7. **Correlation Analysis**: Measure the strength of relationships between two variables by calculating Pearson's and Spearman's correlation coefficients.
8. **Hypothesis Testing (One-sample and Two-sample t-test)**: Test the significance of means for single, independent, and dependent datasets using t-tests.
9. **Chi-Square Test for Independence**: Test the independence between categorical variables by analysing and interpreting a contingency table.

ESSENTIAL/ RECOMMENDED READINGS (Theory and Practical):

- Minium,E.W.,King,B.M.,&Bear,G.(2017).*Statistical Reasoning for Psychology and Education*. New York: Wiley and Sons.
- Gupta,S.P.(2022) *Statistical Methods*, 46th Edn. S.Chandand Sons.
- Agresti,A.,Christine Franklin,C.and Klingenberg, B.(2017).*Statistics:TheArtand Science of Learning from data*, Pearson, Boston

SUGGESTED READINGS

- Schmuller,J.(2016).*Statistical Analysis with Excel forDummies*, 5th Edition, NewYork, USA.
- Gupta,S.C.andmKapoor,V.K.(2020).*FundamentalsofMathematicalStatistics*,12thEdn., S. Chand and Sons.
- Ross,Sheldon M.(2010): *Introductory Statistics*, 3rdEdition, Academic Press.
- Derek Rowntree,(2018). *Statistics Without Tears, An Introduction for Non-Mathematicians*, Penguin Books

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi.

DISCIPLINE SPECIFIC ELECTIVE COURSE – DSE-9-FT: FOOD SAFETY AND QUALITY MANAGEMENT

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Food Safety and Quality Management	4	3	0	1	Class XII	Nil

LEARNING OBJECTIVES:

1. Understand key food quality management systems facilitating food safety.
2. Learn application of standards like ISO, HACCP, and GMP in the food industry.
3. Develop skills to develop and implement food safety plans and audits.
4. Understand the importance of regulatory compliance, food traceability and newer concepts in this area.

LEARNING OUTCOMES:

Students will be able to**:**

1. Apply food safety and quality management system in food processing operations.
2. Develop food safety plans that meet National & International standards and certifications.
3. Conduct food safety audits.
4. Use new technologies to improve food traceability and manage risks.
5. Manage compliance with food safety regulations and maintain proper documentation.

SYLLABUS OF DSE- 9-FT

THEORY
(Credits: 3; Hours: 45)

UNIT I: Introduction to Food Quality Management (10 Hours)

Unit Description: This unit covers food quality management, focusing on quality concepts, food safety, and the principles of quality control and assurance. It also introduces Good Manufacturing Practices (GMP) and Pre-Requisite Programs (PRPs).

Subtopics:

- Introduction to food quality management – Key terms such as quality, food safety, quality planning, quality assessment. Concept of quality attributes - traditional, modern and consumer concepts of quality
- Concepts of quality management- Objectives, importance and functions of quality control and quality assurance,
- Principles of Good Manufacturing Practices (GMP), Pre-Requisite Program (PRP's)

UNIT II: Total Quality Management Systems (13 Hours)

Unit Description: This unit covers key quality and safety concepts being applied in the food industry, including principles of TQM, TQMS, HACCP, ISO standards as well as, Sanitary and Phyto-sanitary Measures.

Subtopics:

- Total Quality Management (TQM)
- Total Quality Management System
- Sanitary and Phyto-sanitary Measures (SPS)
- HACCP (Hazard Analysis Critical Control Points)- Definition, Benefits, Principles, Guidelines for applying HACCP principles, HACCP Plan format

UNIT III: Compliance of TQMS (12 Hours)

Unit Description: This unit covers the key elements of ISO 22000:2005, along with certification systems. It also introduces standardization, accreditation bodies, and the importance of audit procedures and documentation for regulatory compliance.

Subtopics:

- Certification systems in food sector
- Introduction & application of
  i. ISO 9001:2000,
  ii. ISO 14001:2004,
  iii. OHSAS 18001:1999
  iv. ISO 27001:2005
  v. ISO 22000:2005
- Introduction to Standardization and accreditation- International Accreditation Forum (IAF), Quality Council of India (QCI), National Accreditation Board for Testing and Calibration Laboratories (NABL)
- Audit procedures and maintaining documentation for regulatory compliance.

UNIT IV: Risk Analysis and Food Traceability (10 Hours)

Unit Description: This unit covers food safety risk analysis, assessment, management, and communication, along with the role of food traceability systems in recalls. It also explores new technologies in food safety.

Subtopics:

- Concept of food safety risk -analysis, assessment, management, and communication.
- Food traceability systems and their role in food recalls.
- Role of training in effective implementation of total quality management system
- Understanding New technologies in food safety: blockchain, AI, and IoT applications, non-destructive testing solutions, machine vision.

PRACTICALS
(Credit: 1; Hours: 30)

1. Develop an HACCP plan for a small food processing unit or for the preparation of a food product in a canteen.
2. Prepare a process audit checklist for any one operation in a small food business.
3. Case study on food recall.
4. Identify and document common food hazards in a home or restaurant setup.
5. Identify key quality control points during the preparation of a dish.
6. Identify key points of quality assurance during receiving of ingredients by a small food processing unit.
7. Prepare a total quality management system for a bakery specializing in cakes.

ESSENTIAL/ RECOMMENDED READINGS (Theory and Practical):

- International Organization for Standardization. (2022). *ISO 22000:2005 Food safety management systems - Requirements for any organization in the food chain*. International Organization for Standardization.
- Rao, E. S. (2013). *Food quality evaluation*. Variety Books Publishers Distributors.
- Suri, S., & Malhotra, A. (2014). *Food science, nutrition and safety*. Pearson India Ltd.
- Mathur, P. (n.d.). *Food safety and quality control*. Orient Blackswan.
- Alli, I. (2021). *Food quality assurance: Principles and practices*. CRC Press.

SUGGESTED READINGS:

- David, A. H. (2020). *Introduction to food quality management*. Wiley-Blackwell.
- Pieternel A, Luning. &Willem, J. Marcelis. (2009). *Food Quality Management Technological and Managerial principles and practices*. Wageningen. Chapter 1, pg.19-31, Ch 3 pg. 93-139, Ch 9 pg. 391-395
- Williams, P. M. (2021). *Total quality management in the food industry*. Springer.
- Raj, K. K. N. N., & P. R. K. (2020). *Food safety and quality systems in developing countries*. CRC Press.
- Prewitt, A. A. (2021). *Food traceability: A practical guide*. Wiley.
- R., S. C. (2022). *ISO 9001:2015: A complete guide to quality management systems*. CreateSpace Independent Publishing Platform.
- Motarjemi, Y., & Lelieveld, H. (2020). Food safety management: A practical guide for the food industry. Academic Press.
- Sharma, S., Aggarwal, M., & Sharma, D. (Eds.). (2019). *Food frontiers*. New Delhi Publishers. ISBN: 978-93-86453-84-6.

SUGGESTED WEB LINKS:

- [FSSAI Official Website] (https://www.fssai.gov.in)
- [Codex Alimentarius](https://www.fao.org/fao-who-codexalimentarius/en/)
- [WHO Food Safety Guidelines] (https://www.who.int/foodsafety)

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