EXTENDED LECTURE OUTLINE

PFE6 221 Post Harvest Engineering of Cereals, Pulses and Oil Seeds (2+1)

Sl No	Lectures
1	General unit operations in agricultural process engineering and importance of these unit operations in grain processing; Structure and composition of cereals, pulses and oil seeds.
2	Cleaning, Grading, Aspiration, Scalping and Size separators. Screens-Types of screen, Sieve analysis. Air screen cleaner-Design consideration of air screen cleaner, Capacity and Effectiveness of screens. Problems on effectiveness of screen. sieve analysis
3	Various types of separators: specific gravity separator, Magnetic separator , Disc separator, spiral separator, pneumatic separator, Inclined draper, Velvet roll separator, Destoner or stone separator Colour sorters and Working of Cyclone separator and problems on pressure drop
4	Drying : Moisture content and water activity, free , bound and importance of equilibrium moisture content , isotherm, hysteresis effect, EMC determination. Psychometric chart and its use in drying.
5	Drying principles and theory, thin layer and deep bed drying layers. Falling rate and constant rate drying periods, maximum and decreasing drying rate period, drying equations, mass and energy balance. Dryer performance.
6	Different methods of drying, batch – continuous; Mixing – Non-mixing, sun mechanical, conduction, convection, radiation, superheated steam, tempering during drying. Different types of grain dryers: bin, flat bed, LSU, Columnar, RPEC, Fluidized, Rotary, Tray dryer. Problems on moisture determination and amount of moisture evaporated in drying.
7	Principles of grain storage. Different types of grain storage structures; deep bin and shallow bin. Design of a silo, structural and functional requirements of a grain storage go-down.
8	Size reduction devices, principle's – Bond's law, Kick's law, Rittenger's law. Size reduction procedures (Crushing, Impact, Cutting and shearing). Size reduction machinery's – Jaw crusher, Hammer mill, Plate mill and Ball mill. Crushing rolls, Grinders, Attrition mills. Problems on Rittenger's and Kick's law, Calculation of

	operational and critical speed.
9	Material Handling: Selection of proper conveying system, belt conveyor, roller, chain and screw. Elevators: bucket- drive mechanism, cranes and hoists. Screw Conveyor, Pneumatic conveying- Limitations of pneumatic conveying system. Calculations on belt conveyor and bucket elevators.
10	Milling of Rice: Conditioning and parboiling, advantages and disadvantages of parboiling, Parboiling methods: traditional - single boiling and double boiling. Modern methods - CFTRI and Jadavapur methods, Pressure parboiling methods. Effect of parboiling on milling, nutritional and cooking qualities. Types of rice mill, basic flow chart of rice processing in a modern rice milling, different unit operations and equipment, Hulling- Engleberg huller, Under runner disk huller, Rubber roll Sheller. Preparation of rice products as rice flakes and puffed rice.
11	Milling of wheat with flow chart: Unit operations and equipment; Milling of corn: unit operations and equipment in dry and wet milling methods.
12	Important unit operations of pulse milling. Milling of pulses – Traditional milling methods and commercial methods. Commercial Scale Methods - Dry milling and Wet milling methods, CFTRI method and Pantnagar process.
13	Milling of oilseeds: Oil extraction methods - Mechanical expression (Screw press, hydraulic press and Ram press) and Oil extraction (Solvent extraction methods). Process Flow chart for Oil seed processing. Process flow chart of solvent extraction of oil.

References:

1. Unit operations of Agricultural Processing **by KM SAHAY and KK SINGH**

2. Hand book of Post harvest Technology (Cereals, F&V, oil, Spices) by **A Chakraverthy**

3. Principles and Practices of Post Harvest Technology by **P H Pandey.**

4. Hand Book of Agricultural Engineering by **ICAR publication.**