

# Choice Based Credit Based System

## **Scheme & Syllabus of Master of Technology- Process and Food Engineering (M. Tech of Process and Food Engineering)**

**(Batch 2022)**



**By**

**Board of Study (Food Science and  
Engineering)(Main Campus)**

**Department of Food Science and Technology  
IK Gujral Punjab Technical University**

**Master of Technology in Food Technology (M. Tech of Process and Food Engineering)/**

It is a Post Graduate (PG) Programme of 2 years duration (4 semesters)

**Eligibility criteria for Admission:** B.Tech. / B.E. (Food Engineering / Food Technology / Food Engineering & Technology / Food Process Engineering / Food Process Technology / Dairy Technology / Dairy Engineering / Food Biotechnology / Agri. Process Engineering / Agri. Engineering / Biotechnology)

**or**

**B.Sc. (Hons) in Food Technology, B.Sc. (Hons.) Agriculture (with elective / hons in Food Technology / Food Process Engineering) or any equivalent degree with atleast 50% (45% in case of candidate belonging to reserved category) marks in aggregate.**

**Semester First**

Corse Code	Course Title	Type	Load Allocation			Marks Distribution		Total	Credits
			L	T	P	Internal	External		
MTPFE-511-22	Food Engineering	PC	4	0	0	40	60	100	4
MTPFE -512-22	Process Engineering of cereals, pulses & oil seeds	PC	4	0	0	40	60	100	4
MTPFE -513-22	Energy Management	PC	4	0	0	40	60	100	4
MTPFE -514-22	Advances in Post-harvest Technology of Fruits and Vegetable	PC	4	0	0	40	60	100	4
MTPFE -515-22	Lab-I Food Process Engineering	PC	0	0	4	30	20	50	2
MTPFE -516-22	Lab-II Technology of cereals, pulses & oil seeds	PC	0	0	4	30	20	50	2
MTPFE -517-22	Lab-III Advances in Post- harvest Technology of Fruits andVegetable	PC	0	0	4	30	20	50	2
<b>Total</b>			<b>16</b>	<b>0</b>	<b>12</b>	<b>250</b>	<b>300</b>	<b>550</b>	<b>22</b>

SEMESTER  
FIRST

## **MTPFE-511-22: Food Engineering**

### **Unit-1**

Engineering Properties of foods, their significance and importance in equipment and process design. Material and energy balances, types and Properties of fluids Flow rate, friction losses and pressure drop relationships for Newtonian fluids through pipe. Steady state and unsteady state heat transfer. Numerical, graphical methods in the analysis of heat transfer. Solutions of unsteady state equations.

### **Unit-2**

Kinetics of biological reactions-order of reaction, quality changes during storage of foods. Application of Arrhenius equations to biological reactions. Food quality modelling. Principles of Refrigeration. Natural refrigeration, Vapour compression refrigeration. Mollier Chart, Rating of Systems, Compressors, evaporators, Condensers, Expansion valve. Hear Pump, Absorption refrigeration.

### **Unit-3**

Freezing of foods, prediction of freezing time. Thermal Processing foods. Pasteurization and sterilization, D value, F value, Z value. Process time calculation. Cook value and quality retention. Time temperature integrators (TTI). Microbial survival curve. Lethality, Ball method. Process calculation by graphical method.

### **UNIT-4**

Mixing - Terminology (agitating, kneading, blending, and homogenizing), equipments - mixers for liquids of low or moderate viscosity (Paddle agitators, turbine agitators and propeller agitators), mixers for high viscosity pastes (Pan mixer, horizontal mixer and dough mixer), mixers for dry solids (tumbler mixer and vertical screw mixer), effect of mixing on foods. Power consumption and efficiencies.

### **Suggested Readings:**

1. Geankoplis J Christie. (1999). Transport Process and Unit Operations. Allyn & Bacon.
2. Earle R. L. and Earle M.D.. Unit Operations in Food Processing
3. McCabe WL & Smith JC. (1999). Unit Operations of Chemical Engineering. McGraw Hill.
4. Sahay KM & Singh KK. (1994). Unit Operation of Agricultural Processing. Vikas Publ. House.
5. Singh RP and Heldman DR. (1993). Introduction to Food Engineering. Academic Press

## **MTPFE -512-22: Process Engineering of cereals, pulses & oil seeds**

### **UNIT - 1**

Utilization of cereals, pulses and oilseeds, Grain structure of cereals, Pulses and oilseeds and their milling fractions, Grain quality standards and physico-chemical methods for evaluation of quality of flours.

### **UNIT - 2**

Sieving, Particle size analysis, Grinding and cutting, Energy used in grinding, Grinding equipment. By-products and effluents from different cereal processing industries and various techniques for their utilization and management.

### **UNIT – 3**

Pre-milling treatments and their effects on milling quality. Parboiling, conventional, modern and integrated rice milling operations. Wheat flour milling operation. Processes for milling of corn, oats, barley. Dhal milling operation. Expeller and solvent extraction processing of oilseeds. Refining of oil.

### **UNIT - 4**

Grain storage structures - location and material selection for storage building, Types - traditional, modern; temporary and permanent storage structures; design considerations. Air tight, controlled atmosphere and modified atmospheric storage. Infestation control/sanitation-in-process and post process. Fumigation and aeration.

### **Suggested Readings:**

1. Asiedu J.J.1990. Processing Tropical Crops. ELBS/MacMillan. • Chakraverty A. 1995. Post-harvest Technology of Cereals, Pulses and Oilseeds. Oxford & IBH
2. Morris Lieberman. 1983. Post-harvest Physiology and Crop Preservation. Plenum Press.
3. Pandey P.H. 1994. Principles of Agricultural Processing. Kalyani.
4. Pillaiyar P. 1988.Rice - Post Production Manual. Wiley Eastern.
5. Sahay K.M and Singh K.K. 1994. Unit Operations in Agricultural Processing. Vikas Publ. House.

## **MTPFE -513-22: Energy Management**

**UNIT-1** Energy forms and units, energy perspective, norms and scenario; energy auditing, data collection and analysis for energy conservation in food processing industries. Classification of energy sources; Introduction to renewable energy sources; characterization of biomass; types, construction, working principle, uses and safety/environmental aspects of different renewable energy devices like gasifiers, biogas plants.

**UNIT-2** Solar passive heating devices, photovoltaic cells and arrays, Phase Changing Materials; Brief introduction to wind energy, hydroelectric energy, ocean energy, briquetting and baling of biomass, biomass combustion, biodiesel preparation and energy conservation in agriculture.

**UNIT-3** Energy forms and units, energy perspective, norms and scenario; energy audit and management in agro-processing units, data collection and analysis for energy conservation in food processing industries. non-conventional energy sources in agro-processing industries.

**UNIT-4** Reuse and calculation of used steam, hot water, chimney gases and cascading of energy sources. Energy accounting methods, measurement of energy, design of computer-based energy management systems, economics of energy use.

### **SUGGESTED READINGS:**

1. Garg HP & Prakash J.1997. Solar Energy - Fundamental and Application. Tata McGraw Hill
- Rai GD. 1998. Non-conventional Sources of Energy. Khanna Publ.
2. Twindal JW & Anthony D Wier 1986. Renewable Energy Sources. E & F.N. Spon Ltd.
3. Culp AW. 1991. Principles of Energy Conservation. Tata McGraw Hill.
4. Duffle JA & Beckman WA. 1991. Solar Engineering of Thermal Processes. John Wiley.
5. Mittal KM. 1985. Biomass Systems: Principles & Applications. New Age International.

## **MTPFE -514-22: Advances in Post-harvest Technology of Fruits and Vegetables**

### **Unit-1**

Importance of post harvest technology of fruits and vegetables, structure, cellular components, composition and nutritive value of fruits and vegetables, Post harvest technology and its significance, pre-harvest factors affecting post-harvest quality of fruits and vegetables, fruit ripening, spoilage of fruits and vegetables.

### **Unit-2**

Harvesting and washing, pre-cooling, preservation of fruits and vegetables, blanching, commercial canning of fruits and vegetables, minimal processing of fruits and vegetables. Cold storage, controlled atmosphere packaging of fruits and vegetables, Modified Atmospheric storage.

### **Unit-3**

Dehydration of fruits and vegetables, methods, osmotic dehydration, foam mat drying, freeze drying, microwave heating, applications, radiation preservation of fruits and vegetables, irradiation sources.

### **Unit-4**

Intermediate moisture foods, ohmic heating principle, high pressure processing of fruits and vegetables, applications, packaging technology for fruits and vegetables, general principles of quality standards and control, FPO, quality attributes.

### **Suggested readings:**

1. Somogyi, L.P., Ramaswamy, H. S. and Hui, Y.H., eds. 1996. Processing Fruits: Science and Technology. Vol. 1. Biology, Principles and Applications. Technomic Publishing Co., Lancaster PA.
2. Salunkhe and Kadam. 1998. Handbook of vegetable science and technology: Production, composition, storage, and processing, Marcel Dekker, USA.
3. Barrett, D.M., L. Somogyi, and H. Ramaswamy. 2005. Processing Fruits, Second Edition: Science and Technology. CRC Press, Boca Raton, FL.
4. Hui, Y.H. 2006. Handbook of Fruits and Fruit Processing, Blackwell Publishing, Ames, IA, USA.
5. Salunkhe, D.K. and Kadam, S.S. 1995. Handbook of Fruit Science and Technology: Production, Composition and Processing. Marcel Dekker, New York.
6. Chakraverty, A., Mujumdar A.S., Raghavan G.S.V and Ramaswamy H.S. 2001. Handbook of Post-harvest Technology: Marcel Dekker Press, USA



## **MTPFE -515-22 LAB II (Food Process Engineering)**

Determination of the physical properties size, shape, sphericity of food products.

Determination of average particle size and distribution of powdered material.

Determination of moisture content and water activity of food product.

Determination of bulk density, true density and porosity of food grains.

Determination of colour for various food grains, fruits, vegetables, spices and processed foods by hunter colour lab.

Determination of density and specific gravity of various liquids food.

Study the rheological properties of food material by viscometer.

Study of frictional properties; angle of repose and coefficient of friction of food grain material.

To determine the mixing index of food material by ribbon blender and cone blender.

Solving problems on: single and multiple effect evaporator, distillation, extraction, membrane separation and mixing;

Experiments on rotary flash evaporator, humidifiers, reverse osmosis and ultra filtration;

Visit to related food industry.

## **MTPFE -516-22 Lab II (Technology of cereals, pulses & oil seeds)**

Physical properties of cereals.

Conditioning of wheat. Gluten content of wheat flour.

Cooking quality of rice.

Determination of Gelatinization Temp.

Study on production technology of puffed and flaked rice Physical properties of Legumes and Oil seeds.

Principles of dehulling: Dal Milling Process.

Particle size analysis and energy requirement in comminution.

Milling of rice, wheat and pulses.

Estimation of milling yield and performance characteristics of equipment used.

Physical properties of cereals and pulses, raw and milled products quality evaluations;

Parboiling and drying; terminal velocities of grains and their fractions; study of paddy, wheat, pulses and oilseeds milling equipments;

Planning and layout of various milling plants,

Visit to related agro-processing industry.

### **MTPFE -517-22 Lab III (Advances in Post-harvest Technology of Fruits and Vegetables)**

Kinetics of enzyme inactivation.

Drying of vegetables.

Blanching process. Heat.

Pectin determination in fruits and vegetable.

Calculation and mixing of sugar syrup.

Recipe calculation and preparation of fruit juices/squash.

Recipe calculation for and preparation of fruit Jam/jellies.

Thermal processing and preservation of fruits/vegetables (Canning/ bottling).

Preparation of pickles.

Preparation of tomato product (Puree/ketchup).