FST-412,Extrusion Technology 3(2-1)

Educational Objectives:

The goal of this course is to give students a solid foundation in extrusion theory and practice. The focus will be on providing a clear and easy-to-understand explanation of the fundamental scientific and process engineering principles that govern extrusion operation. The explanation of extruder control and operation will follow from this fundamental strategy in order to maximize output and product quality. The chemical composition and changes of the food ingredients used often in extrusion processes will be discussed. The course should result in better understood, controlled, and optimal extrusion operation when combined with a greater understanding of extrusion concepts.

Course Outcomes:

1. Describe how screw extruders used in the food industry function overall.
2. Discuss elements pertaining to raw material preconditioning, process control, and troubleshooting
3. Utilize the knowledge of raw materials, extruder design, and process control in the creation of products and process activities.

Theory:

- Extrusion: definition
- Introduction to extruders and their principles
- Importance, types, functions, applications
- Extruders in the food industry: History and Uses
- Factors affecting extrusion process
- Single screw extruder: principle of working, net flow, advantages, disadvantages, co-kneaders
- Twin screw extruder: counter rotating and co-rotating, advantages, disadvantages
- Process characteristics of twin screw extruder: feeding, screw design, screw speed, screw configurations, die design, barrel temperature and heat transfer, energy balances
- Problems associated with twin screw extruder
- Preconditioners: characteristics, effect on extrusion
- Changes in food during extrusion: effect on starch, proteins, fats, dietary fiber, vitamins

- Applications in industry: textured vegetable protein, breakfast cereals, direct expanded and third generation snacks
- Value addition in food industry by-products through extrusion

Practical:

- Quality assessment of raw material.
- Preparation operations of raw material.
- Preparation of textured vegetable protein, breakfast cereals, flavor coated snacks, third generation snacks.
- Effect of variation of ingredients, screw speed, temperature, etc. on the protein, fat, fibre, vitamins and other quality characteristics of end product.

Recommended Books:

1. Maskan, M. and Altan, A. 2012. Advances in food extrusion technology. CRC Press Taylor & Francis, Boca Raton, USA.
2. Mohammed Maniruzzaman, 2015, Practical guide to hot-melt extrusion: Continuous manufacturing and scale up, Smithers Rapra Technology
3. Girish M. Ganjyal, 2020, Extrusion cooking: Cereal grains processing, Woodhead Publishing
4. Riaz, M.N. 2003. Extruders in food applications. Technomic Pub. Co. Inc., Lancaster, Pennsylvania, USA.