Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Agriculture
M.Sc. Horticulture (Fruit Science)

Course Code	Course Name	TEACHING & EVALUATION SCHEME							
		Theory			Practical		Credits		
		END SEM University Exam	Mid term exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	L	P	Total
PHM 503	Packaging and Storage of fresh Horticultural Produce	50	30	00	15	05	1	1	2

1. **Legends:** L - Lecture; P – Practical
2. *Teacher Assessment shall be based on following components: Quiz / Assignment / Project / Participation in Class.

Aim of the course

To acquaint with the different storage systems and packaging systems for perishable horticultural produce.

The course is organized as follows:

No	Blocks	Units
1	Storage systems	I. Importance of storage
		II. Different methods of storage
		III. Modified methods of storage
2	Packaging	I. Importance of packaging and packaging methods
		II. New technologies in packaging

Theory

Unit I: Storage Systems

Importance of storage of horticultural produce, present status and future scope. Principles and methods of storage – field storage structures and designs for bulk storage of horticultural produce- onion and potato, etc. Evaporative cool chambers. Physiological changes during storage.

Unit II: Refrigerated storage – principles of refrigeration, types of refrigerants, refrigeration equipments. Cold storage rooms – Calculation of refrigeration load. Storage requirements of different fruits, vegetables, flowers. Storage disorder symptoms and control.

Unit III: Controlled or modified atmosphere (CA/MA) storage – principles, uses, structures and equipments, methods and requirements. Effect of CA storage on the physiology of stored produce. Hypobaric storageprinciple, uses, and requirements. Storage disorders.

Unit IV: Packaging

Importance of packaging of fresh and processed horticultural produce, present status and future scope. Gaps in packaging concepts. Packaging requirements of fresh horticultural produce. Packaging patterns and methods. Food packaging systems: Different forms of packaging such as rigid, semi-rigid, flexible forms. Traditional, improved and specialized packages. Paper based packages: corrugated fibre board boxes – raw material and types of boxes. Flexible packaging materials – types and their properties. Consumer and intermediate flexible bulk containers. Testing of flexible packaging material. Barrier properties of packaging materials.

Unit V: New technology in packaging – stretch wrapping system, vacuum packaging, gas packaging, controlled atmosphere (active and intelligent) packaging, vibra packaging, skin

packaging, shrink packaging, formfill-seal packaging, Packaging machines.Quality control and safety aspects of packaging materials.

Practical

- Study of special storage structures for bulk storage of onion/ potato, etc.
- Study of storage behavior of different fruits and vegetables in zero energy cool chamber
- Determination of refrigeration requirements (capacity) for given quantity of fruits and vegetables
- Study of storage behaviour of different fruits and vegetables in cold room
- Study of chilling injury and storage disorders
- Study of shelf-life of fruits and vegetables in modified atmosphere packaging. Visit to special storage structures, cold storage units. Study of types of packaging materials, types of plastic films and their properties
- Determination of water vapour transmission rate (WVTR) and gas transmission rate (GTR) of packaging material
- Applications of packaging material for fresh fruits and vegetables, beverages, spice products
- Determination of shelf-life of fresh products in different types of packages
- Study of packaging machines – vacuum packaging machine, shrink wrapping machine, double seamer, etc. Visit to packaging unit.

Teaching Methods/ Activities

- Lectures
- Assignments (Reading/ Writing)
- Exposure visits
- Student presentations
- Group Work/ seminars

Learning outcome

After successful completion of this course, the students are expected to be able to understand:

- Importance of storage of horticultural produce
- Different methods of storage
- Importance of packaging for fresh horticultural produce
- Different methods of packaging

Suggested Reading

- Ahvenainen R. 2003. Novel Food Packaging Techniques, CRC Press, ISBN 0849317894.
- Ahvenainen R. 2001. Novel Food Packaging Techniques. CRC.
- Burg SP (Ed.). 2004. Postharvest physiology and hypobaric storage of fresh produce, CABI Publishing, ISBN 0851998011.
- Chattopadhya SK. 2007. Handling, transportation and storage of fruits and vegetables. GeneTech books, New Delhi.
- Chandra GopalaRao. 2015. Engineering for Storage of Fruits and Vegetables; Academic Press, 1st Edition.
- Coles R, McDowell D and Kirwan MJ. (Eds.). 2003. Food Packaging Technology, Blackwell Publishing, ISBN 1841272213.
- Mahadevaiah M and Gowramma RV. 1996. Food packaging materials. Tata McGraw