

**POSTGRADUATE INSTITUTE OF SCIENCE
UNIVERSITY OF PERADENIYA**



**Master of Postharvest Technology of Fruits and Vegetables Degree Programme
(SLQF Level 9)**

**Master of Science (M.Sc.) in Postharvest Technology of Fruits and Vegetables
Degree Programme (SLQF Level 10)**

1. INTRODUCTION

Tropical fruits and vegetables are products with excellent market prospects in the world. In spite of the considerably rich collection of exotic varieties of fruits, and vegetables, the South Asia has not exploited the potential economic benefits that the fresh produce can attract from the world market. The fruits and vegetable production is often in excess of the local demand and the surplus could be meaningfully utilized by careful postharvest management of the produce. Surveys have revealed that a substantial portion of the harvest is wasted in the region annually due to improper harvesting and postharvest practices, disease and lack of facilities and technology to extend their storage life. This continues to cause heavy losses in revenue to the grower, wholesaler, retailers and exporter and inconvenience to the consumer and lowers export potential of these commodities.

The reduction of losses and maintenance of quality and freshness of harvested produce prior to consumption are extremely important in both local and export markets. Further, export of fruits and vegetables to distant markets needs special technology that ensures the consumer receives a good quality product and value for money. The postharvest handling of fresh produce presents many technical problems, most of them deriving from the inherent attributes of the commodity. These commodities are composed of living and metabolizing tissues. The functional characteristics of these tissues, their capacity to withstand the stresses of time, temperature and physical handling, to resist infection and spoilage and maintain quality constitute the basis for successful storage, handling and distribution practices. There are fundamental differences between temperate and tropical products. For example, temperate fruits such as apples and oranges are relatively easy to handle, store and transport. Tropical fruits, in contrast, have evolved to decompose quickly after maturity in an environment where there is no impediment to immediate seed germination.

Technical knowledge needed for successful postharvest handling of tropical perishable produce spans many disciplines - chemistry, physiology, biochemistry, pathology, entomology, molecular biology along with marketing and logistics management. This M.Sc. programme, designed within this multidisciplinary framework, is intended to impart scientific knowledge and technology of postharvest management of fruits and vegetables for those engaged or seeks employment in fruit and vegetable industry.

2. OBJECTIVES OF THE PROGRAMME

This is a specialized programme designed for the fruits and vegetables handling, marketing and export sector. The main objectives are to provide,

- a) the latest scientific basis and technological background, while ensuring reduction of losses, enables successful postharvest handling and management, preservation and processing of fresh fruits and vegetables for both local and export market,
- b) exposure to current trends and developments in marketing systems, quality and safety standards, packaging and value addition, requirements and limitations in the overseas market, and,
- c) scientific understanding on the nature of fresh produce and the cause of deterioration and spoilage due to senescence, pest and disease and implementation of rapid, appropriate and economical measures to rectify them, tackle diseases and fruit fly problems in international trade.

3. PROGRAMME SUMMARY

**Master of Postharvest Technology of Fruits and Vegetables Degree Programme
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**Master of Science (M.Sc.) in Postharvest Technology of Fruits and Vegetables
Degree Programme (SLQF Level 10)**

Course Code	Course Title	Lecture hrs.	Practical/ Field hrs.	No. of Credits
First Year - Semester I				
PL 501	Economical and social aspects of fruits and vegetables	20	20	2
PL 502	Pre-and postharvest physiology/biochemistry of fresh produce and ethylene in postharvest Technology	15	30	2
PL 503	Postharvest losses of fruits and vegetables	20	20	2
PL 504	Biostatistics*	20	20	2
PL 505	Postharvest handling and quality assurance of perishables	15	30	2
PL 516	Postharvest diseases and disorders and their control	15	30	2
PL 518	Insect pests in postharvest products and their control	25	10	2
First Year - Semester II				
PL 506	Packaging and packing house operations	15	30	2
PL 507	Transportation and storage of fruits and vegetables	15	30	2
PL 519	Fruit and vegetable processing	15	30	2
PL 521#	Microflora & mycotoxins in fresh & processed produce	20	20	2
PL 522#	Marketing management for postharvest operations	25	10	2
PL 525	Supply chain and Logistics Management	40	10	3
PL 526#	Biotechnology for postharvest quality management of fresh horticultural produce	25	10	2
PHT 599	Independent Study**	500 notional hrs.		5
Second Year				
PL 699	Research Project	3000 notional hrs.		30

*-Not considered for GPA, but a minimum of a C grade is required.

**-Participating at the Scientific Writing Workshop conducted by the PGIS is compulsory

- Optional courses

4. COURSE SYNOPSIS

Course Code	PL 501
Course Title	Economical and Social aspects of fruits and vegetables
Credits	2
Compulsory/Optional	Compulsory
Prerequisites	None
Aims	To discuss economical and social aspects of fruit and vegetables and make students aware of different nutritional aspects of fruit and vegetables on human health. The knowledge acquired may be applied in different industries to increase the economic gains from fruit and vegetables.
Intended Learning Outcomes	Students who successfully complete this course will be able to, <ul style="list-style-type: none"> 1. Describe the economic and social importance of fruit and vegetables to different sectors of the country. 2. Describe the contribution of different nutrients in fruit and vegetables towards human health 3. Assess the nutritional quality of fruit and vegetables 4. Explain the traditional and novel technologies used to control nutritional loss in fruit and vegetables
Time Allocation	Lectures: 20 hrs Practical: 20 hrs
Content	Introduction to the importance of horticultural fresh produce in agriculture sector and human health. Nutrients available in fruit and vegetables, their role in human nutrition, sources and availability and health issues/diseases related with deficiencies of these nutrients. Brief introduction to pre- and postharvest factors contributing towards the nutrient quality of fresh produce. An overview on methods (traditional and novel) to control nutrient losses. Uses of fruit and vegetables in different industries (processing industry, pharmaceuticals, ornamental, fruit carvings, etc.) and value addition. Financial, social and economic issues in fruit and vegetable based industries.

Assessment criteria:

Continuous assessment	End-semester examination
30%	70%

Recommended Texts:

1. Kader, A.A. (2002). Postharvest Technology of Horticultural Crops. Postharvest Center, University of California, USA.
2. Thompson, A.K. (2003). Fruit and Vegetables Harvesting, Handling and Storage. Blackwell publishing, Australia.

3. Wills, R.B.H., McGlasson, W.B., Graham, D. Lee, T.H. and Joyce, D. (2007). Postharvest. An Introduction to the Physiology and Handling of Fruit, Vegetables and Ornamentals (5th Edition). University of New South Wales Press, Australia.

Course Code	PL 502
Course Title	Pre-and postharvest physiology/biochemistry of fresh produce and ethylene in postharvest Technology
Credits	2
Compulsory/Optional	Compulsory
Prerequisites	None
Aims	To provide students with an understanding of physiology and biochemistry of fruit and vegetables so that the knowledge gained may be applied to extend the shelf life depending on the nature of the commodities.
Intended Learning Outcomes	Students who successfully complete this course will be able to, <ul style="list-style-type: none"> 5. Explain the effects of metabolic processes in postharvest quality of fresh produce 6. Discuss the relationship between biochemical properties and postharvest quality of fruit and vegetables. 7. Describe the applications of ethylene in postharvest harvest technology of fruits 8. Suggest the methods of minimizing the deleterious effects of ethylene on keeping quality of harvested fruits and vegetables.
Time Allocation	Lectures: 15 hrs Practical: 30 hrs
Content	Product growth, maturation, physical and chemical changes during fruit ripening, vegetable hardening, senescence and abscission and their physiology and biochemistry; respiration patterns, measurement of climacteric and non-climacteric fruits; fruit ripening and associated changes. Ethylene, biosynthesis and mechanism of action and its role in fruit ripening, senescence; systems for ethylene treatment; deleterious effects of ethylene; control of ethylene in postharvest environment. Techniques assessing physico-chemical changes in harvested commodities.

Assessment criteria:

Continuous assessment	End-semester examination
40%	60%

Recommended Texts:

1. Wills, R.B.H. and Golding, J.B. (2016). Postharvest: An introduction to the physiology and handling of fruit and vegetables (6th Edition). CAB International, UK 293 pp
2. Wills, R., McGlasson, B., Graham, D. and Joyce, D. (1998). Postharvest: An introduction to the physiology and handling of fruit, vegetables and ornamentals (4th Edition). CAB International, UK 262 pp.

3. Mitra, S. (1997). Postharvest physiology and storage of tropical and subtropical fruits. CAB International, UK 423 pp.

Course Code	PL 503
Course Title	Postharvest losses of fruits and vegetables
Credits	2
Compulsory/Optional	Compulsory
Prerequisites	None
Aims	To provide knowledge on importance of postharvest losses of fruits and vegetables, types of postharvest losses, loss assessment, identification of causative factors of postharvest losses and ways to minimize them.
Intended learning outcomes	Students who successfully complete this course will be able to, <ul style="list-style-type: none"> 1. Describe the importance of postharvest losses in the fruits and vegetables sector 2. Discuss different types of postharvest losses 3. Assess the postharvest losses and their causative factors 4. Propose strategies to minimize the postharvest losses of different fruits and vegetables for varying marketing conditions.
Time Allocation	Lectures: 20 hrs Practicals: 20 hrs
Content	Importance of postharvest losses in the fruits and vegetables sector; Types of postharvest losses and causes of occurrence; Pre and postharvest factors affecting postharvest losses; Effect of postharvest losses of fruits and vegetables on nutritional aspects in the country; Supply chain management practices effecting postharvest losses; Role of supply chain factors on postharvest losses; Procedures of loss assessment; Methods of postharvest loss reduction; Barriers and constraints in reducing postharvest losses.

Assessment criteria:

Continuous assessment	End-semester examination
40%	60%

Recommended Texts:

1. Galanakis, C. (2021). Food Losses, Sustainable Postharvest and Food Technologies. Academic Press, UK.
2. Thompson, A.K. (2003). Fruit and vegetables harvesting, handling and storage. Blackwell publishing, Australia.

3. Kader, A.A. (2002). Postharvest Technology of Horticultural Crops. Postharvest Center, University of California, USA.

Course Code	PL 505
Course Title	Postharvest handling and quality assurance of perishables
Credits	2
Compulsory/Optional	Compulsory
Prerequisites	None
Aims	To discuss on pre-and postharvest factors contributing to postharvest quality of fruit and vegetables and making aware of students on quality parameters and standards so that they can apply that knowledge to assure postharvest quality of perishables.
Intended learning outcomes	Students who successfully complete this course will be able to, <ul style="list-style-type: none"> 1. Describe factors contributing to postharvest quality of fruits and vegetables 2. Suggest maturity indices used for different horticultural commodities 3. Test different quality parameters of selected fruits and vegetables 4. Recommend pre-and postharvest handling protocols to assure maximum postharvest quality of perishables.
Time Allocation	Lectures:15 hrs Practical: 30 hrs
Content	General introduction, maturity indices, maturity standards; harvesting methods and mechanization; effect of pre harvest practices and harvesting conditions on postharvest quality; management of field heat; pre-cooling and refrigeration, pack-house operations and special treatments; ethylene damage; container handling. Quality assurance: quality components; quality criteria for fresh fruits and vegetables; factors affecting quality; methods for quality evaluation; appearance quality, textural quality, flavour quality, nutritional quality and safety factors.

Assessment criteria:

Continuous assessment	End-semester examination
30%	70%

Recommended Texts:

1. Ahmad, M.S. and Siddiqui, M.W. (2015). Postharvest Quality Assurance of Fruits: Practical Approaches for Developing Countries (1st Edition), Springer, USA.

2. Yahia, E.M. (ed) (2019). Postharvest Technology of Perishable Horticultural Commodities; Woodhead Publishing, UK.
3. Siddiqui, M. (ed) (2017). Preharvest Modulation of Postharvest Fruit and Vegetable Quality (1st Edition), Academic Press, UK.

Course Code	PL 506
Course Title	Packaging and pack-house operations
Credits	2
Compulsory/Optional	Compulsory
Prerequisites	None
Aims	To introduce students the principles and applications in packaging and pack-house operations of food crop produce so that the knowledge acquired may be applied in management of fresh produce supply chain catering to the intended markets.
Intended learning outcomes	<p>At the successful completion of the course, students will be able to,</p> <ol style="list-style-type: none"> 1. describe procedures involved in packaging and pack-house operations of fresh produce 2. apply basic principles of packaging and pack-house operations to extend the shelf life of fresh produce 3. asses the cost of packaging and pack-house operations 4. design strategies to modify packaging and pack-house operations to minimise the losses 5. evaluate the quality of a food crop produce with reference to intended destination markets
Time Allocation	Lectures: 15 hrs Practicals: 30 hrs
Content	Fundamentals and purpose of packaging; package development criteria, selection of packaging materials to minimize waste, enhance productivity, profitability and suitability of the commodity; packaging that minimizes impacts, protects from compression and vibration bruises, ensures immobilization and facilitates temperature management; hand packing operations; packhouse operations; new trends in packaging of fresh produce, environmental standards.

Assessment criteria

Continuous assessment	End-semester examination
30%	70%

Recommended Texts:

1. Robertson, G.L. (2009). Food Packaging and Shelf life: A practical guide (1st Edition) CRC Press, New York
2. Robertson, G.L. (2013). Food Packaging: principles and practice (3rd Edition) by Gordon L. Robertson, New York
3. Kader, A.A. (2011). Packages for Horticultural Crops, In: Postharvest Technology of Horticultural Crops (3rd Edition), University of California, California

Course Code	PL 507
Course Title	Storage and transportation of fresh fruits and vegetables
No. of Credits	2
Compulsory/Optional	Compulsory
Pre-requisites	None
Aims	To discuss the role of storage and transportation in order to extend the postharvest life of fresh fruits and vegetables and make students aware of proper selection of mode transportation and storage conditions based on the commodity, target market and the duration of storage.
Intended learning outcomes	<p>Students who successfully complete this course will be able to,</p> <ol style="list-style-type: none"> 1. explain the importance of the use of proper storage and transport system to reduce postharvest losses. 2. describe different cooling systems which can be used to reduce the product temperature before storage 3. identify suitable storage systems and select commodities suitable for different storage conditions such as modified and controlled atmospheric storage methods 4. recommend suitable storage and transportation systems to preserve the fresh quality of perishables.
Time Allocation	Lectures:15 hrs Practical: 30 hrs
Content	Importance of proper storage and transportation systems; Methods of cooling of fresh commodities; Storage systems; Fundamentals of Controlled Atmosphere (CA) and Modified Atmosphere (MA) storage, CA storage structures, equipment and monitoring of environmental conditions; MA packaging; Transport equipment; Product transit temperature management; cold chains; Refrigeration and air circulation system; Shipping packages; MA transport; Product compatibility in mixed loads; Measures to prevent impact, vibration and heat damage during transport.

Assessment criteria:

Continuous assessment	End-semester examination
30%	70%

Recommended Texts:

1. Kader A.A. (ed). (2002). Postharvest Technology of Horticultural (3rd Edition) UC Publication 3311, University of California, Division of Agriculture and Natural Resources, Oakland, California 94608, pp 97-145.
2. Thompson, K. (2010). Controlled Atmosphere storage of fruits and vegetables (2nd Edition), CAB International, UK.

Course Code	PL 516
Course Title	Postharvest diseases and disorders and their control
Credits	2
Compulsory/Optional	Compulsory
Prerequisites	None
Aims	To give students an in-depth understanding of the mechanisms of infection, causal agents, symptoms and preventive strategies of postharvest diseases and disorders in fruits and vegetables.
Intended learning outcomes	<p>Students who successfully complete this course will be able to,</p> <ol style="list-style-type: none"> 1. diagnose common postharvest diseases and disorders And comment on their causal agents/ factors 2. explain the process of infection and how this process overcomes innate resistance mechanisms in fruits and vegetables. 3. Identify and apply suitable methods for preventing onset of postharvest diseases.
Time Allocation	Lectures: 15 hrs Practicals: 30 hrs
Content	Nature, cause and significance of postharvest disease; The extent of loss caused by disease; Disease diagnosis; Pre-harvest factors, postharvest handling and storage factors affecting postharvest disease; Mechanism of development of disease; Fungi causing quiescent and wound infections, the biochemical basis of quiescence; Natural disease resistance in fresh produce and their use and manipulation in disease control; Principles and methods (chemical, physical and biological) of postharvest disease control; Non agrochemical alternatives for disease management; Laboratory investigation of diseases and disorders of fruits and vegetables.

Assessment criteria:

Continuous assessment	End-semester examination
30%	70%

Recommended Texts:

1. Agrios, George, N. (2005). Plant Pathology (5th Edition), Elsevier academic Press, UK.
2. Snowdon, A. L. (1991). A colour atlas of postharvest diseases and disorders of fruits and vegetables. Volume 1 and 2. Wolfe Scientific.
3. Carlile, W.R. (1995). Control of Crop Diseases (2nd Edition), Cambridge: Cambridge University Press.

Course Code	PL 518
Course Title	Insect pests in postharvest products and their control
Credits	2
Compulsory/Optional	Compulsory
Prerequisites	None
Aims	To enable the students acquaint with knowledge on insects infesting perishable agricultural produce following harvest, quarantine regulations and practices, and develop skills on the appropriate management strategies.
Intended Learning Outcomes	Students who successfully complete this course will be able to, <ul style="list-style-type: none"> 1. describe different types of losses caused by insects to the perishable commodities following harvest 2. identify the main insect species that infest perishables following harvest 3. review the existing management methods and latest innovations in the protection of perishables from insect infestation 4. design appropriate strategies for the management of pests in perishables
Time Allocation	Lectures: 25 hrs Practicals: 10 hrs
Content	Types of agricultural commodities and their deterioration; Insect pests in harvested commodities; Damage assessment, taxonomy of pests and preharvest & postharvest control methods; Fruit fly control; History and the need of quarantine, international agreements; plant quarantine activities in Sri Lanka; Pathways of pest entry; Risk analysis, prevention of entry; Pest free areas; Pests of quarantine significance relevant to postharvest management of fruits.

Assessment criteria:

Continuous assessment	End-semester examination
30%	70%

Recommended Texts:

1. Saha, T., Kalmesh, M., Nithya, C., Singh, M.P., Kumari, K. (2018). Preharvest modulation of postharvest fruit and vegetable quality. In: M. W. Siddiqui (Ed.), Insect Pest Management of Preharvest Vegetables for Better Postharvest Quality, Academic Press, UK 277-300.
2. Yahia, E. M., Neven, L. G., Jones, R. W. (2019). Postharvest Insects and Their Control. In: E. M. Yahia (Ed.), Postharvest Technology of Perishable Horticultural Commodities., Woodhead Publishing: 529-562.

Course Code	PL 519
Course Title	Fruit and vegetable processing
Credits	2
Compulsory/Optional	Compulsory
Prerequisites	None
Aims	To provide the knowledge on principles, technologies, and applications involved in different fruits and vegetables processing and preservation methods in order to develop high quality processed foods
Intended learning outcomes	<p>Students who successfully complete this course will be able to,</p> <ol style="list-style-type: none"> 1. Recognize the principles & technologies applied in the industrial scale fruits and vegetable processing and preservation operations 2. Process fruits and vegetable and evaluate their quality and efficiency of the preservation treatment/s applied 3. Introduce different types of novel products in the area of food processing
Time Allocation	Lectures: 15 hrs Practicals: 30 hrs
Content	Methods of processing and preservation of fruit and vegetables; Enzymatic and non-enzymatic browning in processing; Preservation by chemical additives; Thermal processing; Role of fruits and vegetables in human diet; Assay of PPO activity, overcome browning; Preparation of ready-to- serve drinks; Indices of postharvest quality; Utilization of horticultural waste for pectin production; Criteria for selection of fruits and vegetables to be minimally processed, preparation, packaging and storage; Problems associated with minimally processed fruits and possible solutions; Hurdle technology, non thermal preservation technologies; Different types of novel products/innovations in the area of food processing.

Assessment criteria:

Continuous assessment	End-semester examination
30%	70%

Recommended Texts:

1. Barbosa-Canovas, G.V., Pothakamury, U.R., Palou, E. and Swanson, B.G. (2001). Non thermal Preservation of Foods, Marcel Dekker, New York
2. Desrosier, N.W. and Desrosier, J.N. (1959). The Technology of Food Preservation, AVI Publishing Co., USA
3. Fuller, G. W. (2011). New Food Product Development from Concept to Market Place (2nd Edition) CRC Press, Boca Raton Florida

Course Code	PL 521
Course Title	Microflora and mycotoxins in fresh and processed produce
Credits	2
Compulsory/Optional	Optional
Prerequisites	None
Aims	To make the students aware of the significance of different types of toxins involved in postharvest produce: sources, mechanisms of action and economic impact.
Intended learning outcomes	<p>Students who successfully complete this course will be able to,</p> <ol style="list-style-type: none"> name different types of toxins and their origin involved in postharvest produce describe mechanisms of action of major types of toxins perform novel toxin detection techniques in postharvest produce practice different preventive and control measures to minimize the effects of toxins on postharvest produce describe international standards in terms of toxins in postharvest produce and their trade
Time Allocation	Lectures: 20 hrs Practicals: 20 hrs
Content	Main types of toxins contaminating postharvest produce and their sources; factors affecting toxin production and the mechanisms of action; novel methods for detection of toxins in biological tissues; Postharvest diseases and toxins; Toxins, trade and international agreements: WTO and other national and international organisations, international commodity agreements, trade associations, commercial practices, ethical trade, phytosanitary agreements, requirements and standards, food safety and HACCP; Impact of climate change on toxin accumulation in postharvest produce.; Prevention and control of toxin accumulation in postharvest produce; Toxin data bases and international regulations.

Assessment criteria:

Continuous assessment	End-semester examination
40%	60%

Recommended Texts:

1. Barkai-Golan, R. and Paster, N. (2011). Mycotoxins in Fruits and Vegetables. Elsevier.
2. Florkowski, W.J, Shewfelt, R.L. and Prussia, S.E. (2018). Postharvest Handling: A Systems Approach. Academic Press, UK.
3. Golob, P., Farell, G., and Orchard, J.E. (2002). Crop Post-Harvest: Science and Technology, Volume 1: Principles and Practice. Blackwell Science Ltd., USA.

Course Code	PL 522
Course Title	Marketing Management for Postharvest Operations
No. of Credits	2
Pre-requisites	None
Compulsory/Optional	Compulsory
Aims	To provide students who are predominately coming from a scientific background with an understanding on principles of marketing management in the contexts of pre and post-harvest operations so that they will be able to apply the theories learned to minimise postharvest losses.
Intended learning outcomes	<p>Students who successfully complete this course will be able to,</p> <ol style="list-style-type: none"> Identify and explain basic theoretical concepts related to marketing management Demonstrate an ability to comprehend and explain what is involved in marketing management i.e. understanding markets, and creating, communicating and delivering values to satisfy customer needs and wants at a profit and appreciate the need for businesses to be market/customer oriented in order to minimize postharvest losses Analyse a given fresh produce value chain to identify problematic interfaces and propose interventions to create sustainable fresh produce value chains. Demonstrate the ability to apply theories learned to analyse real-life cases.
Time Allocation	Lectures: 30 hrs
Content	Introduction to marketing concept; Marketing process; Marketing environment; Consumer and organizational buying behaviour; Market segmentation; Targeting, differentiating and positioning; Product pricing; Marketing communication, distribution; Marketing strategy and sustainable value chain development.

Assessment criteria:

Continuous assessment	Mid-semester examination	End-semester examination
10%	40%	50%

Recommended Texts:

Kotler, P.T and Armstrong, G. (2018). Principles of Marketing (17th Edition). Pearson Education Ltd., UK.

Course Code	PL 525
Course Title	Supply Chain and Logistics Management
Credits	3
Compulsory/Optional	Optional
Prerequisites	None
Aims	To provide students who are predominantly coming from a scientific background with an understanding of supply chain and logistics management considering its operational, tactical and strategic aspects from a firm's point of view.
Intended Learning Outcomes	<p>Students who successfully complete this course will be able to,</p> <ol style="list-style-type: none"> 1. Explain the role of supply chain and logistics in a firm's business environment. 2. Apply knowledge on supply chain and logistics management in achieving strategic fit of a firm 3. Design and evaluate networks in relation to supply chain and logistics management 4. Discuss on planning and coordinating activities in a supply chain 5. Explain the stages in planning, and managing inventories in a supply chain 6. Design transportation networks in a supply chain\ 7. Describe the importance of customer values, information technology, and sustainability in relation to supply chain and logistics management
Time Allocation	Lectures: 40 hrs Practical: 10 hrs
Content	Introduction to supply chain and logistics management (SCLM); achieving strategic fit and scope; supply chain drivers and metrics; supply chain network designs and global networks; planning, and coordination in SCL; planning and managing inventories in SCLM; planning and designing transport networks in SCLM; customer values; information technology and sustainability in SCLM.

Assessment criteria:

Continuous assessment	End-semester examination
50%	50%

Recommended Texts:

1. Chopra, S. (2018). Supply Chain Management: Strategy, Planning, and Operation, (Seventh Edition), Pearson Education Ltd., UK
2. Christopher, M. (2011). Logistics and Supply Chain Management (Fourth Edition), Pearson Education Ltd., UK
3. Jacobs, F.R. and Chase, R.B. (2018). Operations and Supply Chain Management, (Fifteenth Edition), McGraw Hill Ltd., USA.
4. Min, H. (2015). The Essentials of Supply Chain Management: New Business Concepts and Applications (First edition), Pearson Education Ltd., UK

Course Code	PL 526
Course Title	Biotechnology for postharvest quality management of fresh horticultural produce
Credits	2
Compulsory/Optional	Optional
Prerequisites	None
Aims	To provide an understanding about basic concepts and tools of biotechnology so that students will be able to choose appropriate technologies for improving postharvest quality of fresh produce.
Intended Learning Outcomes	<p>On successful completion of the course the students should be able to,</p> <ol style="list-style-type: none"> 1. Describe the basic biotechnology concepts. 2. Explain basic biotechnology tools. 3. Describe how basic biotechnology concepts and tools are applied in postharvest quality management of fresh produce. 4. Recommend possible applications of biotechnology for improvement of postharvest quality management of fresh produce in Sri Lanka. 5. Explain challenges in adaptation of technology and biosafety concerns.
Time Allocation	Lectures: 25 hrs Practical: 10 hrs
Content	Introduction to biotechnology; basic concept and tools; lab demonstrations of basic tools; current applications of biotechnology in postharvest quality management of fresh produce; the role of biotechnology in reduction of postharvest losses of fresh produce; biosafety concepts.

Assessment criteria:

Continuous assessment	End-semester examination
50%	50%

Recommended Texts:

1. Krebs, J.E., Goldstein, E.S. and Kilpatrick, S.T. (2021). Lewin's Genes XII, Jones & Bartlett Learning, USA.

Course code	PHT 599
Course title	Independent Study
Credits	05
Prerequisites	PL 504 can be taken concurrently
Compulsory/optional	Compulsory
Aims	<p>The overall aim is to familiarize the student with concepts and methods involved in scientific research</p> <p>Specific aims:</p> <ol style="list-style-type: none"> 1. To explain the scientific process in the conduct of research. 2. To develop skills to write a review paper and a scientific research proposal. 3. To develop skills to make a presentation. 4. To master the application of statistical methods on quantitative scientific data.
Intended learning outcomes	<p>At the end of successful completion of the course, students will be able to,</p> <ol style="list-style-type: none"> 1. Conduct an independent review of literature on a selected topic in the area of Postharvest Technology. 2. Write a formal scientific report conforming to the guidelines provided. 3. Transfer the knowledge gained through (1) and (2) above in the form of a PowerPoint presentation. 4. Complete a research proposal conforming to the guidelines provided. 5. Perform statistical analysis of quantitative data.
Time allocation	500 notional hrs
Content	<p><i>Review paper:</i> Review of literature; Development of the review paper in concise and professional manner and logical presentation of results that have been reported, writing the abstract, compilation of the list of references.</p> <p><i>Proposal writing:</i> Interpretation and critical evaluation of results of published research; Formulation of a research problem: Concise literature review, justification, time frame, identification of resources, budgeting, etc.</p> <p><i>Project:</i> Collection and statistical analysis of data on a topic associated with the review paper.</p> <p><i>Seminar:</i> Presentation of literature and data collected on a given topic; Preparation of an abstract, preparation of slides.</p>

Assessment criteria:

Review paper	Proposal writing	Project	Seminar
20%	10%	40%	30%

Recommended texts:

1. Backwell, J., Martin, J. (2011). A Scientific Approach to Scientific Writing, Springer, USA.
2. Postgraduate Institute of Science (2019). Guidelines for Writing M.Sc. Project Report/M.Phil. Thesis/Ph.D. Thesis, University of Peradeniya, Sri Lanka.

Course Code	PL 699
Course Name	Research Project
Credits	30
Prerequisites	GPA of 3.00 at M.Sc. (Course work)
Compulsory/optional	Compulsory for MSc in Postharvest Technology of Fruits and Vegetables by Research
Aims	<p>The overall aim is to prepare the student to conduct a well-planned research independently. Specific objectives are to,</p> <ol style="list-style-type: none"> 1. Provide an in-depth knowledge on scientific process in conducting research 2. Develop skills to plan and conduct a scientific research 3. Train students in collecting and evaluating scientific literature, generate hypotheses, planning and conducting of scientific research, analyzing, handling and presenting scientific data and scientific writing 4. Develop self-motivation and confidence in students to conduct research.
Intended Learning Outcomes	<p>At the end of the successful completion of the course, students will be able to,</p> <ol style="list-style-type: none"> 1. Perform a review of scientific literature on the selected topic 2. Generate hypothesis, plan and conduct scientific experiments, collect and analyze results and make inferences based on the results 3. Present scientific data logically 4. Demonstrate effective communication skills when presenting research findings 5. Demonstrate a thorough knowledge in the subject area
Content	The students will conduct sufficient amount of laboratory/field work on a chosen research topic under the guidance provided by an assigned supervisor/s, produce a thesis and make a presentation on research findings.

Assessment criteria:

Continuous assessment	End-semester examination
30%	70%

Recommended Texts:

1. Backwell, J., Martin, J. (2011). A Scientific Approach to Scientific Writing, Springer, USA.
2. Postgraduate Institute of Science (2019). Guidelines for Writing M.Sc. Project Report/M.Phil. Thesis/Ph.D. Thesis, University of Peradeniya, Sri Lanka.