

CENTRAL UNIVERSITY OF PUNJAB



Ph.D. (Food Science and Technology)

Batch 2025-26

**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.709	Seminar	2	0	0	2
5	FST.752	Teaching Assistantship	0	0	2	1
6	UNI.753	Curriculum, Pedagogy and Evaluation	1	0	0	1
		Total	13	0	2	14

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

Course Name: Research Methodology and Computer Applications

Course Code: FST.701

Total Hours-60

L	T	P	Credits
4	0	0	4

Course Learning Outcomes (CLO):

Students will be able to:

CLO 1: Critically analyse, 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: Apricate 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 good of a 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
Unit 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. Learning activity: Seminars and group discussions on topics	CLO1 and CLO2
Unit 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	CLO3 and CLO4

	during research, consent. Animal handling/testing, Animal experimental models and animal ethics. Perspectives and methodology & 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. Learning activity: Seminars and group discussions on topics of good lab practices and research ethics	
Unit III/15 hours	Computer Application and Biostatistics: Spreadsheet, Presentation, Image processing and Reference Management software. Internet browsers, World Wide Web: Origin and concepts, internet and its application for quality literature collection and secondary data related to research work. Exploring websites, search engines and Cloud computing. Statistical packages and their applications (Graphpad, Prism, SPSS). Statistical tests: Student's t-test, Paired t-test, Mann-Whitney U-test, Wilcoxon signed-rank, One-way and two-way analysis of variance (ANOVA), Critical difference (CD), Fisher's LSD (Least significant difference), Kruskal-Wallis one-way ANOVA by ranks, Friedman two-way ANOVA by ranks, Chi-square test. Regression and correlation. Learning activity: Exercise on application of computers and biostatistics in research	CLO5 and CLO6
Unit IV/15 hours	Bioinformatics: Biological databases (DNA/RNA/Protein; Predicting features of individual residues), Alignment tools, BLAST, FASTA, multiple sequence alignment, Pathway and molecular interactions, Primers designing (degenerative and gene specific primers), Genome projects (human, <i>Arabidopsis</i> and other genome projects), NCBI, UCSC and other database searches. <i>In silico</i> approaches for drug designing, Virtual and Quantitative Screening, identification of cell types epitopes for vaccine designing. Learning activity: Group discussions and exercise application of bioinformatics	CLO7 and CLO8

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.

Transactional Modes:

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

L	T	P	Cr
2	0	0	2

Course Name: Research and Publication Ethics

Course Code: FST.751

Total Hours-30

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	CLO1

	• Introduction to Philosophy: definition, nature and scope, content, branches • Ethics: definition, moral philosophy, nature of 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 Journal Citation Report, SNIP, SJR, IPP, Cite Score; Metrics: h-index, g-index, i10 index, almetrics	CLO4
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Course Name: Advances in Food Processing Technology

Course Code: FST.708

Total Hours-60

L	T	P	Cr
4	0	0	4

Course Learning Outcome (CLO):

This course will make students able:

CLO 1: To compare novel and traditional technologies of Food Processing.

CLO 2: To apply various advanced processing/preservation techniques for quality improvement of foods.

CLO 3: To analyse the effect of advanced preservation techniques on processed foods

CLO 4: To recommend novel techniques/methods for preservation of foods.

Unit/hours	Content	Mapping with CLO
Unit I/15 hours	Membrane Technology: Micro-filtration, Ultra-filtration and their application; Nano-filtration and Reverse Osmosis and their application. Learning activity: Seminars and group discussions on membrane technology applications in food processing and research	CLO1 and CLO2
Unit II/15 hours	Nanotechnology: Principles and Applications in Foods Electrical Resistance Heating of foods; Irradiation for food processing High Pressure processing: Concept; Equipment for HPP Treatment, Mechanism of Microbial Inactivation and its Application in Food Processing. Learning activity: Seminars and group discussions on nanotechnology application in food processing and research	CLO1 and CLO2
Unit III/15 hours	Novel non-thermal food processing technologies: Supercritical Fluid Extraction and its Application; Principles and Applications of Hurdle Technology; Ultrasonic Processing: Properties of Ultrasonic, Application of Ultrasonic in Food Processing; High Voltage Pulse Techniques in Food Processing.	CLO3 and CLO4

	Learning activity: Seminars and group discussions on novel processing technologies in food processing	
Unit IV/15 hours	Advanced food packaging: Biodegradable Food Films and Coatings and Applications; Intelligent packaging; Smart packaging; Antimicrobial packaging; CAS, MAS Learning activity: Seminars and group discussions on advancements in food applications	CLO3 and CLO4

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.709

Course Title: Seminar

L	T	P	Cr
2	0	0	2

Course Learning Outcome (CLO):

CLO1: After the completion of the course students will be able to survey literature, write clear and concise technical reports and communicate concise technical presentation based on constructive criticism effectively

Transactional Modes:

Mode of transaction shall be Lecture-cum-demonstration, dialogue/discussion, etc.

Evaluation criteria:

Seminars shall be evaluated as detailed below:

Continuous Assessment

Innovation in idea 20

Interaction with Supervisor 20

Attendance 10

Assessment of end term evaluation

Report : 15 marks

Content : 10 marks

Presentation skills : 15 marks

Responses to queries : 10 marks

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

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

L	T	P	Credit
1	0	0	1

Unit/hours	Content	Mapping with CLO
Unit I/4 hours	Bases and Principles of Curriculum 1. Curriculum: Concept and Principles of curriculum development, Foundations of Curriculum Development. 2. 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	II Curriculum Development 1. Process of Curriculum Development: Formulation of graduate attributes, course/learning outcomes, content selection, organization of content and learning experiences, transaction process. 2. Comparison among Interdisciplinary, multidisciplinary and trans-disciplinary approaches to curriculum.	CLO2

Unit III/3 hours	Curriculum and Pedagogy 1. Conceptual understanding of Pedagogy. 2. Pedagogies: Peeragogy, Cybergogy and Heutagogy with special emphasis on Blended learning, Flipped learning, Dialogue, cooperative and collaborative learning 3. Three e- techniques: Moodle, Edmodo, Google classroom	CLO3
Unit IV/4 hours	Learners'Assessment 1. Assessment Preparation: Concept, purpose, and principles of preparing objective and subjective questions. 2. Conducting Assessment: Modes of conducting assessment – offline and online; use of ICT in conducting assessments. 3. 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>

