

Storage & Packaging Technology

Full Marks: (50+50)

A. Storage Technology:

1. **Introduction to the storage of food materials.**
2. **Transport and handling of food materials. (Fresh fruits & vegetable, grain & oilseeds)**
3. **Food losses & damage during storage.**
 - a) Types of storage loss
 - b) Loss assessment and estimation - an approach to more efficient storage,
 - c) Factors responsible for food losses during storage and their prevention.
4. **Definition & measurement of physical factors affecting stored grain.**
 - a) Mechanical & Thermal properties of grain
 - b) Moisture migration to grain
 - c) Grain quality
5. **Grain Sampling:** Theoretical basis of grain sampling , sampling devices, their applications, analysis of grain sample.
6. **Inspection procedures:** grain, grain stores & handling equipment, milling premises
7. Entomology and mycology of stored grain stores & handling equipment, milling premises.
8. Biology of stored product insects, food performances & specificity, infestation quality & quantity.
9. **Stored product insects:** processed food
10. **Rodents & their control**
Rodents- identification, biology & economic importance Chemical & Physical control of rodents
11. **Storage structures-** principles of grain storage, types of storage, selecting of design of storage building, physical, chemical, biological storage structure and handling equipment.
12. Control measures

A. Non chemical control methods:

- a) Aeration principles
- b) Grain and seed drying
- c) Modified atmosphere, hermetic storage and CA storage.
- d) Refrigeration storage
- e) Irradiation

B. Chemical control method:

Fumigants & their application, principle of fumigation & properties of fumigants. Effects of fumigants on stored grains. Estimation and detection of fumigants. Fumigant application methods & dosage. Fumigating devices and their operation.

13. Use of Insecticides:

Properties, general principles, preparation and application, pesticide residues & their significance, pesticides resistance in stored product insect, methods of detecting pesticide resistance in storage pests; type, active principle and application of natural insecticides.

14. Good storage practices, warehouse management, maintenance

15. Farm level storage and storage structure in Nepal and possible ways of improvement.

PRACTICALS:

A. Storage Technology

1. Infestation evaluation, precautions, causes & control
2. Godown sanitation
3. Handling of equipment
4. Fumigation technique- ballooning techniques
5. Grading and inspection of grain- analysis of pesticide residues
6. Storage study of dehydrated products.
7. Visit to warehouse , rural storage structure
8. Factory visit in Dharan & Biratnagar

TEXT BOOKS:

1. B.K Bala, Drying and storage of Cereal grains. Oxford and IBH Pub.Co.P.Ltd New Delhi 1997
2. Carl W.Hall P.E. Drying and storage of Agricultural Crops. AVI Pub Co.Inc. Westport, Connecticut
3. D.W Hall Handling and Storage of food Grains in the Tropical and Subtropical Oxford IBH P.Co. New Delhi
4. Fred J.Baur .Insect Management for food storage and processing . The American Association of Cereal Chemists Inc. St.Paul Minnesota 55121, 2097 USA

B. Packaging Technology

Introduction to Packaging:

16. Evolution of packaging as a science technology package functions & design considerations , packaging operation & hazards distribution. 2

17. **Principles of packaging** - mechanical damage, physical and biochemical, biological and microbiological hazards. 4
18. **Principles in the development of protective packaging.** Deteriorative changes in food stuffs and packaging methods adopted in retard them. The shelf -life of packaged food stuffs - predication and estimation methods of extend shelf life. 4
19. **Packaging materials, properties and identification.**
Paper and paper board, regenerated cellulose films, plastic films, aluminum foils and laminations. 12
20. Food packages: Bags, pouches and wrap, folding cartons, set - up boxes and liquid tight paper board containers, aluminum, tin and composite cans, collapsible metal and plastic tubes, glass containers, molded plastic containers, traditional packages 6
21. Types of closures and lids 2
22. **Special packaging methods:** Vacuum and gas packaging, shrink packaging 2
23. **Shipping containers:** Wooden box and crates, plywood and wire bound boxes, basko corrugated and solid fiber board containers, textile and paper sack, miscellaneous containers. 4
24. Properties of food (Physical , thermal, mechanical electrical, biological) and packaging requirement of fresh products(fruit & vegetable, meat, poultry, seafood, facts and oils, dairy products cereals, pulses, spice, dry products. 8
25. **Product package compatibility:** Toxicity, tainting and corrosion, Protection against insects by packaging industrial packaging outline - material handling cushioning: palletizing: stacking and containerization 4
26. Evaluation of packaging materials and package performance 4
27. Package standards and regulations 2
28. Packaging specifications and quality control
29. Marketing and economics: An idea of disposal of wastes package materials.

Practical:

1. Testing of paper - moisture content, thickness, grease resistance, brightness, opacity, chloride test pH, alkali staining, wax covering .
2. Determination of basis weight, water absorptiveness, ink adhesion of paper and paper board.
3. Testing of bottle - Dimension measurement , resisance to thermal shock
4. Identification of plastic films

5. Chemical resistance of plastic films
6. Shrink packaging of poultry

TEXT BOOKS:

1. A.S. Athalye, Plastics in packaging, Tata Mcgraw. 1992
2. Hanlon Handbook of package engineering
3. Crosby . Food Packaging Materials; NT Appl/Sc.1981
4. Frank A Paine. A hand book of Food Packaging,Leonand Hall 1983