Ph.D. Food Technology

Program Specific Outcomes

PSO1 Learning to conduct innovative and high quality research to solve emerging problems in Food Science and Technology through applying the fundamental scientific knowledge and designing and conducting research experiments and analyzing the findings.

PSO2 Conceptualizing and solving scientific and technological problems through lateral and original thinking and evaluating a wide range of potential solutions for those problems to arrive at feasible and optimal solutions after considering public health, food safety, food preservation, novel value added product development, nutritional enhancement and food security as core areas of expertise.

PSO3 Doctoral students will attain professional and leadership skills for professional positions in food and allied industries, government, or research institutes.

PSO4 Communication skills and professional approach to convey technical information and defend scientific findings within the scientific community by presenting research to local, regional, and national audiences through publications, report writings and presentations will be enhanced.

PSO5 Developing skills and competencies in budding researchers and inculcating the requisite aptitude in them to conduct advanced research in the emerging areas of food science and technology with a rigorous and scientific approach.

Examination Scheme for the Ph.D Course work (Jan,17 to Dec,17)

Sr. No.	Paper code	Subject	Internal Assessment*	Written Theoretical Evaluation	Seminar** (if any)	Total Marks
1	17FTEPC1	Trends in Food Safety and Quality Management Systems	20	80	----	100
2	17FTEPC2	Advanced Tools and Techniques in Food Research & Analysis	20	80	----	100
3	17FTEPC3	Research Methodology and Data Analysis	20	80	----	100
4	17FTEPC4	Review writing and presentation/seminar	---	50	50	100
	Grand	Total				400

Course Outcomes

Trends in Food Safety and Quality Management Systems (17FTEPC1)

Course Outcomes:

CO1   Students would be acquainted with the national as well as global issues, concerns and challenges to food safety and quality.

CO2   The knowledge of food safety practices, tools, techniques and standards would empower the students to make constructive contribution in implementing safe food practices.

CO3   The knowledge of food safety acts, certification, accreditation and food safety standards would enable the students to render their services in food industry and other related organisations for maintaining food safety and quality standards.

Detailed Syllabus contents:

MM. 80   **Time: 3 h**

Note: There will be nine questions in all. The first question will be compulsory and will comprise of eight short answer type questions each of 2 marks. The remaining eight questions will comprise of two questions from each unit and the candidates will have to attempt four questions selecting one question from each unit. Each question will consist of 16 marks.

Unit 1
Concept of food quality and food safety, need for food safety, major challenges to food safety, major consumer concerns and issues regarding food safety and quality, food safety scenario in India, food safety and quality measures techniques in India, FPO, MFPO, MMPO, AGMARK.

Unit II
Principles of food safety management: good hygienic practices (GHP), good manufacturing practices (GMP), food safety hazards, hazard analysis, HACCP principles and implementation in food industry, Good laboratory practices: concept, present status and future need for food industry, concept of food traceability and its need for food safety management system.

Unit III
Food safety management systems, Food safety standards: purpose, classification and types of food standards, standards setting organizations, ISO 15161: 2001, ISO 15161:20002, ISO 22000, legal aspects of food safety management systems, global laws on food safety, Food Safety and Standards Act of India (FSSA): prospects and problems.

Unit IV
Quality assurance and management systems in food industry, principles of quality control, quality standards, ISO standards for food industry, total quality management (TQM) in food industry, certification for food safety and quality management systems, certification criteria, selection of certification bodies, role of accreditation in food industry, accreditation agencies, benefits of certification and accreditation.

Books recommended
  *   Arora, K.C. 2000. TQM and ISO 14000, Kataria Publications, New Delhi.

* Bank, J. 1996. The Essence of Total Quality Management, Printice Hal of India, New Delhi.
* Jouve, J.L., Stringer, M.F., Baird Parker, A.C. 1998. Food Safety Management Tools, International Life Science Institute, ILSI Europe, Brussels.
* Hester, R.E., Harrison, R.M. 2001. Food Safety and Food Quality, The Royal Society of Chemistry.
* Inteaz Alli. 2003. Food Quality Assurance: Principles and Practices, CRC Press
* Schimdt, Ronald, H.,Rodrick, Gary, E. 2003. Food Safety Handbook, John Wiley and Sons Publication

Advanced Tools and Techniques in Food Research & Analysis (17FTEPC2)

Course Outcomes:

CO1   Knowledge regarding the principles and applications of different analytical techniques in food research and analysis would strengthen the research and analytical acumen of the students and it will make the student skilful enough to work in a research/food analytical lab.

CO2   The understanding of the microscopic techniques of food analysis would empower the students for microbial analysis, safety and preservation of foods.

CO3   The theoretical and conceptual knowledge of working principles and applications of various research techniques like chromatography, electrophoresis, spectroscopic, viscometry and microscopy would infuse in hand working confidence to handle the research analytical instruments.

Detailed Syllabus contents:

MM. 80   **Time: 3**

Note: There will be nine questions in all. The first question will be compulsory and will comprise of eight short answer type questions each of 2 marks. The remaining eight questions will comprise of two questions from each unit and the candidates will have to attempt four questions selecting one question from each unit. Each question will consist of 16 marks.

Unit I
Electrophoresis: different methods of electrophoresis for protein, electrofocussing and SDS-PAGE, chromatography:–adsorption, affinity, partition, Ion-exchange, gel permeation, GC, TLC, HPLC etc
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Unit II
Theory and principles of centrifugation and application to food systems, rotor heads, differential centrifugation density gradient centrifugation, gel filtration, supercritical fluid extraction

Unit III

Introduction to principles and applications of Spectroscopic techniques (UV, Vis, IR, fluorescence, FTIR, NMR), atomic absorption, theory of lyophilization and its applications to food systems

Unit IV
Microscopic techniques in food analysis, introduction to principles and working of light and electron microscope, thermal methods in food analysis (differential scanning calorimetry), viscosity measurement in food systems (viscometers and viscoamylographs)

Books recommended
1. AOAC International.2003. Official methods of analysis of AOAC International. 17th Ed. Gaithersburg, MD, USA, Association of Analytical Communities.
2. Kirk, R.S.& Sawyer, R. 1991. Pearson's Chemical Analysis of Foods. 9th Ed. Longman Scientific & Technical.
3. Leo, M.L. 2004.Handbook of Food Analysis.2nd Ed. Vols.I-III.
4. Linden, G. 1996. Analytical Techniques for Foods and Agricultural Products. VCH.
5. Macleod, AJ. 1973. Instrumental Methods of Food Analysis. Elek Sci. Marcel Dekker.
6. Nielsen, S. (Eds.). 1994. Introduction to Chemical Analysis of Foods. Jones & Barltlett.
7. Pomeranz, Y. & Meloan, C.E. 1996. Food Analysis- theory and Practice. 3rd Ed.CBS.publisher.
8. Ranganna, S. 2001. Handbook of Analysis and Quality Control for Frui and Vegetable Products. 2nd Ed. Tata-McGraw-Hill.

Research Methodology and Data Analysis (17FTEPC3)

Course Outcomes:

CO1   Knowledge of basic fundamentals of planning and hypothesising a research problem and designing the experiments would be helpful in effective pursuance of the research objectives.

CO2   The students would be acquainted with the effective means of writing, compiling, presenting and discussing the findings of the experiments and their further publications in the reputed journals.

CO3   Knowledge of statistical tools would be instrumental in drawing inferences and conclusive reports from the laboratory experiment results.

Detailed Syllabus contents:

MM. 80   **Time: 3 h**

Note: There will be nine questions in all. The first question will be compulsory and will comprise of eight short answer type questions each of 2 marks. The remaining eight questions will comprise of two questions from each unit and the candidates

will have to attempt four questions selecting one question from each unit. Each question will consist of 16 marks.

Unit I
Planning a research problem: Meaning, aims, nature and scope of research, steps in research process, characteristics and prerequisites of good research, criteria / characteristics of a good research problem, criteria in selecting a research problem, formulation of objectives, research plan and its components.

Unit II
Research methodology and experimental design: Guidelines for design of experiments, materials and methods, designing experiments for food analysis, types of samples and sampling techniques, characteristics of a good sample, sampling and non sampling errors, preparation of samples, performing experiments, compilation and documentation of data.

Unit III
Thesis writing, presentation and research publication: Format of the research report, style of writing the report, references and bibliography, effective presentation and discussion of results/findings, significance of writing research papers and review articles, impact factor and citation index, intellectual property rights and plagiarism.

Unit IV
Statistical applications and data analysis: An overview of application of central tendency and dispersion, standard deviation, standard error of mean, coefficient of variation, variance, population null hypothesis, level of significance and confidence, power of test, one tail and two tail test, parametric tests: definitions and applications of Z test for one and two sample means, t-test for one and two sample means, F test for two variances, analysis of variance (ANOVA) (One way and two way), correlation and regression analysis.

Books Recommended
1. Basotia, G.R. and Sharma, K.K. 2009. *Research methodology*
2. Chaudhary, C.M. 2009. *Research methodology*, RBSA Publications
3. Kothari, C.R. 2004. *Research methodology: Methods and Techniques*
4. Gupta, S. P. 2008. *Statistical Methods,* Sultan Chand and Sons, New Delhi.
5. Gupta, S.C. & Kapoor, V.K. 2003. Fundamentals of Mathematical Statistics. S. Chand & sons.

Review Writing and Presentation/Seminar (17FTEPC4)

Course Outcomes:

CO1   The students would be acquainted with the collection, compilation and reviewing of the existing literature/developments in a particular area.

CO2   Compilation of the reports would improve the knowledge and ability of the students to write good review papers for publication in reputed journals.

CO3 Presentation of the complied report and its discussion would infuse confidence in the students to compile and handle the various reports and their presentation in their professional career.

CO4 The review writing in an area of emerging importance/research would prepare a platform for the students to move for advance research in that particular area.