

- De Ávila, M. D. R., Cambero, M. I., Ordóñez, J. A., de la Hoz, L., & Herrero, A. M. (2014). Rheological behaviour of commercial cooked meat products evaluated by tensile test and texture profile analysis (TPA). *Meat science*, 98(2), 310-315.

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### DISCIPLINE SPECIFIC ELECTIVE COURSE

#### DSE FT 09: FOOD PLANT DESIGN SANITATION

#### CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course Title & Code	Credits	Credit Distribution of the Course			Eligibility Criteria	Pre-requisite of the Course
		Lecture	Tutorial	Practical/Practice		
Food Plant Design Sanitation DSE FT 09	4	2	0	2	Studied Semester VI	Nil

#### Learning objectives

- To study the principles and design of plant and processing equipment.
- To understand the concepts of food storage, warehousing and Cold chain Management.
- To develop comprehensive understanding of waste product handling, management, cleaning and sanitation processes.

#### Learning Outcomes

- To understand the principles and draw/design food processing plant and processing equipment.
- To get an understanding of warehousing and cold chain management used for storage and transportation of foods.
- To be able to develop waste management and sanitation schedules and designs for food industry and Effluent treatment plant.

#### SYLLABUS OF DSE FT 09

**Theory**  
**(Credits 2; Hours 30)**

**UNIT I Food Plant Layout and Design****8 Hours**

- General principles of food plant Design and layout , Principles of Site Location, Planning and selection.
- Types of layout, Construction materials and design principles, Illumination, Ventilation and Maintenance of food plant.
- Design of Food Service Areas.

**UNIT II Processing Equipment Design****4 Hours**

- Design of food processing equipment : Size Reduction, Mixing, Extraction, Filtration, Centrifugation, Heat exchanger, Dryer, distillation and, Gas absorption equipment.

**UNIT III Warehousing and Cold Chain Management****8 Hours**

- Food hygiene and safety in transportation, with a focus on warehouse storage and refrigerated ships- Safe food storage at shopping outlets: use of coolers/chillers/freezers.
- Scope of Cold Chain for enhancing marketing potentials of perishables in domestic and international markets.
- Principles of Cold Chain Creation and Management. Aerated, refrigerated and controlled atmospheric storage. Economics of warehouse storage.

**UNIT IV Food Plant Hygiene and Sanitation****10 Hours**

- Waste disposal, Control methods using Physical and Chemical Agents, Pest and Rodent Control.
- Good Manufacturing Practices and Personal Hygiene.
- Detergents, Sanitizers. Sanitation Schedule, CIP, COP.
- Classification of waste: Wastewater and solid waste characterization. BOD, COD
- Waste water Treatment : Physical, Chemical, Biological, Aerobic, Anaerobic, Primary, Secondary and Tertiary (advanced) treatments.

**PRACTICAL**  
**(Credit 2; Hours 60)**

1. Design and layout of food processing Plant (Dairy/ fruit and Vegetable/Bakery/Meat)
2. Design and layout of cold storage and warehouse.
3. Design of Food Processing Equipment.
4. Preparation of a sanitation schedule for food preparation area.
5. Testing of sanitizers and disinfectants.
6. Study of Phenol coefficient of sanitizers.
7. Determination of BOD (biological oxygen demand)/ COD in waste water.
8. Study of waste water treatment system/ETP.
9. Study of CIP Layout

**Essential Readings**

- Norman G. Marriott and Robert B. Gravani. (2006). Principles of Food Sanitation, 5th edition
- Rao, D. G. (2010). Fundamentals of Food Engineering, PHI learning Private Ltd.

- Fellows P. (2000). Food Processing Technology, 2nd Edition. Woodhead Publishing Limited and CRC Press LLC
- James A (2013) The supply chain handbook, distribution group.
- Singh, R. P., & Heldman, D. R. (2014). Introduction to food engineering (5th ed.). Academic Press.

#### **Suggested Readings**

- Forsythe, S.J. and Hayes, P.R. (1998). Food Hygiene, Microbiology and HACCP. Gaitersburg, Maryland: Aspen.
- Hui, Y.H., Bruinsma, B., Gorham, R., Nip, W.-K. (2003). Food Plant Sanitation. New York: Marcel Dekker.
- Rees, N. and D. Watson. (2000). International Standards for Food Safety. Gaitersburg, Maryland: Aspen
- Saravacos, G. D., & Kostaropoulos, A. E. (2016). Handbook of food processing equipment (2nd ed.). Springer.
- Ghosh, P. (2015). Cold chain: Principles and practices. Tata McGraw-Hill.
- Fick, R. J. (2005). Environmental management of wastewater treatment plants. John Wiley & Sons

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