Pre-Ph.D. Courses (Food Science & Technology)

Total Contact Hours = 18 **Total Marks = 400** **Total Credits = 15**

		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MREM0-101	Research Methodology	3	1	-	40	60	100	4
PFOT1-101	Advances in Food Technology	3	1	-	40	60	100	4
PFOT1 -102	Journal Club and Report Writing	-	-	4	50	-	50	2
PFOT1 -103	Seminar	-	-	2	50	-	50	1
Departmental Electives (Choose any one subject)								
PFOT1-104	Advances in Cereal Technology	3	1	-	40	60	100	4
PFOT1-105	Advances in Fruits and Vegetable Processing Technology	3	1	-	40	60	100	4
Total	**Theory = 3 Lab = 2**	**9**	**3**	**6**	**220**	**180**	**400**	**15**

RESEARCH METHODOLOGY

Subject Code –MREM0-101 **L T P C** **Duration – 60 Hrs**
3 1 0 4

UNIT–I (15 Hrs.)

Introduction to Research: Meaning, Definition, Objective and Process.
Research Design: Meaning, Types - Historical, Descriptive, Exploratory and Experimental.
Research Problem: Necessity of Defined Problem, Problem Formulation, Understanding of Problem, Review of Literature.
Design of Experiment: Basic Principal of Experimental Design, Randomized Block, Completely Randomized Block, Latin Square, Factorial Design.
Hypothesis: Types, Formulation of Hypothesis, Feasibility, Preparation and Presentation of Research Proposal.

UNIT–II (15 Hrs.)

Sources of Data: Primary and Secondary, Validation of Data
Data Collection Methods: Questionnaire Designing, Construction.
Sampling Design & Techniques – Probability Sampling and Non Probability Sampling.
Scaling Techniques: Meaning & Types.
Reliability: Test – Retest Reliability, Alternative Form Reliability, Internal Comparison Reliability and Scorer Reliability.
Validity: Content Validity, Criterion Related Validity and Construct Validity.

UNIT–III (15 Hrs)

Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation.
Analysis of Data: Statistical Measure and Their Significance, Central Tendency, Dispersion, Correlation: Linear and Partial, Regression: Simple and Multiple Regression, Skewness, Time series Analysis, Index Number.
Testing of Hypothesis: T-test, Z- test, Chi Square, F-test, ANOVA.

UNIT – IV (15 Hrs.)

Multivariate Analysis: Factor Analysis, Discriminant Analysis, Cluster Analysis, Conjoint Analysis, Multi-Dimensional Scaling.
Report Writing: Essentials of Report Writing, Report Format.
Statistical Software: Application of Statistical Softwares like SPSS, MS Excel, Mini Tab or MATLAB Software in Data Analysis.
**Each Student has to Prepare Mini Research Project on Topic/ Area of their Choice and Make Presentation. The Report Should Consists of Applications of Tests and Techniques Mentioned in The Above UNITs*

Recommended Books:

1. R.I. Levin and D.S. Rubin, 'Statistics for Management', 7th Edn. Pearson Education New Delhi.
2. N.K. Malhotra, 'Marketing Research – An Applied Orientation', 4th Edn., Pearson Education New Delhi.
3. Donald Cooper, 'Business Research Methods', Tata McGraw Hill, New Delhi.
4. Sadhu Singh, 'Research Methodology in Social Sciences', Himalaya Publishers.
5. Darren George & Paul Mallery, 'SPSS for Windows Step by Step', Pearson Education, New Delhi

ADVANCES IN FOOD TECHNOLOGY

Subject Code – PFOT1-101 **L T P C** **Duration – 60 Hrs**
3 1 0 4

UNIT-I (15 Hrs)

Functional foods: different functional compounds and their health promoting effects
Nutraceuticals: sources, scope and challenges
Food fortification: methods and benefits
Food allergens: different allergens and their health effects
Food additives: different additives and their usage in foods

UNIT-II (16 Hrs)

Advances in food analysis techniques:
Spectroscopy: UV-Visible spectroscopy, Atomic absorption spectroscopy, Fourier Transform Infra-Red, Mass-spectroscopy
Methods of separation and analysis of biochemical compounds: Gas chromatography, HPLC
Thermal analysis of foods: Differential scanning calorimetry, Thermo gravimetric analysis
Rheological measurements in foods: RVA, rheometer and texture analyzer

UNIT-III (14 Hrs)

Non thermal processing techniques: Membrane technology, High intensity pulsed electric field, Irradiation, Microwave, High pressure processing in food industry; their principles, safety aspects and applications in food system.

UNIT-IV (15 Hrs)

Food packaging: Active packaging, controlled and modified packaging
Use of nanotechnology in food processing
National and international food standards and regulatory agencies

Reading Material Recommended

- Handbook of Food Preservation. 2nd Edition, Edited by: M. Shafiur Rahman. (2007). CRC Press.
- Food Allergens. Edited by: T. C. Velickovic and M. Gavrovic-Jankulovic. Springer.
- Food Fortification and Supplementation: Technological, Safety and Regulatory Aspects. Editor(s): P. Berry Ottaway, Berry Ottaway and Associates Ltd, UK.
- Pare, J. R. J. and Bélanger, J. M. R. (2015). Instrumental Methods of Food Analysis: Elsevier
- Nutraceuticals and Functional Foods. 2nd Edition, Edited by: Robert E.C. Wildman, CRC Press.
- Nanotechnology applications in food. 1st Edition, Edited by: A. E. Opera and A. Mihai. (2017). Elsevier.
- Nanotechnology Applications in Food Industry. 1st Edition, Edited by: V. R. Rai and J A Bai. (2018) CRC Press.
- Food Packaging: Principles and Practices. 3rd Edition, Edited by: G. L. Robertson (2012) Taylor and Francis.

JOURNAL CLUB AND REPORT WRITING

Subject Code – PFOT1-102 **L T P C** **Duration - 30 Hrs**
0 0 4 2

Essentials of Report and article writing: Search Engines, Research/Review paper writing, Introduction to Impact Factor, Indexing, Citations, Peer Review, h-index, i10-index, ISSN, Leading Science Publishers Referencing styles and Process of article submission.

Journal Club – Presentation of research problems and publications. Critical review of published articles.

Working knowledge of softwares like Minitab, SPSS etc.

Recommended Websites

1. www.google.com
2. www.ncbi.nlm.nih.gov/pubmed
3. www.sciencedirect.com
4. www.elsevier.co.in
5. www.wiley.com
6. www.thomsonreuters.com
7. www.benthamscience.com
8. www.scholar.google.co.in

SEMINAR

Subject Code – PFOT1-103 **L T P C** **Duration - 15 Hrs**
0 0 2 1

- Introduction, information and retrieval systems.
- Writing assignments and term papers.
- Reading/Presentation on areas/expertise/technology related to field of research.
- Organization and presentation of scientific material, research work, dissertations, patents etc.
- Skills in oral and technical presentations.

Each student has to present seminars during the semester.

ADVANCES IN CEREAL TECHNOLOGY

Subject Code – PFOT1-104 **L T P C** **Duration – 60 Hrs**
3 1 0 4

UNIT-I (14 Hrs)

Status of cereal processing industries in India
Significance of enzymes in cereals: sources and utilization
Pseudo cereals: processing and utilization

UNIT-II (14 Hrs)

Milling technology of wheat, rice, corn and minor millets: conventional and advanced techniques

UNIT-III (14 Hrs)

Role of wheat protein in dough and gluten; application of gluten, visco-elasticity
Equipments used in dough rheology: mixograph, Rapid visco analyzer, extensograph, alveograph, falling number apparatus, and texture analyzer.
Bread and biscuit making technology: process and techniques, variety of products
Breakfast cereals and other products of extrusion cooking

UNIT-IV (18 Hrs)

Extraction of starches from different botanical sources, native starch properties, types of starch modifications, food and non-food applications of starch,
Malt technology: Malting and brewing of barley

Reading Material Recommended

- Wheat Chemistry and Technology, 4th Edition, Edited by: K. Khan and P. R. Shewry, AACC.
- Rice Chemistry and Technology, 3rd Edition, Edited by: E. T. Champagne. AACC.
- Corn Chemistry and Technology, 2nd Edition, Edited by: P. J. White and L.A. Johnson, AACC.
- Technology of Cereals. 4th Edition, Edited by: N. L. Kent and A. D. Evers. (1994). Woodhead Publishing Ltd. England.
- Dough Rheology and Baked Product Texture, Edited by: H. Faridi and J.M. Faubion. Springer.
- Starch in Food, Edited by: Ann-Charlotte Eliasson, Woodhead Publications.
- Starches: Properties and Uses, Edited by: O. B. Wurzburg, CRC Press.
- Technology of Breadmaking, 3rd Edition, Edited by: S. Cauvain, Springer.
- Biscuit, Cookie and Cracker Production, 2nd Edition, Edited by: L. Davidson. Elsevier.
- Breakfast Cereals and How they are made? Edited by: R. B. Fast and E. F. Caldwell. AACC.

ADVANCES IN FRUITS AND VEGETABLE PROCESSING TECHNOLOGY

Subject Code – PFOT1-105 **L T P C** **Duration – 60 Hrs**
3 1 0 4

UNIT-I (15 Hrs)

Present status of fruits and vegetable processing in India & world. Prospects in fruits and vegetables processing in India.

UNIT-II (15 Hrs)

Fresh fruits & vegetable handling: Post-harvest physiology. Pre-packaging of fresh fruits and vegetables. Phyto-chemicals: fruits and vegetables as a source of bioactive compounds.

UNIT-III (15 Hrs)

Modern techniques such as MAP, Ionizing irradiation to enhance shelf life of fresh fruits and vegetables. Fruits and vegetables processing techniques: Advances in canning, aseptic canning, dehydration and freezing.

UNIT-IV (15 Hrs)

Fruit products processing: General process and modern equipments. Applications 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.

Reading Material Recommended

- Modified Atmosphere Packaging of Food. Edited by: O. O. Raikul, Springer.
- Controlled and Modified Atmosphere for Fresh and Fresh Cut Produce. 1st Edition, Edited by: M. Gil and R. B. Randolph. Elsevier.
- Preservation of Fruits and Vegetables. G. L. Siddappa and G. L. Tandon 1998. ICAR, New Delhi.
- The Preservation of Fruit and Vegetable Food Products, Edited by: S. D. Holdsworth. Spriger.
- Rangana S. 1989. Handbook of analysis of fruits and vegetables products. Tata McGraw Hills, New Delhi.
- Fruit and Vegetable Phytochemicals-Chemistry and Human Health, 2nd Edition, Edited by: E. M. Yahia, Wiley Blackwell.
- Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies. Edited by: D. S. Levi, P. Kaminsky and E. S. Levi. 2000, McGraw-Hill, New York.
- Food Canning Technology. Edited by: J. Larousse and B. E. Brown. Wiley-VCH.
- Food Irradiation Research and Technology, Edited by: C. H. Bommera and X. Fan. Wiley Blackwell Publishing.