

# **Course Title with Credit Load M.Sc. (Hort.) in Vegetable Science**

Course Code	Course Title	Credit Hours		
	Major Courses (20 Credits)			
VSC 501	Production of Cool Season Vegetable Crops	2+1		
VSC 502	Production of Warm Season Vegetable Crops	2+1		
VSC 503	Growth and Development of Vegetable Crops	2+1		
VSC 504	Principles of Vegetable Breeding	2+1		
VSC 505	Breeding of Self Pollinated Vegetable Crops	2+1		
VSC 506	Breeding of Cross Pollinated Vegetable Crops	2+1		
VSC 507	Protected Cultivation of Vegetable Crops	1+1		
VSC 508	Seed Production of Vegetable Crops	2+1		
VSC 509	Production of Underutilized Vegetable Crops	2+1		
VSC 510	Systematics of Vegetable Crops	1+1		
VSC 511	Organic Vegetable Production	1+1		
VSC 512	Production of Spice Crops	2+1		
VSC 513	Processing of Vegetable	1+1		
VSC 514	Postharvest Management of Vegetable Crops	2+1		
	Minor Courses	08		
	Supporting Courses	06		
	Common Compulsory Courses	05		
VSC 591	Seminar	0+1		
VSC 599	Research	0+30		
	Total Credits	70		



# <u>Syllabus</u>

# PHM 503: Packaging and Storage of fresh Horticultural Produce (1+1)

	Course Name	TEACHING & EVALUATION SCHEME							
		THEORY			PRACTICAL				
Course code		End Sem University Exam	Mid Term Exam	Teachers Assessment*	End Sem University Exam	Teacher's Assessment*	L	Р	CREDITS
PHM 503	Packaging and Storage Of fresh Horticultural Produce	50	30	00	15	05	1	1	2

### Legends: L - Lecture; P – Practical

\*Teacher Assessment shall be based on following components: Quiz / Assignment / Project / Participation in Class etc.

## Objective

To acquaint with the different storage systems and packaging systems for perishable

horticultural produce.

## Theory

### Unit I:

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 equipment's. 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 equipment's, methods and requirements. Effect of CA storage on the physiology of stored produce. Hypobaric storage principle, uses, and requirements. Storage disorders.

### Unit IV:

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, form fill- 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.

#### 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*. Gene-Tech 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 Hill.

Painy FA. 1992. *A handbook of food packaging*. Blackie Academic. Pantastico B. 1975. Postharvest Physiology, Handling and Utilization of Tropical and Subtropical Fruits and Vegetables. AVI Publ.

Robertson GL. (Ed.). 2010. Food packaging and shelf life: a practical guide CRC Press, ISBN 9781420078442.

Thompson AK. 2010. *Controlled atmosphere storage of fruits and vegetables* (2nd Edition), CABI International, ISBN 9781845936464.

Wilson CL. (Ed.). 2007. *Intelligent and active packaging for fruits and vegetables*, CRC Press, ISBN 9780849391668.

