

AGPC2007 POST-HARVEST ENGINEERING OF CEREALS, PULSES & OIL SEEDS (3-0-0)

Course Objectives:

- Provide comprehensive knowledge about post-harvest processing techniques for cereals, pulses, and oil seeds.
Develop understanding of various engineering principles and technologies used in agricultural product handling and processing.
- Equip students with technical skills in cleaning, grading, drying, milling, and material handling of agricultural commodities.
- Introduce students to advanced processing technologies like extrusion cooking and by-product utilization.
- Foster analytical skills in understanding unit operations and equipment used in agricultural processing.

Module I

Cleaning and grading, aspiration, scalping; size separators, screens, sieve analysis, capacity and effectiveness of screens. Various types of separators: specific gravity, magnetic, disc, spiral, pneumatic, inclined draper, velvet roll, colour sorters, cyclone, shape graders.

Module II

Drying: moisture content and water activity; Free, bound and equilibrium moisture content, isotherm, hysteresis effect, EMC determination, Psychrometric chart and its use in drying, Drying principles and theory, Thin layer and deep bed drying analysis, Falling rate and constant rate drying periods, maximum and decreasing drying rate period, drying equations, Mass and energy balance, Shedd's equation, Dryer performance, Different methods of drying, batch-continuous; mixing-non-mixing, Sunmechanical, conduction, convection, radiation, superheated steam, tempering during drying, Different types of grain dryers: bin, flat bed, LSU, columnar, RPEC, fluidized, rotary and tray.

Module III

Size reduction: principle, Bond's law, Kick's law, Rittinger's law, procedure (crushing, impact, cutting and shearing), Size reduction machinery: Jaw crusher, Hammer mill, Plate mill, Ball mill.

Mixing: Theory of mixing of solids and pastes, Mixing index, types of mixers for solids, liquid foods and pastes.

Module IV

Milling of rice: Conditioning and parboiling, advantages and disadvantages, traditional methods, CFTRI and Jadavpur methods, Pressure parboiling method, Types of rice mills, Modern rice milling, different unit operations and equipment. Milling of wheat, unit operations and equipment. Milling of pulses: traditional milling methods, commercial methods, pre-conditioning, dry milling and wet milling methods: CFTRI and Pantnagar methods. Pulse milling machines, Milling of corn and its products. Dry and wet milling. Milling of oilseeds: mechanical expression, screw press, hydraulic press, solvent extraction methods, preconditioning of oilseeds, refining of oil, stabilization of rice bran.,

Module V

Material handling equipment. Types of conveyors: Belt, roller, chain and screw. Elevators: bucket, Cranes & hoists. Trucks (refrigerated/ unrefrigerated), Pneumatic conveying

Module VI

Extrusion cooking: principle, factors affecting, single and twin screw extruders. By-products utilization.

Course Outcomes:

- CO1: Analyze and apply appropriate cleaning, grading, and separation techniques for different agricultural products, demonstrating proficiency in using various types of separators and understanding their operational principles.
- CO2: Comprehend moisture dynamics, drying principles, and select appropriate drying methods and equipment for different agricultural commodities, including understanding psychrometric charts and drying rate periods.
- CO3: Evaluate and design size reduction and mixing processes for agricultural products, utilizing theoretical laws and selecting suitable machinery for specific processing requirements.
- CO4: Explain and compare milling technologies for different agricultural products (rice, wheat, pulses, corn, and oilseeds), including traditional and modern processing methods and equipment.
- CO5: Critically assess material handling technologies and extrusion cooking principles, with an emphasis on efficient processing, equipment selection, and by-product utilization strategies.

Suggested Readings:

1. Chakraverty, A. Post Harvest Technology of cereals, pulses and oilseeds. Oxford & IBH publishing Co. Ltd., New Delhi.
2. Dash, S.K., Bebartta, J.P. and Kar, A. Rice Processing and Allied Operations. Kalyani Publishers, New Delhi.
3. Sahay, K.M. and Singh, K.K. 1994. Unit operations of Agricultural Processing. Vikas Publishing house Pvt. Ltd. New Delhi.
4. Geankoplis C. J. Transport processes and unit operations, Prentice Hall of India Pvt Ltd, New Delhi
5. Earle, R.L. 2003. Unit Operations in Food Processing. Pergamon Press. Oxford. U.K.
6. Henderson, S.M., and Perry, R. L. Agricultural Process Engineering, Chapman and hall, London
7. McCabe, W.L., Smith J.C. and Harriott, P. Unit operations of Chemical Engineering. McGraw Hill.
8. Singh, R. Paul. and Heldman, R.Dennis. 2004. Introduction to Food Engineering. 3rd Edition. Academic Press, London