Ph.D. course work in Food Technology
Scheme of Examination and Course Curriculum (2020-21)

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. .

Duration: One Semester (Six months)
Total Credits: 14
Program Structure: Ph.D. in Food Technology

SEMESTER I						
Course Code	**Nomenclature of Course**	**Theory marks (end semester examination)**	**Internal Assessment marks**	**Max. marks**	**Hours /Week**	**Credits**
20FTEPH11C1 (Compulsory for all Ph.D. course work)	Research Methodology	80	20*	100	4	4
20MPCC1 (Compulsory for all Ph.D. Course work)	Research and Publication Ethics	40	10**	50	2	2
20FTEPH11C3	Trends in Food Safety and Quality Management Systems	80	20*	100	4	4
20FTEPH11C4	Advanced Tools and Techniques in Food Research & Analysis	80	20*	100	4	4
Total marks/Credits				**350**		**14**

Note: The compulsory course on 'Research and Publication Ethics' shall be offered by Ch. Ranbir Singh Institute of Social and Economic Change for all UTDs/Centers/Institutes as passed vide Resolution No. 27 of the 271st meeting of EC held on 29.7.2020.

Internal assessment

* Two assignments each of 5 marks and two presentations each having 5 marks.

**One assignment and one presentation each having 5 marks

Ph.D. Course Work Syllabus

Name of the Program	Ph.D. Course work in Food Technology	**Program Code**	FTE
Name of the Course	Research Methodology	**Course Code**	20FTEPH11C1
Hours/Week	4	**Credits**	4
Max. Marks.	80	**Time**	3 Hours

Note: The examiner has to set a total of nine questions (two from each unit and one compulsory question consisting of short answer from all units. The candidate has to attempt one question from each unit along with the compulsory question (5 x 16 = 80 marks)

Course Objectives:

1. To inculcate methodological approach and scientific acumen to conceptualize, hypothesize and implement an objective oriented research problem.
2. To make the students acquainted with the importance of writing reports, analyzing and discussing the findings and getting them published for dissemination to scientific masses.
3. To impart knowledge of statistical tools and approaches for the analysis and interpretation of data in research.

Course Outcomes:

1. Knowledge of basic fundamentals of planning and hypothesizing a research problem and designing the experiments would be helpful in effective pursuance of the research objectives.
2. 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.
3. Knowledge of statistical tools would be instrumental in drawing inferences and conclusive reports from the laboratory experiment results.

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**,** writing materials and methods, review of literature, effective presentation and discussion of results/findings, references and bibliography, significance of writing research papers and review articles, poster or oral presentation of research reports.

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.

References:

1. Basotia, G. R., & Sharma, K. K. (2009). *Research methodology*. Jaipur, India: Mangal Deep Publications.
2. Chaudhary, C. M. (2009). *Research methodology*. Jaipur, India: RBSA Publications.
3. Kothari, C. R. (2004). *Research methodology: methods and techniques*. New Delhi, India: New Age International.
4. Gupta, S. P. (2008). *Statistical methods*. New Delhi, India: Sultan Chand & Sons.
5. Gupta, S. C., & Kapoor, V. K. (2003). *Fundamentals of mathematical statistics*. New Delhi, India: Sultan Chand & Sons.

Name of the Program	Ph.D. Course work in Food Technology	**Program Code**	FTE
Name of the Course	Research and Publication Ethics	**Course Code**	20MPCC1
Hours/Week	2	**Credits**	2
Max. Marks.	50	**Time**	3 hours

Note: Note: The examiner has to set a total of nine questions (two from each unit and one compulsory question consisting of short answer from all units. The candidate has to attempt one question from each unit along with the compulsory question (5 x 8 = 40 marks)

Course Objectives:

1. To study the philosophy of ethics.
2. To study the scientific conduct of research.
3. To study the publication ethics.
4. To know about various journal citation databases.
5. To know the importance of quality publications.

Course Outcomes:

1. Ethics in conduct of scientific research.
2. Know the scientific misconducts.
3. How to avoid plagiarism and what are the penalties of plagiarism.
4. Know the quality of research publications.
5. Write research and review articles.

Unit - I

PHILOSOPHY AND ETHICS

1. Introduction to philosophy: definition, nature and scope, concept, branches
2. Ethics: definition, moral philosophy, nature of moral judgments and reactions

SCIENTIFIC CONDUCT

1. Ethics with respect to science and research
2. Intellectual honesty and research integrity
3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP)
4. Redundant publications: duplicate and overlapping publications, salami slicing
   Selective reporting and misrepresentation of data

Unit - II

PUBLICATION ETHICS

1. Publication ethics: definition, introduction, and importance
2. Best practices / standards setting initiatives and guidelines: COPE, WAME, etc.
3. Conflicts of interest
4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types
5. Violation of publication ethics, authorship, and contributor ship
6. Identification of publication misconduct, complaints and appeals
   Predatory publishers and journals

Unit -III

DATABASES AND RESEARCH METRICS

(A) Databases

1. Indexing databases
2. Citation databases: Web of Science, Scopus, etc.

(B) Research Metrics

1. Impact Factor of journal as per Journal Citation Report, SNIP, SIR, IPP, Cite Score
   Metrics: h-index, g index, i10 index, altmetrics

Unit -IV

Practice

OPEN ACCESS PUBLISHING

1. Open access publications and initiatives
2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies
3. Software tool to identify predatory publications developed by SPPU
4. Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggested, etc.

PUBLICATION MISCONDUCT

(A) Group Discussions

1. Subject specific ethical issues, FFP, authorship
2. Conflicts of interest
3. Complaints and appeals: examples and fraud from India and abroad

(B) Software tools (2 hrs.) :Use of plagiarism software like Turnitin, Urkund and other open source software tools

References

1. Bird, A. (2006). *Philosophy of science*. Routledge.

2. Chaddah, P. (2018) Ethics in competitive research: Do not get scooped; do not get plagiarized.

3. Ethics in science education, research and governance (2019). Indian National Science Academy (INSA).

4. Beall, J. (2012). Predatory publishers are corrupting open access. Nature, 489(7415), 179.

5. National Academy of Engineering and Institute of Medicine (2009). On being a scientist: A guide to responsible conduct in research (3rd ed.). National Academy of Sciences: National Academic press

Name of the Program	Ph.D. Course work in Food Technology	**Program Code**	FTE
Name of the Course	Trends in Food Safety and Quality Management Systems	**Course Code**	20FTEPH11C3
Hours/Week	4	**Credits**	4
Max. Marks.	80	**Time**	3 Hours

Note: The examiner has to set a total of nine questions (two from each unit and one compulsory question consisting of short answer from all units. The candidate has to attempt one question from each unit along with the compulsory question (5 x 16 = 80 marks)

Course Objectives:

1. To sensitize the budding scientists regarding the problems of food safety and quality making them aware of global food safety concerns.
2. To understand and analyze the emerging trends and practices in food safety management systems.
3. To impart the latest knowledge regarding the trends in certification and accreditation areas helping to build up the safe and quality-oriented practices in food processing sector.

Course Outcomes:

1. Students would be acquainted with the national as well as global issues, concerns and challenges to food safety and quality.
2. The knowledge of food safety practices, tools, techniques, and standards would empower the students to make constructive contribution in implementing safe food practices.
3. 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 organizations for maintaining food safety and quality standards.

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.

References:

1. Arora, K. C. (2000). *TQM and ISO 14000*. New Delhi, India: Kataria Publications.
2. Alli, I. (2003). *Food quality assurance: Principles and practices*. Boca Raton, Florida, USA: CRC Press.
3. Ronald, S., Rodrick, H., & Gary, E. (2003). *Food safety handbook*. Hoboken, USA: John Wiley and Sons Publication.
4. Hester, R. E., & Harrison, R. M. (2001). *Food safety and food quality*. Cambridge, UK: The Royal Society of Chemistry.
5. Jouve, J. L., Stringer, M.F., & Baird Parker, A. C. (1998). *Food safety management tools*. Brussels, Europe: International Life Science Institute.

Name of the Program	Ph.D. Course work in Food Technology	**Program Code**	FTE
Name of the Course	Advanced Tools and Techniques in Food Research & Analysis	**Course Code**	20FTEPH11C4
Hours/Week	4	**Credits**	4
Max. Marks.	80	**Time**	3 Hours

Note: The examiner has to set a total of nine questions (two from each unit and one compulsory question consisting of short answer from all units. The candidate has to attempt one question from each unit along with the compulsory question (5 x 16 = 80 marks)

Course Objectives:

1. To impart the knowledge regarding the principles and applications of various analytical techniques in food research and analysis.
2. To develop the research and instrumentation handing acumen in the young researchers.
3. To develop scientific aptitude to explore innovative methods for food analysis and quality control using various novel techniques of food analysis.

Course Outcomes:

1. 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.
2. The understanding of the microscopic techniques of food analysis would empower the students for microbial analysis, safety, and preservation of foods.
3. 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.

Unit - I

Electrophoresis: different methods of electrophoresis for protein, electro focusing and SDS-PAGE, chromatography: adsorption, affinity, partition, Ion-exchange, gel permeation, GC, TLC, HPLC etc.

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).

References:

1. AOAC International. (2003). *Official methods of analysis of AOAC International* (17th ed.). Gaithersburg, USA: Association of Analytical Communities.
2. Leo, M. L. (2004). *Handbook of food analysis* (2nd ed.) New York, USA: Marcel Dekker.
3. Linden, G. (1996). *Analytical techniques for foods and agricultural products*. New York, USA: VCH.
4. Pomeranz, Y., & Meloan, C. E. (1996). Food analysis- theory and practice (2nd ed.). New Delhi, India: CBS Publisher.
5. Ranganna, S. (2001). *Handbook of analysis and quality control for fruit and vegetable products* (2nd ed.). New Delhi, India: Tata-McGraw-Hill.