques in Postharvest Technology	3(2-3-7)
PHT	611	Postharvest Losses of Agricultural Products	3(3-0-9)
PHT	xxx	Elective in Postharvest Technology	3(x-x-x)
XXX	xxx	Free Elective	3(x-x-x)
Total			<u>12 (5+x-3+x-16+x)</u>

Second Semester

PHT	622	Postharvest Physiology and Technology of Perishable Crops	3(2-3-7)
PHT	631	Postharvest Handling System of Cereals and Grain Legumes	3(3-0-9)
PHT	691	Seminar in Postharvest Technology I	1(0-2-7)
PHT	699	Thesis	2(0-4-8)
PHT	xxx	Elective in Postharvest Technology	3(x-x-x)
Total			<u>12 (5+x-9+x-31+x)</u>

◆ **Second Year
First Semester**

PHT	xxx	Elective in Postharvest Technology	3(x-x-x)
PHT	698	Special Problem	3(0-3-9)
PHT	699	Thesis	3(0-6-12)
XXX	xxx	Free Elective	3(x-x-x)
Total			<u>12 (x-9+x-21+x)</u>

Second Semester

PHT	692	Seminar in Postharvest Technology II	1(0-2-7)
PHT	699	Thesis	7(14-28)
Total			<u>8 (0-16-35)</u>

COURSE DESCRIPTIONS

PHT	601	Research Techniques in Postharvest Technology Prerequisite : Consent of the instructor Laboratory and field approach to postharvest technological research. Theoretical and practical aspects of techniques use in qualitative and quantitative analysis of biological materials. Discussion and demonstration of modern instrumental methods currently available for measurement of mechanical properties, physical characteristics and physico-chemical constituents of agricultural products. Planning and initiating research, review literature, discussion on selecting project and experimental procedures, recording data, analysis of data, interpreting data and reporting orally and/or in scientific written style.	3(2-3-7)
PHT	602	Statistics for Agricultural Research Prerequisite: Statistics or consent of the instructor Design of experiments and variance analysis necessary in agricultural research. Experimental techniques in the field and laboratory. Conducting research and management. Recording data and analysis of data by using of general statistical computer programs. Interpretation of experimental data and reporting results.	3(2-3-7)
PHT	611	Postharvest Losses of Agricultural Products Prerequisite : Consent of the instructor Causes, principles and practices responsible for losses of agricultural products. Qualitative, quantitative, nutritional and socioeconomic losses. Factors responsible for causing agricultural products losses. Loss assessment and estimation techniques and their limitations. Methods appropriate for reducing losses in technologically advanced.	3(3-0-9)
PHT	621	Postharvest Handling System of Perishable Crops Prerequisite : Plant Physiology or Biochemistry or consent of the instructor Biological, morphological and anatomical principles involving physical movement of fresh produce from farm to consumer. Quality components. Current technological procedures used in harvesting and field operations, packaging system, packinghouse operations. Standardization and quality control, storage and preservation techniques, transportation and its environment. Distribution system of fresh produce. Tropical commodities emphasized.	3(2-3-7)
PHT	622	Postharvest Physiology and Technology of Perishable Crops Prerequisite : Plant Physiology or Biochemistry or consent of the instructor Biochemical, biophysical and physiological changes of harvested perishable crops and consideration of methods and techniques to prolong life and maintain quality of perishable commodities. Emphasis on the effects of storage facilities and techniques, quality evaluation as related to physiological mechanism controlling the maturation, ripening and senescence of perishable commodities.	3(2-3-7)
PHT	623	Postharvest Handling System of Ornamental Plants Prerequisite: Plant Physiology or Biochemistry or consent of the instructor Growing condition, harvesting and utilization of ornamental plants. Structural, physiological and metabolic changes associated with senescence of ornamental plants. Quality evaluation and grading. Preservation techniques and factors involving extent of postharvest life. Packaging system, packinghouse operation, storage, transportation and marketing. Retail florist care and operation. Care of ornamental plants in home.	3(2-3-7)

PHT	631	Postharvest Handling System of Cereals and Grain Legumes 3(3-0-9) Prerequisite : Basic Thermodynamics or consent of the instructor Interrelationship of temperature, moisture, molds and insects in cereals and grain legumes in storage. Biochemical and nutritive changes during storage. A complete systems and methods for handling, drying and storage operation. Facilities layout and facility management. Storage conditions and method, storage pests and their control. Structural environment design. Containers and transportation.
PHT	632	Postharvest Technology of Seeds 3(2-3-7) Prerequisite : Plant Physiology or consent of the instructor Morphological and physiological changes during seed formation, development, maturation and germination. Practical and biological aspects of seed drying, storage, deterioration, dormancy and quality. Included storage, cleanness, packing and distribution. Seed certification under international rules.
PHT	651	Engineering Application for Postharvest Technology 3(3-0-9) Prerequisite : Basic Thermodynamics or consent of the instructor Review of basic thermodynamics, fluid mechanics, heat transfer and mechanics of materials. A study of unit operations pertaining to processing of agricultural material, mechanical handling, conditioning and storage of postharvest products. Cleanness, sorting, grading, sizing, heating, cooling, drying and storage. Concepts on the design of processes and equipments.
PHT	652	System Designs of Postharvest Equipments and Storage Structures 3(3-0-9) Prerequisite : Consent of the instructor Application of fundamental principles used in engineering design and development of postharvest handling systems. Consideration of the interrelationship between the characteristics of the agricultural products and the facilities, equipment and environment. Human factors in design, flow processes diagram, design synthesis and concept development of equipment, specific examples of machine design for postharvest processing and computer aided design. Design, construction and management of packinghouse and storage structures. Handling system and environmental control of store structures.
PHT	653	Produce Packaging System 3(2-3-7) Prerequisite : Consent of the instructor Types of packaging materials and producing packages. Physical and chemical properties of packaging materials. Packing and packaging system. Preparing produce for packaging. Mathematical models to produce packs. Computerized pallet and container dimension. Wholesale and retail produce packaging. Shipping containers and transport system. Graphic and package design. Governmental regulations, public health aspects associated with produce packaging. Recycling.
PHT	661	Postharvest Insect Pest of Agricultural Products 3(2-3-7) Prerequisite : Introduction to Entomology or consent of the instructor Biology, ecology, types of damage and behavior of stored insect pests. Major insect pests, current practices in their control of economic agricultural products. Postharvest insect pests management of stored products.
PHT	662	Postharvest Pathology of Agricultural Products 3(2-3-7) Prerequisite : Introduction to Plant Pathology or consent of the instructor Typical symptom characteristics and signs associated with various postharvest diseases. Different groups of microorganism that causes diseases. Diseases cycles, source of infection, type of infection and infection processes. Major postharvest diseases and their controls. Some important seed pathology.

PHT	691	Seminar in Postharvest Technology I Prerequisite : Approval of department Preparation, presentation and discussion of the selected topics of interesting literature, techniques and research pertaining to postharvest technology. Attendance requires of all graduate students in postharvest technology program.	1(0-2-7)
PHT	692	Seminar in Postharvest Technology II Prerequisite : Approval of department Preparation, presentation and discussion by graduate students on current interests in postharvest technology emphasized the topics in relation to thesis research. Required of all graduate students in postharvest technology program.	1(0-2-7)
PHT	697	Selected Topics in Postharvest Technology Prerequisite : Approval of department Discussion and lectures on special aspects or advanced topics of current interest in postharvest technology and not included in other courses. Check departmental announcement for topics offered any given semester or contact instructor for information.	3(3-0-9)
PHT	698	Special Problem Prerequisite : Consent of the instructor Investigation of selected problems of special interests in postharvest technology to individual graduate student. The research supervised by member of department. The work includes library work, field or laboratory research, recording data, analyzing data and writing of research paper.	3(0-3-9)
PHT	699	Thesis Prerequisite : Consent of the advisor or Graduate committee Ms. degree candidate have to present the thesis proposal and approval by the department. Intensive experimental research on postharvest problems which may extend throughout the year and furnish data under the supervision of the advisor.	12 Credits
ET	683	Engineering Experimental Design and Analysis Prerequisite : - Randomized block t-test, factorial and factorial design confounding, response surface methodology. Mathematical model building and nonlinear estimation; determination of optimum condition.	3(3-0-6)
ET	647	Refrigeration and Air Conditioning Prerequisite : Thermodynamics Reviews of processes, cycles and designs of refrigeration and air conditioning systems. Absorption refrigeration with emphasis on solar energy application. Theory and methods of food freezing and preservation. Advanced studies of air conditioning systems with environmental and economic consideration.	3(3-0-9)
ET	626	Drying of Foods and Cereal Grains Prerequisite : Basic Thermodynamics and Heat Transfer Moist air properties. Air movement. Equilibrium moisture contents, thermo-physical properties of food and grains. Grain drying systems. Rigorous and simplified analysis of grain drying : single-kernel, thin layer, and deep-bed grain drying. Analysis of food drying : fixed-bed and moving-bed drying, spray drying, drum drying.	3(3-0-9)
FdE	501	Food Science Concepts I Prerequisite : none Chemical composition of foods and their nutritive values, the effect of food handling and processing on nutritional qualities. The effect of water activity on food preservation. Chemical analysis of food compositions, postharvest technology of raw materials and it effect on processed food qualities. The role of food additives in processing and storage of food products. Important raw materials and their products. Students are required to do additional work from the current journals, finally, report and seminar have to be done.	3(3-0-9)

FdE	504	Technology of Food Preservation Prerequisite : FdE 501 and FdE 504 Principles of food preservation. Preservation by heat, chilling, freezing, irradiation and fermentation etc. Development of current food processing technology. Food packaging and packaging materials. Relevant practical examples from Thai food industry are highlights. The depth of the materials is at the level of first year graduate student in science. Students are expected to do substantial amount of library research.	3(2-3-7)
FdE	541	Drying of Foods Prerequisite : FdE 511 and FdE 512 Moist air properties. Air movement. Equilibrium moisture contents, thermo-physical properties of food. Analysis of food drying : fixed - bed and moving - bed drying, spray drying, drum drying. Solar drying : natural and forced convection, type of solar dryers. Mathematical modeling of drying process and drying mechanics.	3(3-0-9)
FdE	543	Packaging Technology Prerequisite : FdE 504 and FdE 662 Packaging technology system, selection and protective test of packages in relation to handling and transportation and its impact, Affect of packages to the product quality. Types and quality of material for suitable packages. Development of the graphic and structural design of packages.	3(3-0-9)
FdE	622	Physical and Engineering Properties of Foods and Biomaterials Prerequisite : none Principles involved in physical properties and measurement of food texture, mechanical, thermal, electrical and optical properties, and application to harvesting, handling, processing, storage and quality evaluation, An integrated program of laboratory designed to illustrate the principles presented in the lecture course.	3(2-3-4)
MTH	672	Statistical Analysis I Prerequisite : MTH 371 Statistics II or consent of the instructor Tests of hypotheses : tests concerning means and difference between two means, tests concerning proportion means and difference between two proportions, tests concerning variances, goodness of fit test, test of independence, tests for homogeneity, testing for several proportions. Nonparametric Statistics : nonparametric tests, sign test, sign-rank test, rank sum test, Kruskal - Wallis test, runs test, tolerance limits, rank correlation coefficient. Analysis of variance : Analysis of variance technique one - way classification, tests for the equality of several variances, comparing treatments with a control, comparing a set treatment in blocks, randomized complete block designs, Latin square, random effects models, power of analysis of variance tests, factorial experiments.	3(3-0-9)

Doctor of Philosophy Program in Postharvest Technology

CURRICULUM

Type 1

Total program credit for Master background		48 credits
Curriculum Component		
A. Fundamental Courses		non credits
B. Dissertation		48 credits
1. Fundamental Courses		non credit
PHT 791 Seminar in Postharvest Technology 1 in Ph.D. Programme		1(0-2-3)
PHT 792 Seminar in Postharvest Technology 2 in Ph.D. Programme		1(0-2-3)
PHT 793 Seminar in Postharvest Technology 3 in Ph.D. Programme		1(0-2-3)
2. Dissertation		48 credits
PHT 799 Dissertation		48 credits

STUDY PLAN

◆	First Year			
	First Semester			
	PHT 791 Seminar in Postharvest Technology 1 in Ph.D. Programme		1(0-2-3)	
	PHT 799 Dissertation		8 credits	
	Total		<u>9 (0-2-3)</u>	
	Second Semester			
	PHT 792 Seminar in Postharvest Technology 2 in Ph.D. Programme		1(0-2-3)	
	PHT 799 Dissertation		8 credits	
	Total		<u>9 (0-2-3)</u>	
◆	Second Year			
	First Semester			
	PHT 793 Seminar in Postharvest Technology 3 in Ph.D. Programme		1(0-2-3)	
	PHT 799 Dissertation		8 credits	
	Total		<u>9 (0-2-3)</u>	
	Second Semester			
	PHT 799 Dissertation		8 credits	
	Total		<u>8 credits</u>	
◆	Third Year			
	First Semester			
	PHT 799 Dissertation		8 credits	
	Total		<u>8 credits</u>	
	Second Semester			
	PHT 799 Dissertation		8 credits	
	Total		<u>8 credits</u>	

Type 2

Total program credit for **Bachelor background** **74 credits**
Curriculum Component

A.	Core Courses	23 credits
B.	Electives Courses	3 credits
C.	Dissertation	48 credits

1. Core Courses **23 credits**

PHT	601	Research Techniques in Postharvest Technology	3(2-3-9)
PHT	611	Postharvest Losses of Agricultural Products	3(3-0-9)
PHT	622	Postharvest Physiology and Technology of Perishable Crops	3(2-3-9)
PHT	691	Seminar in Postharvest Technology 1	1(0-2-3)
PHT	692	Seminar in Postharvest Technology 2	1(0-2-3)
PHT	701	Research Philosophy	3(3-0-9)
PHT	702	Advanced Postharvest Technology	3(3-0-9)
PHT	703	Molecular Biology for Postharvest Technology	3(3-0-9)
PHT	791	Seminar in Postharvest Technology 1 in Ph.D. Programme	1(0-2-3)
PHT	792	Seminar in Postharvest Technology 2 in Ph.D. Programme	1(0-2-3)
PHT	793	Seminar in Postharvest Technology 3 in Ph.D. Programme	1(0-2-3)

2. Electives Courses **3 credits**

PHT	602	Statistics for Agricultural Research	3(2-3-9)
PHT	621	Postharvest Handling System of Perishable Crops	3(2-3-9)
PHT	623	Postharvest Handling System of Ornamental Plants	3(2-3-9)
PHT	631	Postharvest Handling System of Cereals and Grain Legumes	3(3-0-9)
PHT	632	Postharvest Technology of Seeds	3(2-3-9)
PHT	651	Engineering Application for Postharvest Technology	3(3-0-9)
PHT	652	System Designs of Postharvest Equipment and Storage Structure	3(3-0-9)
PHT	653	Produce Packaging System	3(2-3-9)
PHT	662	Postharvest Pathology of Agricultural Products	3(2-3-9)
PHT	697	Selected Topics in Postharvest Technology	3(3-0-9)
BCT	601	Enzyme Technology	3(3-0-9)
BCT	602	Protein Engineering	3(3-0-9)
BCT	611	Carbohydrate Technology	3(3-0-9)
BCT	621	Lipid Technology	3(3-0-9)
BCT	641	Functional Properties of Biochemicals	3(3-0-9)
BCT	662	Separation Technology	3(3-0-9)
BIT	631	Introduction to Gene Technology	3(3-0-9)
ET	625	Refrigeration and Air Conditioning	3(3-0-9)
ET	626	Drying of Foods and Cereal Grains	3(3-0-9)
FdE	541	Drying of Foods	3(3-0-9)
FdE	543	Packaging Technology	3(3-0-9)
FdE	622	Physical and Engineering Properties of Foods and Biomaterials	3(3-0-9)

At least three credits of free electives can be chosen from any course offered by adviser or head department of postharvest technology.

3. Dissertation **48 credits**

PHT	799	Dissertation	48 credits
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STUDY PLAN

◆ First Year First Semester

PHT	xxx	Core Course	3(x-x-x)
PHT	xxx	Core Course	3(x-x-x)
PHT	xxx	Core Course	3(x-x-x)
PHT	691	Seminar in Postharvest Technology I	1(0-2-7)
Total			<u>10 (x-2+x-7+x)</u>

Second Semester

PHT	xxx	Core Course	3(x-x-x)
PHT	xxx	Core Course	3(x-x-x)
PHT	692	Seminar in Postharvest Technology 2	1(0-2-3)
PHT	xxx	Elective	3(x-x-x)
Total			<u>10 (x-2+x-3+x)</u>

◆ Second Year First Semester

PHT	xxx	Core Course	3(x-x-x)
PHT	791	Seminar in Postharvest Technology 1 in Ph.D. Programme	1(0-2-3)
PHT	699	Dissertation	4(0-8-16)
Total			<u>8 (x-10+x-19+x)</u>

Second Semester

PHT	792	Seminar in Postharvest Technology 2 in Ph.D. Programme	1(0-2-3)
PHT	699	Dissertation	9(0-18-36)
Total			<u>10 (0-20-39)</u>

◆ Third Year First Semester

PHT	793	Seminar in Postharvest Technology 3 in Ph.D. Programme	1(0-2-3)
PHT	699	Dissertation	9(0-18-36)
Total			<u>10 (0-20-39)</u>

Second Semester

PHT	699	Dissertation	8(0-16-32)
Total			<u>8 (0-16-32)</u>

◆ Fourth Year First Semester

PHT	699	Dissertation	9(0-18-36)
Total			<u>9 (0-18-36)</u>

Second Semester

PHT	699	Dissertation	9(0-18-36)
Total			<u>9 (0-18-36)</u>

Total program credit for **Master background** **48 credits**
 Curriculum Component

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|----|-------------------|------------|
| A. | Core Courses | 9 credits |
| B. | Electives Courses | 3 credits |
| C. | Dissertation | 36 credits |

1. Core Courses **9 credits**

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| PHT | 701 | Research Philosophy | 3(2-3-9) |
| PHT | 702 | Advanced Postharvest Technology | 3(3-0-9) |
| PHT | 791 | Seminar in Postharvest Technology 1 in Ph.D. Programme | 1(0-2-3) |
| PHT | 792 | Seminar in Postharvest Technology 2 in Ph.D. Programme | 1(0-2-3) |
| PHT | 793 | Seminar in Postharvest Technology 3 in Ph.D. Programme | 1(0-2-3) |

2. Electives Courses **3 credits**

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|-----|-----|---|----------|
| PHT | 602 | Statistics for Agricultural Research | 3(2-3-9) |
| PHT | 621 | Postharvest Handling System of Perishable Crops | 3(2-3-9) |
| PHT | 623 | Postharvest Handling System of Ornamental Plants | 3(2-3-9) |
| PHT | 632 | Postharvest Technology of Seeds | 3(2-3-9) |
| PHT | 651 | Engineering Application for Postharvest Technology | 3(3-0-9) |
| PHT | 652 | System Designs of Postharvest Equipment and Storage Structure | 3(3-0-9) |
| PHT | 653 | Produce Packaging System | 3(2-3-9) |
| PHT | 662 | Postharvest Pathology of Agricultural Products | 3(2-3-9) |
| PHT | 697 | Selected Topics in Postharvest Technology | 3(3-0-9) |
| PHT | 703 | Molecular Biology for Postharvest Technology | 3(3-0-9) |
| BCT | 601 | Enzyme Technology | 3(3-0-9) |
| BCT | 602 | Protein Engineering | 3(3-0-9) |
| BCT | 611 | Carbohydrate Technology | 3(3-0-9) |
| BCT | 621 | Lipid Technology | 3(3-0-9) |
| BCT | 641 | Functional Properties of Biochemicals | 3(3-0-9) |
| BCT | 662 | Separation Technology | 3(3-0-9) |
| BIT | 631 | Introduction to Gene Technology | 3(3-0-9) |
| ET | 625 | Refrigeration and Air Conditioning | 3(3-0-9) |
| ET | 626 | Drying of Foods and Cereal Grains | 3(3-0-9) |
| FdE | 541 | Drying of Foods | 3(3-0-9) |
| FdE | 543 | Packaging Technology | 3(3-0-9) |
| FdE | 622 | Physical and Engineering Properties of Foods and Biomaterials | 3(3-0-9) |

At least three credits of free electives can be chosen from any course offered by adviser or head department of postharvest technology.

3. Dissertation **36 credits**

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| PHT | 799 | Dissertation | 36 credits |
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STUDY PLAN

◆ First Year First Semester

PHT	xxx	Core Course	3(x-x-x)
PHT	xxx	Core Course	3(x-x-x)
PHT	xxx	Elective	3(x-x-x)
PHT	791	Seminar in Postharvest Technology 1 in Ph.D. Programme	<u>1(0-2-3)</u>
		Total	<u>10 (x-2+x-3+x)</u>

Second Semester

PHT	792	Seminar in Postharvest Technology 2 in Ph.D. Programme	1(0-2-3)
PHT	799	Dissertation	<u>7(0-14-28)</u>
		Total	<u>8 (0-16-31)</u>

◆ Second Year First Semester

PHT	793	Seminar in Postharvest Technology 3 in Ph.D. Programme	1(0-2-3)
PHT	799	Dissertation	<u>7(0-14-28)</u>
		Total	<u>8 (0-2-3)</u>

Second Semester

PHT	799	Dissertation	<u>7(0-14-28)</u>
		Total	<u>7 (0-14-28)</u>

◆ Third Year First Semester

PHT	799	Dissertation	<u>7(0-14-28)</u>
		Total	<u>7 (0-14-28)</u>

Second Semester

PHT	799	Dissertation	8(0-16-32)
		Total	<u>8 (0-16-32)</u>

COURSE DESCRIPTIONS

PHT	601	Research Techniques in Postharvest Technology Prerequisite : Consent of the instructor Laboratory and field approach to postharvest technological research. Theoretical and practical aspects of techniques use in qualitative and quantitative analysis of biological materials. Discussion and demonstration of modern instrumental methods currently available for measurement of mechanical properties, physical characteristics and physico-chemical constituents of agricultural products. Planning and initiating research, review literature, discussion on selecting project and experimental procedures, recording data, analysis of data, interpreting data and reporting orally and/or in scientific written style.	3(2-3-9)
PHT	602	Statistics in Agricultural Research Prerequisite : Statistics or Consent of the instructor Design of experiments and variance analysis necessary in agricultural research. Experimental techniques in the field and laboratory. Conducting research and management. Recording data and analysis of data by using general statistical computer programs. Interpretation of experimental data and reporting results.	3(2-3-9)
PHT	611	Postharvest Losses of Agricultural Products Prerequisite : Consent of the instructor Cause, principles and practices responsible for losses of agricultural products. Qualitative, quantitative, nutritional and socioeconomic losses. Factors responsible for causing agricultural products losses. Loss assessment and estimation techniques and their limitations. Methods appropriate for reducing losses in technologically advanced.	3(3-0-9)
PHT	621	Postharvest Handling System of Perishable Crops Prerequisite : Plant Physiology and Biochemistry or consent of the instructor storage and preservation techniques, transportation and it environment. Distribution system of fresh produce. Tropical commodities emphasized.	3(2-3-9)
PHT	622	Postharvest Physiology and Technology of Perishable Crops Prerequisite : Plant Physiology and Biochemistry or consent of the instructor Biochemical, biophysical and physiological changes of harvested perishable crops and consideration of methods and techniques to prolong life and maintain quality of perishable commodities. Emphasis on the effects of storage facilities and techniques, quality evaluation as related to physiological mechanism controlling the maturation, ripening and senescence of perishable commodities.	3(2-3-9)
PHT	623	Postharvest Handling System of Ornamental Plants Prerequisite : Plant Physiology and Biochemistry or consent of the instructor Growing condition, harvesting and utilization of ornamental plants. Structural, Physiological and metabolic changes associated with senescence of ornamental plants. Quality evaluation and grading. Preservation techniques and factors involving extent of postharvest life. Packaging system, packinghouse operation, storage, transportation and marketing. Retail florist care and operation. Care of ornamental plants in home.	3(2-3-9)
PHT	631	Postharvest Handling System of Cereals and Grain Legumes Prerequisite : Basis Thermodynamics or consent of the instructor Interrelationship of temperature, moisture, molds and insects in cereal and grain legumes in storage. Biochemical and nutritive changes during storage. A complete system and methods for handling, drying and storage operation. Facilities layout	3(3-0-9)

and facility management. Storage conditions and method, Storage pests and their control. Structural environment design. Containers and transportation.

PHT	632	Postharvest Technology of Seeds Prerequisite : Plant Physiology or consent of the instructor Morphological and physiological changes during seed formation, development , maturation and germination. Practical and biological aspects of seed drying, storage, deterioration, dormancy and quality. Include storing, cleaning, packing and distribution. Seed certification under international rules.	3(2-3-9)
PHT	651	Engineering Application for Postharvest Technology Prerequisite : Basic Thermodynamics or consent of the instructor Review of basic thermodynamics, fluid mechanics, heat transfer and mechanics of materials. A study of unit operations pertaining to processing of agricultural material, Mechanical handling, conditioning and storage of postharvest produces. Cleaning, sorting, grading, sizing, heating, cooling, drying and storage. Concepts on the design of processes and equipments.	3(3-0-9)
PHT	652	System Designs of Postharvest Equipments and Storage Structures Prerequisite : Consent of the instructor Application of fundamental principles used in engineering design and development of interrelationships between the characteristics of the agricultural products and the facilities, equipment and environment. Human factors in design, flow processes diagram, design synthesis and concept development of equipment, specific examples of machine design for postharvest processing and computer aided design. Design, construction and management of packinghouse and storage structures. Handling system and environmental control of store structures.	3(3-0-9)
PHT	653	Postharvest Packaging System Prerequisite : Consent of the instructor Types of packaging materials and produce packages. Physical and chemical properties of packaging materials. Packing and packaging system. Preparing produce for packaging. Mathematical models to produce packs. Computerized pallet and container dimensioning. Wholesale and retail produce packaging. Shipping containers and transport system. Graphic and package design. Governmental regulations, public health aspects associated with produce packaging.	3(2-3-9)
PHT	662	Postharvest Pathology of Agricultural Products Prerequisite : Introduction to Plant pathology or consent of the instructor Typical symptom characteristic and signs associated with various postharvest diseases. Different groups of microorganism that cause diseases. Disease cycles, source of infection, type of infection and infection processes. Major postharvest diseases and their controls. Some important seed pathology.	3 (2-3-7)
PHT	691	Seminar in Postharvest Technology I Prerequisite : Consent of the instructor Preparation, presentation and discussion of the selected topics of interest literature, techniques and research pertaining to postharvest technology. Attendance require of all departmental graduate students in postharvest technology programme.	1 (0-2-3)
PHT	692	Seminar in Postharvest Technology II Prerequisite : Consent of the instructor Preparation, presentation and discussion by graduate students on current interests in postharvest technology emphasized the topics in relation to thesis research. Attendance require of all graduate students in postharvest technology programme.	1 (0-2-3)
PHT	697	Selected Topics in Postharvest Technology Prerequisite : Consent of the instructor Discussion and lectures on special aspects or advanced topics of current interest in postharvest technology and not include in other courses. Check departmental	3 (3-0-9)

announcement for topics offered any given semester or contact instructor for information.

PHT	701	<p>Research Philosophy Prerequisite : Consent of the instructor An introduction of research philosophy and the scientific method. Preparation of research proposal. Use of library resources. Application of information technology and computer for data processing and retrievals. Data analysis. Technical report writing. Technical presentation skills and group discussion, paper preparation for international journal publication, writing style and professional ethics in Postharvest technology</p>	3 (3-0-9)
PHT	702	<p>Advance in Postharvest Technology Prerequisite : Consent of the instructor The combination of plant physiological and biochemical changes in various pathways during plant senescence such as plant cell degrading enzymes, volatile, pigments, ethylene production, hormones, physiological disorder, changing of enzyme activities of produce after harvesting.</p>	3 (3-0-9)
PHT	703	<p>Molecular Biology for Postharvest Technology Prerequisite : Consent of the instructor The application of molecular biological techniques for the researching of postharvest physiology and biochemistry in genetically and enzymatically level. Such as gene expression and its protein function, gene regulation during harvesting, invasion by pathogens and environmental stresses and including the development of the plant genetic by genetic engineering technology for a long term storage, the development of plant quality and the increase of plant resistance</p>	3 (3-0-9)
PHT	791	<p>Seminar in Postharvest Technology I in Ph.D. Programme Prerequisite : Consent of programme's committee Preparation, presentation and discussion of the selected topics of interest literature, techniques and research pertaining to postharvest technology. Attendance require of all departmental graduate students in postharvest technology programme.</p>	1 (0-2-3)
PHT	792	<p>Seminar in Postharvest Technology II in Ph.D. Programme Prerequisite : Consent of programme's committee Preparation, presentation and discussion by graduate students on current interests in postharvest technology emphasized the topics in relation to thesis research. Attendance require of all graduate students in postharvest technology programme.</p>	1 (0-2-3)
PHT	793	<p>Seminar in Postharvest Technology III in Ph.D. Programme Prerequisite : Consent of programme's committee Preparation, presentation and discussion by graduate students on current interests in postharvest technology emphasized the topics in relation to thesis research. Attendance require of all graduate students in postharvest technology programme.</p>	1 (0-2-3)
PHT	798	<p>Dissertation Prerequisite: Consent of advisor or graduate committee of Ph.D. degree candidate or the consent of programme's committee Intensive experimental research on postharvest problems which may extend throughout the year and furnish data under the supervision or the advisor.</p>	36 credits
PHT	799	<p>Thesis Prerequisite: : Consent of advisor or graduate committee of Ph.D. degree candidate or the consent of programme's committee Intensive experimental research on postharvest problems which may extend throughout the year and furnish data under the supervision or the advisor.</p>	48 credits
BCT	601	<p>Enzyme Technology Prerequisite: none The chemistry and structure of enzymes. Enzyme kinetics and mechanism of enzyme action. Enzyme regulation and production. Extraction and purification of</p>	3 (3-0-9)

enzyme. Technique of immobilization. Characteristics of immobilized enzyme reactors. Enzyme reaction in organic solvent; solid phase a supercritical fluid. Application of enzyme in industries. Modification of enzyme molecule. Principle of protein engineering. Modification of enzyme structure by protein engineering techniques. Example of engineered enzyme.

BCT	602	Protein Engineering Prerequisite: biochemical Structure, folding and function of proteins. Determination of protein structure by the method of X-ray crystallography and NMR. Principle for redesigning the structure of protein by the technique of the genetic engineering and chemistry. Creation of the new protein by improvement the properties or function of wild-type proteins by protein engineering and its applications.	3 (3-0-9)
BCT	611	Carbohydrate Technology Prerequisite: biochemical Classification, chemistry and biochemistry of carbohydrates. Structure and function of carbohydrates. Biosynthesis of carbohydrates. Hydrolysis an bioconversion of carbohydrates and applications of products. Modification of the carbohydrates. Processing and application of native and modified carbohydrates in industries.	3 (3-0-9)
BCT	621	Lipid Technology Prerequisite: biochemical Chemistry, structures and occurrences of triglycerides and other lipids. Biosynthesis and degradation of fatty acid. Polyunsaturated fatty acid. Extraction of total lipid and purification. Industrial process of fat and oil extraction, degumming, physical and chemical refinings, deoderization, crystallization and hydrogenation. Analysis and quality control of lipid and edible oil industries. Microbial and enzymatic modification of lipid. Fats and oils utilization and oleochemical industries.	3 (3-0-9)
BCT	641	Function Properties of Biochemical Prerequisite: none Systematic approaches on the physical and chemical properties of sugars and polysaccharides, amino acids and polypeptides, fatty acids and other lipids, nucleic acids, phenols and polyphenols and other biomolecules. Relate these physical and chemical properties to their functionality or functional properties in various consumer and industrial products.	3 (3-0-9)
BCT	662	Separation Technology Prerequisite: none Principles and applications of separation processes relevant to concentration, fractionation and purification of biomolecules. The topics include techniques for cell disruption, centrifugation, conventional filtration, membrane filtration, solvent extraction, aqueous two phase extraction, adsorption, precipitation, distillation, crystallization, etc.	3 (3-0-9)
BIT	631	Introduction to Gene Technology Prerequisite: biology and biochemical Gene structure and function. Principles of gene cloning and recombinant DNA technology. Basic techniques. Applications in medicine and industries. The knowledge gained will enable students to follow the current literatures and future developments.	3 (3-0-9)
ET	625	Refrigeration and Air Conditioning Prerequisite : Thermodynamics Reviews of processes, cycles and designs of refrigeration and air conditioning systems. Absorption refrigeration with emphasis on solar energy application. Theory and methods of food freezing and preservation. Advanced studies of air conditioning systems with environmental and economic consideration.	3 (3-0-9)

ET	626	Drying of Foods and Cereal Grains Prerequisite : Basic Thermodynamics and heat Transfer Moist air properties. Air movement. Equilibrium moisture contents, thermo-physical properties of food and grains. Grain drying systems. Rigorous and simplified analysis of grain drying :single-kernel, thin layer, and deep-bed grain drying. Analysis of food drying : fixed-bed and moving-bed drying, spray drying, drum drying.	3 (3-0-9)
FdE	541	Drying of Foods Prerequisite : FdE 511, FdE 512 Moist air properties. Air movement. Equilibrium moisture contents, thermi-physical properties of food. Analysis of food drying; fixed – bed and moving – bed drying, spray drying, drum drying. Solar drying: natural and forced convection, type of solar dryers. Mathematical modeling of drying process and drying mechanics.	3 (3-0-9)
FdE	543	Packing Technology Prerequisite : FdE 504, FdE 622 Packing technology system, selection and protective test of packages in relation to handling and transportation and its impact, affect of packages to the product quality. Types and quality of material for suitable packages. Development of the graphic and structural design of packages.	3 (2-3-9)
FdE	622	Physical and Engineering Properties of Foods and Biomaterials 3 Prerequisite : none Principles involved in physical properties and measurement of food texture, mechanical, thermal, electrical and optical properties, and application to harvesting, handling, processing, storage and quality evaluation, an integrated program of laboratory designed to illustrate the principles presented in the lecture course.	3 (2-3-9)