

FACULTY OF SCIENCES

SYLLABUS

FOR

Pre Ph.D. Course in FOOD TECHNOLOGY

(Credit Based Evaluation & Grading System)

Examinations: 2019-20



GURU NANAK DEV UNIVERSITY

AMRITSAR

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PRE PH.D. COURSE IN FOOD TECHNOLOGY (CBE & GS)

Scheme:

Course No.	C/E/I	Course Title	Credits			Total Credits
			L	T	P	
LSL-901	C	Research Methodology	3	1	-	4
FTL-902	C	Advanced Food Analysis	3	-	-	3
FTL-903	C	Advances in Food Processing Technology	3	-	-	3
FTL-904 OR FTL-905	E	Advanced Fruits and Vegetables Processing Technology Or Advanced Cereal Science and Technology	3	-	-	3
FTP-906	A	Seminar	-	-	1	1
	I	Optional (Outside Department)	4	-	-	4

LSL-901 - Research Methodology**Credits 3-1-0****Mid Semester Examination: 20% weightage****End Semester Examination: 80% weightage****Instructions for the Paper Setters :**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Note: The course will be numerical oriented to train the students for the analysis of research data. Use of calculators will be allowed in the examination.

SECTION-A

1. **Descriptive statistics:** Statistical expressions, central tendency, dispersion of data (arithmetic and geometric), moments, skewness, kurtosis, sample size estimation.
2. **Probability:** Concept of probability, conditional probability, distributions: Normal, Poisson, binomial, 't', χ^2 , F-distributions.

SECTION-B

3. **Testing of hypothesis:** Central limit theorem, null hypothesis and alternative hypotheses, Z-test, Student's t-test, χ^2 -square, F-test, sample size, confidence intervals, odds ratio, index numbers, Probit analysis.
4. **Correlation and regression analysis:** Linear correlation and regression, exponential regression, logarithmic regression, reciprocal regression, Michael-Menten's regression, logistic regression, Gompertz regression, monomolecular regression.

SECTION-C

5. **Multiple correlation and regression:** MLR with 2 and 3 independent variables, quadratic and cubic polynomial regressions, Beta regression, sine curve, multiple correlation, partial correlation, path analysis, time series analysis.
6. **Experimental designs:** Experimental designs, central composite designs with 2 and 3 factors.

SECTION-D

7. **Analysis of Variance:** Assessing normality, one way and 2-way ANOVA, Tukey's multiple comparison test, HSD.
8. **Multivariate analysis:** Cluster analysis and dendrogram, principal component analysis, factor analysis, artificial neural networks.
9. **Non-parametric tests:** Wilcoxon's, Mann-Whitney's tests, Spearman's rank correlation, Kendall's Tau.
10. **Basic Greek and Latin words:** The students will learn Greek alphabet and more than 100 basic roots and words used in science.

Note: The students will be asked to submit an assignment of computer softwares designed by them on the basis of the Research methodology syllabus.

References:

1. Bailey, N.T.J. (1995). *Statistical Methods in Biology*. Cambridge University Press, Cambridge.
2. Kothari, C.R. (2004). *Research Methodology: Methods and Techniques*, New Age International Publishers, New Delhi.

FTL-902: ADVANCED FOOD ANALYSIS**Credits: 3-0-0****Mid Semester Examination: 20% weightage**
End Semester Examination: 80% weightage**Instructions for the Paper Setters :**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Applications of the following in the food analysis:

Microscopic techniques in Food Analysis: Scanning Electron Microscope, Transmission Electron microscopy, Laser particle size analysis.

SECTION-B

Thermal methods in food analysis: Differential scanning calorimetry, Differential Thermal Analysis.

Chromatographic methods in Food Analysis: Column, Size exclusion and ion exchange.

SECTION-C

High Performance Liquid Chromatography, Gas Liquid Chromatography.

Visible and Ultraviolet Spectroscopy, FTIR Spectroscopy.

Flame Photometry and Atomic Absorption Spectroscopy.

SECTION-D

X-ray methods: Diffraction, Fluorescence.

Electrophoresis, Capillary Zone Electrophoresis.

Nuclear Magnetic Resonance.

Suggested Readings:

1. Clifton M & Pomeranz Y. 1988. Food Analysis - Laboratory Experiments. AVI Publ.
2. Gruenwedel, DW & Whitaker JR. 1984. Food Analysis Principles and Techniques. Vol. I. Physical Characterization. Marcel Dekker.
3. Gruenwedel DW & Whitaker JR. 1984. Food Analysis Principles and Techniques. Vol. II. Physicochemical Techniques. Marcel Dekker.
4. Gruenwedel DW & Whitaker JR. 1984. Food Analysis Principles and Techniques. Vol. III. Biological Techniques. Marcel Dekker.
5. Gruenwedel DW & Whitaker JR. 1984. Food Analysis Principles and Techniques. Vol. IV. Separation Techniques. Marcel Dekker.
6. Leenheer AP, Lambert WE & van Bocxlaer JF. 2000. Modern Chromatographic Analysis of Vitamins. 3rd Ed. Marcel Dekker.
7. Nollet LML. 1986. Handbook of Food Analysis. Vol. I., Marcel Dekker.
8. Pomeranz and Clifton. Food Analysis. Theory and Practice 3rd Ed. Chapman and Hall, New York.

FTL-903: ADVANCES IN FOOD PROCESSING TECHNOLOGY**Credits: 3-0-0****Mid Semester Examination: 20% weightage****End Semester Examination: 80% weightage****Instructions for the Paper Setters :**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Microwave and Radio Frequency Processing: Mechanism of Heat Generation, Applications in Food Processing: Microwave Blanching, Sterilization and Finish Drying. High Pressure processing: Concept, Equipments for HPP Treatment, Mechanism of Microbial Inactivation and its Application in Food Processing. Aseptic Processing-methods of sterilization, aseptic packaging systems.

SECTION-B

Nanotechnology: Principles and Applications in Foods. Electrical Resistance Heating of foods. Membrane Technology: Micro-filtration, Ultra-filtration and their application.

SECTION-C

Nano-filtration and Reverse Osmosis and their application. Supercritical Fluid Extraction and its Application. Principles and Applications of Hurdle Technology.

SECTION-D

Ultrasonic Processing: Properties of Ultrasonic, Application of Ultrasonic in Food Processing. High Voltage Pulse Techniques in Food Processing. Biodegradable Food Films and Coatings and Applications.

Suggested Readings:

1. Barbosa-Canovas 2002. Novel Food Processing Technologies. CRC.
2. Dutta AK & Anantheswaran RC.1999. Hand Book of Microwave Technology for Food Applications.
3. Frame ND. (Ed.). 1994. The Technology of Extrusion Cooking. Blackie.
4. Gould GW. 2000. New Methods of Food Preservation. CRC.
5. Shi J. (Ed.). 2006. Functional Food Ingredients and Nutraceuticals: Processing Technologies. CRC.
6. Gibson GR & William CM. 2000. Functional Foods - Concept to Product.
7. Goldberg I. 1994. Functional Foods: Designer Foods, Pharma Foods
8. Robert EC. 2006. Handbook of Nutraceuticals and Functional Foods. 2nd Ed. Wildman.

FTL-904: ADVANCED FRUITS AND VEGETABLES PROCESSING TECHNOLOGY**Credits: 3-0-0****Mid Semester Examination: 20% weightage****End Semester Examination: 80% weightage****Instructions for the Paper Setters :**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Present status of fruits and vegetables processing in India & world.
Prospects of future growth in fruits and vegetables processing in India.
Fresh Fruits & Vegetable Handling: Post-harvest physiology.

SECTION-B

Pre-packaging of fresh fruits and vegetables.
Modern techniques such as MAP, Ionizing Irradiation, growth hormones etc to enhance shelf life of fresh fruit and vegetable.

Fruits and Vegetables Processing Techniques: Advances in conventional canning, aseptic canning.

SECTION-C

Dehydration and freezing of fruits and vegetables.

Phyto-chemicals: Fruits and vegetables as a source of bioactive compounds.

SECTION-D

Fruit Juice Processing: General process and modern equipments. Application of membrane technology in clarification and concentration. Blending of fruit juices.

Cold chain: Importance of cold chain in food processing industry and retail chain.
Components of cold chain and integration.

Suggested Readings:

1. Yahia Elhadi M. (Editor). 2009. Modified and controlled atmospheres for transportation, storage and packaging of horticultural commodities. Recent advances. CRC Press (Taylor & Francis).
2. Lal G, Siddappa GS & Tandon GL. 1998. Preservation of Fruits and Vegetables. ICAR, New Delhi.
3. Nelson PE & Tressler DK. 1980. Fruit & Vegetable Juice Processing Technology. Vol. III. AVI Publishers New York.
4. Rangana S. 1989. Handbook of analysis of fruits and vegetables products. Tata McGraw Hills, New Delhi.
5. Levi, D.S., Kaminsky, P., Levi, E.S. 2000, Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies, McGraw-Hill, New York.
6. Wills, R.B.H., W.B. McGlasson, D. Graham, and D.C. Joyce. 2007. Postharvest- An introduction to the physiology and handling of fruit, vegetables and ornamentals. Fifth edition. CAB International, Wallingford, UK, 225 pp.
7. Somogyi LP et al. Processing fruits: science and technology. Vol. 1 and 2, Technomic Publishing Co. Inc, USA.

FTL-905: ADVANCED CEREAL SCIENCE AND TECHNOLOGY**Credits: 3-0-0****Mid Semester Examination: 20% weightage****End Semester Examination: 80% weightage****Instructions for the Paper Setters :**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Criteria of wheat and flour quality, structure and functional properties of gluten, wheat grain protein, starch, phytochemicals, dough chemistry, rheology, evaluation of flour quality by Farinograph, Mixograph, Extensogram, rapid visco analyzer, dynamic rheometry.

SECTION-B

Changes in physico-chemical, pasting and milling properties during aging of rice. Improving nutritional properties of rice by different methods. Manufacture of value added products such as zein from corn, processing of breakfast cereals from corn.

SECTION-C

Dietary fibre from barley and oats: glucan structure, extraction, physiological effects and functional properties.

Additives used in bakery products.

Staling of bread, partially baked bread, frozen dough.

Gluten free bread: celiac disease, use of different cereal flours, enzymes and optional ingredients to improve gluten free bread quality.

SECTION-D

Raw materials for extrusion cooking, ingredients, classification of materials for snack foods and breakfast cereals, processing of flakes (wheat, rice, corn). Functions of extrusion technology, different types of extruders, applications, pros and cons.

Suggested Readings:

1. Dendy DAV & Dobraszczyk BJ. 2001. Cereal and Cereal Products. Aspen.
2. Hosney RS. 1994. Principles of Cereal Science and Technology. 2nd Ed. AACC.
3. Kulp K & Ponte GJ. 2000. Handbook of Cereal Science and Technology. 2nd Ed. Marcel Dekker.
4. Lorenz KL. 1991. Handbook of Cereal Science and Technology. Marcel Dekker.
5. Marshall WE & Wadsworth JI. 1994. Rice Science and Technology. Marcel Dekker.
6. Pomeranz Y. 1987. Modern Cereal Science & Technology. VCH Publ.
7. Watson SA & Ramstad PE. 1987. Corn; Chemistry and Technology. AACC.
8. Pyler EJ. Bakery Science & Technology. 3rd Ed. Vols. I, II. Sosland Publ.
9. Frame ND. 1994. The Technology of Extrusion Cooking. Blackie Academic.
10. Gordon BR. 1997. Snack Food. AVI Publ.
11. Samuel AM. 1976. Snack Food Technology. AVI Publ.

FTP-906: SEMINAR

Credits: 0-0-1

Optional Subject from Other Department

Credits: 3-0-0