

CENTRAL UNIVERSITY OF PUNJAB



Ph.D. (Food Science and Technology)

Batch 2026-27

**Department of Applied Agriculture
School of Basic Sciences**

Graduate attributes

The programme will enable learners to adopt themselves as research and development professionals/experts (scientists, innovators, etc.) in the field of food science and processing for meeting requirements of industry, regulatory bodies and other organizations at various levels (regional, national and international).

Course structure

S.N.	Course Code	Course Title	L	T	P	Cr
1	FST.701	Research Methodology and Computer Applications	4	0	0	4
2	FST.751	Research and Publication Ethics	2	0	0	2
3	FST.708	Advances in Food Processing Technology	4	0	0	4
4	FST.752	Teaching Assistantship	0	0	2	1
5	UNL.753	Curriculum, Pedagogy and Evaluation	1	0	0	1
		Total	11	0	2	12

L: Lectures T: Tutorial P: Practical Cr: Credits

Course Code: FST.701

Course Title: Research Methodology and Computer Applications

L	T	P	Cr
4	0	0	4

Learning Outcomes

Students will be able to:

CLO 1: Critically analyze, interpret, and synthesize existing scientific knowledge based on literature review.

CLO 2: Identify the knowledge gap and formulate a hypothesis and design experimental/theoretical work.

CLO 3: Apply good laboratory practices and biosafety protocols.

CLO 4: Appreciate the crucial issues in research ethics, like responsibility for research, ethical clearance for experimental studies and scientific misconduct.

CLO 5: Perform hypothesis testing on small and large data samples.

CLO 6: Use correlation and linear regression methods to find a relationship and goodness of fit for the given data.

CLO 7: Retrieve various biological data from the appropriate databases for analysis.

CLO 8: Compare protein structures and perform structure-based drug designing.

Unit/ Hours	Content	Mapping with CLO
I 15 hours	General Principles of Research: Meaning and importance of research, Critical thinking, Formulating hypothesis and development of research plan, Review of literature, Interpretation of results and discussion. Bibliographic index Technical Writing: Scientific writing, writing synopsis, Research paper, Poster preparation, oral presentations and Dissertations. Reference Management using various softwares such as Endnote, reference manager, Refworks, etc. Communication skills: defining communication; type of communication; techniques of communication, etc.	CLO 1 & CLO 2
II 15 hours	Introduction and Principles of Good Lab Practices: Good laboratory practices, Biosafety for human health and environment. Biosafety issues for using cloned genes in medicine, agriculture, industry, and eco-protection, Biological containment and physical containment, Biosafety in Clinical laboratories and biohazard management, Physical, Chemical & Biological hazards and their mitigation. Biosafety level/category of pathogens. Biosafety level of laboratories, WHO/CDC/DBT guidelines for biosafety. Research Ethics: Ethical theories, Ethical considerations during research, consent. Animal handling/testing, Animal experimental models and animal ethics. Perspectives and methodology &	CLO3 & CLO4

	Ethical issues of the human genome project, ICMR guidelines for biomedical and health research. Intellectual property protection (IPP) and intellectual property rights (IPR), WTO (World Trade Organization), WIPO (World Intellectual Property Organization), GATT (General Agreement on Tariff and Trade), TRIPs (Trade Related Intellectual Property Rights), TRIMS (Trade Related Investment Measures) and GATS (General Agreement on Trades in Services). Patents, Technology Development/Transfer Commercialization Related Aspects, Ethics.	
III 15 hours	Computer Applications and Biostatistics: Introduction to spreadsheet, presentation tools. Reference Management software. Role of Cloud computing and HPC in life science research. Introduction to Big data in biology and big data analytics. Data types and sources – variables and types. Descriptive statistics of categorical data and continuous data. Estimation of parameters – hypothesis testing: tests of significance, type I and II errors, z test, t test, analysis of variance (ANOVA), chi-square goodness-of-fit test. Regression and correlation. Statistical packages and their applications.	CLO 5 & CLO 6
IV 15 hours	Bioinformatics: Sequence, structure, gene expression, pathway databases. Introduction to Next generation Sequencing. Pair-wise, local and global sequence analysis, BLAST, PHI-BLAST and Multiple sequence alignment. Molecular phylogeny - building phylogenetic trees. Applications of Artificial Intelligence and Machine Learning in genomics, transcriptomics, proteomics and Biomedical Image analysis. Introduction to Protein structure, Structure comparison and visualization, Structure classification of protein: CATH and SCOP. Introduction to molecular modeling and structure-based drug designing. AI-driven approaches for protein structure prediction, biomolecular interaction prediction, functional annotation, and precision medicine.	CLO 7 & CLO 8

Suggested Reading:

1. Gupta, S. (2010). *Research Methodology and Statistical Techniques*. Deep & Deep Publications (P) Limited, New Delhi.
2. Kothari, C.R., Garg, G. (2019). *Research Methodology: Methods and Techniques*. 4th Edition, New Age International (p) Limited. New Delhi.
3. Sahay, Vinaya and Pradumna Singh (2009). *Encyclopedia of Research Methodology in Life Sciences*. Anmol Publications. New Delhi.
4. Kauda J. (2012). *Research Methodology: A Project Guide for University Students*. Samfunds

literature Publications.

5. Dharmapalan B. (2012). *Scientific Research Methodology*. Narosa Publishing
6. Norman, G. and Streiner, D. (2014). *Biostatistics: The Bare Essentials*. 4th Edition, PMPH-USA Limited.
7. Rao, P. P., S. Sundar and Richard, J. (2009). *Introduction to Biostatistics and Research Methods*. PHI learning.
8. Christensen, L. (2007). *Experimental Methodology*. Boston: Allyn & Bacon.
9. Fleming, D. O. and Hunt, D.L. (2006). *Biological Safety: Principles and Practices*. American Society for Microbiology, USA.
10. Rockman, H. B. (2004). *Intellectual Property Law for Engineers and Scientists*. Wiley-IEEE Press, USA.
11. Shannon, T. A. (2009). *An Introduction to Bioethics*. Paulist Press, USA.
12. Vaughn, L. (2012). *Bioethics: Principles, Issues, and Cases*. 2nd Edition, Oxford University Press, UK
13. Lesk, A.M. (2019). *Introduction to Bioinformatics*. 5th Edition, Oxford University Press, UK.
14. Ramsden, J. (2021). *Bioinformatics: An Introduction (Series: Computational Biology)*. 4th Edition, Springer International Publishing.
15. Mount, D.W. (2004) *Bioinformatics: Sequence and Genome Analysis*. 2nd Ed., CSHL Press, New York.
16. Branden, C. and J. Tooze, (1999) *Introduction to Protein Structure*, 2nd Ed., Garland Science, USA.

Transactional Modes:

Mode of transaction shall be Lecture, presentation, Lecture-cum-demonstration, Seminar, discussion etc.

Course Name: Research and Publication Ethics

Course Code:

FST.751 Total

Hours-30

L	T	P	Cr
2	0	0	2

Course Learning Outcomes (CLO): Students will be able to:

CLO1: Familiarize with the ethics of research.

CLO2: Illustrate the good practices to be followed in research and publication.

CLO3: Judge the misconduct, fraud and plagiarism in research.

CLO4: Utilize various online resources and software to analyze their research output.

Unit/ Hours	Content	Mappin g with CLO
I/3 hours	Philosophy and Ethics • Introduction to Philosophy: definition, nature and scope, content, branches • Ethics: definition, moral philosophy, nature of	CLO1

	moral judgements and reactions	
II/5 hours	Scientific Conduct • Ethics with respect to science and research • Intellectual honesty and research integrity • Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP) • Redundant publications: duplicate and overlapping publications, salami slicing • Selective reporting and misrepresentation of data	CLO1 and CLO2
III/7 hours	Publication Ethics Publication ethics: definition, introduction and importance • Best practices/ standards setting initiatives and guidelines: COPE, WAME, etc. • Conflicts of interest • Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa, types • Violation of publication ethics, authorship and contributor ship • Identification of publication misconduct, complaints and appeals • Predatory publishers and journals	CLO2 and CLO3
IV/4 hours	Open Access publishing • Open access publications and initiatives • SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies • Software tool to identify predatory publication developed by SPPU • Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer, Journal Suggester etc.	CLO2
V/4 hours	Publication Misconduct • Group Discussions: Subject-specific ethical issues, FFP, authorship; conflicts of interest; complaints and appeals: examples and fraud from India and abroad • Software tools: Use of plagiarism software like Turnitin, Urkund and other open source software tools	CLO2 and CLO3
VI/7 hours	Databases and Research Metrics • Databases: Indexing databases; Citation database: Web of Science, Scopus etc. • Research Metrics: Impact Factor of journal as per	CLO4

	Journal Citation Report, SNIP, SJR, IPP, Cite Score; Metrics: h-index, g-index, i10 index, almetrics	
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Course Name: Advances in Food Processing
Technology Course Code: FST.708

L	T	P	Cr
4	0	0	4

Total Hours-60

Course Learning Outcome (CLO):

This course will make students able:

CLO 1: Explain the principles and working mechanisms of advanced thermal and non-thermal food processing technologies.

CLO 2: Analyze the role of novel preservation and packaging techniques in enhancing food quality, safety, and shelf life.

CLO 3: Evaluate modern food processing techniques such as membrane processing, extrusion, and encapsulation for product development.

CLO 4: Assess the applications of automation, AI, and IoT in improving efficiency and sustainability in food processing industries.

CLO 5: Examine emerging trends and innovations in food processing and their impact on the food industry.

CLO 6: Apply knowledge of advanced processing technologies to solve real-world problems in food processing and preservation.

Unit/hours	Content	Mapping with CLO
Unit I/15 hours	Emerging Thermal and Non-Thermal Processing Technologies Limitations of conventional food processing methods; Advanced thermal technologies: Ohmic heating, microwave heating, infrared heating; Non-thermal technologies: High Pressure Processing (HPP), Pulsed Electric Fields (PEF), Cold Plasma; Ultrasound processing in foods; Applications, advantages, and limitations of novel technologies <i>Learning activity: Seminars and group discussions on thermal and non-thermal technologies applications in food processing and research</i>	CLO1 and CLO2
Unit II/15 hours	Novel Preservation and Packaging Technologies Active and intelligent packaging systems; Modified Atmosphere Packaging (MAP) and Controlled Atmosphere Storage (CAS); Edible coatings and films; Nanotechnology in food packaging;	CLO1, CLO2 and CLO3

	Shelf-life extension and quality evaluation Learning activity: Seminars and group discussions on nanotechnology application novel packaging technologies in food processing and research	
Unit III/15 hours	Advanced Food Processing Techniques and Product Development Membrane technology (microfiltration, ultrafiltration, reverse osmosis); Encapsulation and nanoencapsulation of bioactive compounds; Extrusion technology and its applications; 3D food printing and personalized nutrition; Development of functional foods and nutraceuticals Learning activity: Seminars and group discussions on novel processing technologies in food processing	CLO3, CLO 4 and CLO5
Unit IV/15 hours	Automation, Sustainability, and Future Trends Automation and robotics in food processing industries; Artificial Intelligence (AI) and Internet of Things (IoT) in food processing; Sustainable processing technologies and waste valorization; Energy-efficient processing methods; Future trends and challenges in food processing industries Learning activity: Seminars and group discussions on advancements in food applications	CLO3, CLO4 and CLO 6

Suggested Readings:

- AK Haghi, *Food Science: Research and Technology*. Academic Press (2011).
- D Singh, *Food Processing and Preservation*. Shree Publisher (2015).
- G Saravakos and AK Kostaropoulos, *Handbook of Food Process Equipment*. Springer (2016).
- GV Barbosa-Canovas and GW Gould, *Innovation in Food Processing*. CRC Press (2017).
- H W Xiao et al., Recent developments and trends in thermal blanching - A comprehensive review. *Information Processing in Agriculture*. Volume 4, 2017, 101-127
- HS Ramaswamy and M Marcotte, *Food Processing Principle and Application*. Taylor and Francis (2006).
- JS Smith and YH Hui, *Food Processing*. Wiley (2014).
- K Kai, *Innovative Food Processing Technologies*. WP Publisher (2016).
- M Regier, *The Microwave Processing of Foods*. Academic Press, (2017).
- MC Knirsch et al., Ohmic heating—a review. *Trends in Food Science & Technology*, 21, 2010, 436-441.
- NN Potter, *Food Science*. CBS Publishers (2007).

- P Fellows, *Food Processing Technology Principles and Practice*. CRC Press (2005).
- RL Shewfelt, *Introducing Food Science*. CRC (2013).
- T Varzakas and C Tzia, *Handbook of Food Processing*. CRC Press (2016).
- Edelstein S (2018) *Food Science*, Jones & Bartlett Learning
- Baisya (2019) *Changing Face of Processed Food Industry in India*, Ane Books
- Mehta (2020) *Fermentation effects on food properties*, CRC Press
- Ahmed J (2018) *Novel Food Processing*, CRC Press
- Sun DW (2020) *Thermal food processing new technology and quality issues*, CRC Press
- Boye J (2012) *Green Technology in food Production*
- Chemat F (2019) *Green Food Processing Techniques: Preservation Transformation and Extraction*, Academic Press
- Boye J (2012) *Green Technology in Food Production*
- James et al. (2002) Ozone: A Potential Disinfectant for Food Industry. *Journal of Scientific and Industrial Research*, 61, 504-509.
- Yang, N., Sun, Z. X., Feng, L. S., et al., (2015). Plastic film mulching for water- efficient agricultural applications and degradable films materials development research. *Materials and Manufacturing Processes*, 30(2), 143-154.

Transactional Modes:

Mode of transaction shall be Lecture, presentation, Lecture-cum-demonstration, Seminar, discussion etc.

Course Code: FST.752

Course Title: Teaching Assistantship

L	T	P	Credit
0	0	2	1

Course Learning Outcome (CLO):

At the end of this skill development course, the scholars shall be able to

CLO1: Familiarize themselves with the pedagogical practices of effective class room delivery and knowledge evaluation system.

CLO2: Manage large and small classes using appropriate pedagogical techniques for different types of content.

Activities and Evaluation:

- The scholars shall attend Master degree classes of his/her supervisor to observe the various transaction modes that the supervisor follows in the class room delivery or transaction process one period per week.
- The scholars shall be assigned one period per week under the direct supervision of his/her supervisor to teach the Master degree students adopting appropriate teaching strategy(s).
- The scholars shall be involved in examination and evaluation system of the Master

degree students such as preparation of questions, conduct of examination and preparation of results under the direction of the supervisor.

- At the end of the semester, the supervisor shall conduct an examination of teaching skills learned by the scholar as per the following **evaluation criteria**:
 - The scholars shall be given a topic relevant to the Master degree course of the current semester as his/her specialization to prepare lessons and deliver in the class room before the master degree students for one hour (45 minutes teaching + 15 minute interaction).
 - The scholars shall be evaluated for a total of 50 marks comprising *content knowledge* (10 marks), *explanation and demonstration skills* (10 marks), *communication skills* (10 marks), *teaching techniques employed* (10 marks), and *classroom interactions* (10).

Mapping with course learning outcome: CLO1 and CLO2

Course Code: UNI.753

Course Title: Curriculum, Pedagogy and Evaluation

L	T	P	Credit
1	0	0	1

Course Learning Outcomes (CLO):

After completion of the course, scholars shall be able to:

CLO1: analyze the principles and bases of curriculum design and development

CLO2: examine the processes involved in curriculum development

CLO3: develop the skills of adopting innovative pedagogies and conducting students' assessment

CLO4: develop curriculum of a specific course/programme

Unit/hours	Content	Mapping with CLO
Unit I/4 hours	Bases and Principles of Curriculum Curriculum: Concept and Principles of curriculum development, Foundations of Curriculum Development. Types of Curriculum Designs- Subject centered, learner centered, experience centered and core curriculum. Designing local, national, regional and global specific curriculum. Choice Based Credit System and its implementation.	CLO1
Unit II/4 hours	Curriculum Development Process of Curriculum Development: Formulation of graduate attributes, course/learning outcomes, content selection, organization of content and learning experiences, transaction process. Comparison among Interdisciplinary, multidisciplinary and trans-disciplinary approaches to curriculum.	CLO2

Unit hours	III/3	Curriculum and Pedagogy Conceptual understanding of Pedagogy. Pedagogies: Peeragogy, Cybergogy and Heutagogy with special emphasis on Blended learning, Flipped learning, Dialogue, cooperative and collaborative learning Three e- techniques: Moodle, Edmodo, Google classroom	CLO3
Unit hours	IV/4	Learners' Assessment Assessment Preparation: Concept, purpose, and principles of preparing objective and subjective questions. Conducting Assessment: Modes of conducting assessment – offline and online; use of ICT in conducting assessments. Evaluation: Formative and Summative assessments, Outcome based assessment, and scoring criteria.	CLO4

Transaction Mode

Lecture, dialogue, peer group discussion, workshop

Evaluation criteria

There shall be an end term evaluation of the course for 50 marks for duration of 2 hours. The course coordinator shall conduct the evaluation.

Suggested Readings

- Allyn, B., Beane, J.A., Conrad, E.P., & Samuel J.A., (1986). *Curriculum Planning and Development*. Boston: Allyn & Bacon.
- Brady, L. (1995). *Curriculum Development*. Prentice Hall: Delhi. National Council of Educational Research and Training.
- Deng, Z. (2007). Knowing the subject matter of science curriculum, *Journal of Curriculum Studies*, 39(5), 503-535. <https://doi.org/10.1080/00220270701305362>
- Gronlund, N.E. & Linn, R.L. (2003). *Measurement and Assessment in teaching*. Singapore: Pearson Education
- McNeil, J.D. (1990). *Curriculum: A Comprehensive Introduction*, London: Scott, Foreman/Little
- Nehru, R.S.S. (2015). *Principles of Curriculum*. New Delhi: APH Publishing Corporation.
- Oliva, P.F. (2001). *Developing the curriculum* (Fifth Ed.). New York, NY: Longman
- Stein, J. and Graham, C. (2014). *Essentials for Blended Learning: A Standards-Based Guide*. New York, NY: Routledge.

Web Resources

- https://www.westernsydney.edu.au/_data/assets/pdf_file/0004/467095/Fundamentals_of_Blended_Learning.pdf
- <https://www.uhd.edu/academics/university-college/centers-offices/teaching-learning-excellence/Pages/Principles-of-a-Flipped-Classroom.aspx>
- <http://leerwegdialoog.nl/wp-content/uploads/2018/06/180621-Article-The-Basic-Principles-of-Dialogue-by-Renate-van-der-Veen-and-Olga-Plokhooij.pdf>