Department of Food Science and Technology
Chaudhary Devi Lal University, Sirsa
Ph.D. Food Science and Technology
Scheme and Syllabi w.e.f. Session 2016-17

Type of course	Course code	Title of course	Teaching hours per week	Credits	Internal Assessment/ Evaluation	End term examination	Total	Duration of exam (Hrs.)
Core	FST-701	Research Methodology	4	4	30	70	100	3
Core	FST-702	Advances in Food Technology	4	4	30	70	100	3
Elective Discipline	FST-703	Advances in Cereal Technology	4	4	30	70	100	3
	FST-704	Advances in Fruits and Vegetables Processing Technology						
Total				12			**300**	

Open Elective Courses: For the student of Ph.D. Food Science and Technology

The student will earn minimum **two** credits by choosing some open elective course offered by the different department s in the university other than the Department of Food Science and Technology.

Open Elective Course: For the Student of other department of the university

The Department of Food science and Technology offer the following open elective course for the Ph.D. students of other departments of the university.

Type of course	Course Code	Title of Course	Teaching Hours per week	Credits	Internal Assessment / Evaluation	End term Examination	Total	Duration of Exam. (Hrs.)
Open elective	OEC-FST-700	Basic concepts in Food Technology	2	2	20	30	50	3

Total Credits & Marks

Semester	Credits	Marks
Core and Elective Courses	12	300
Open Elective Course	2	50
Grand Total	14	350

General instructions:

1. Each student will submit one assignment and present one presentation to the concerned teacher of the subject.
2. The ordinance (Choice Based Credit System) of the university shall be followed by the department.

Research Methodology
Paper Code: FST-701

Credits: 4
Periods per week: 4 Hrs.

Max. Marks: 70
Duration of Exam.: 3Hrs

Note: There are **nine** questions in all. Question No. 1 is compulsory, it consists of 5 short questions of 2 marks each. Students have to attempt **five** questions in all, selecting one question from each unit.

Unit I
Latest Research and Development in Food Science
Broad areas of research, ethics in research, plagiarism, Intellectual Property rights.

Unit II
Statistical Analysis and tools: Regression and Correlation Analysis, Duncan's multiple range teat, analysis of variance (ANOVA), standard deviation, use of statistical softwares like SPSS, Mintab etc, application of MS Excel, word and power point.

Unit III
Instrumentation: Differential scanning calorimeter, Chromatography- types and applications, Lyphollization techniques, Spectroscopy- types and applications, Electrophoresis, NMR spectroscopy, X-ray diffraction.

Unit IV
Report writing
Writing of scientific document, research citation, compilation of data and thesis.

TEXT / REFERENCE BOOKS:

- Pressman, Software Engineering – A Practitioner's Approach.
- Amos Gilat, MATLAB A Introduction with Applications – Willey student Edition.
- Multimedia: Making it work – Tay Vaughan – TMH 5th edition.
- J Banks: Discrete Time Simulation & Systems – PHI.

Advances in Food Technology
Paper code: FST-702

Credits: 4
Periods per week: 4 Hrs.

Max. Marks: 70
Duration of Exam.: 3Hrs

Note: There are **nine** questions in all. Question No. 1 is compulsory, it consists of 5 short questions of 2 marks each. Students have to attempt **five** questions in all, selecting one question from each unit.

Unit I
Functional foods and Nutraceuticals
Food fortification
Food allergens
Food additives

Unit II
Food infection and intoxication
Phytochemicals and proactive compounds in fruits and vegetables-health benefits

Unit III
Advances in food processing techniques
Non thermal processing techniques: Application, safety aspects of Membrane technology, High intensity Pulsed electric field, irradiation, microwave, high pressure processing in Food industry.

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

TEXT / REFERENCE BOOKS:

- Food Fortification and Supplementation: Technological, Safety and Regulatory Aspects Editor(s): P. Berry Ottaway, *Berry Ottaway and Associates Ltd, UK*
- Prebiotics and Probiotics Ingredients: Health benefits and food applications, Edited by Susan Sungsoo Cho, E. Terry Finocchiaro, CRC Press
- Nutraceuticals and Functional Foods, Second edition, Edited by Robert E.C. Wildman, CRC press

Advance in Cereal Technology
Paper code: FST-703

Credits: 4
Periods per week: 4 Hrs.

Max. Marks: 70
Duration of Exam.: 3Hrs

Note: There are **nine** questions in all. Question No. 1 is compulsory, it consists of 5 short questions of 2 marks each. Students have to attempt **five** questions in all, selecting one question from each unit.

Unit I
Status of cereal processing industries in India
Significance of enzymes in cereals

Unit II
Dry Milling Technology of wheat, rice and corn

Unit III
Rheology and chemistry of flours from cereals: Use of Rapid visco analyzer, differential scanning calorimeter, extensograph, alveograph, falling number apparatus, texture analyzer
Bread and biscuit making Technology: process and techniques, variety of products
Breakfast cereals and other products of extrusion cooking

Unit IV
Wet Milling: Separation of starch and gluten, extraction of starches from different botanical sources, Starch on the basis of amylose content, starch properties, types of starch modifications, food and non food applications of starch, application of gluten
Malt technology: Malting and brewing of barley
Industrial Uses of Cereals

TEXT / REFERENCE BOOKS:

- Rice Chemistry and Technology, 3rd Edition, Edited by Elaine T. Champagne (AACC).
- Wheat Chemistry and Technology, Fourth Edition, Edited by Khalil Khan and Peter R. Shewry (AACC).
- Corn Chemistry and Technology, 2nd Edition, Edited by: Pamela J. White and Lawrence A. Johnson (AACC).
- Technology of Cereals (4th Edition) Edited by: Kent, N.L; Evers, A.D. (1994). Woodhead Publishing Ltd. England.
- Starch in food, Ann-Charlotte Eliasson, Edited by: Woodhead Publications.
- Starches: Properties and uses, Edited by: Otto B. Wurzburg, CRC Press.
- Bread making: Improving quality. Edited by: Cauvain, S. P. (2003). Woodhead Publication Ltd. England.

Advances in Fruits and Vegetables Processing Technology
Paper code: FST-704

Credits: 4 **Max. Marks: 70**
Periods per week: 4 Hrs. **Duration of Exam.: 3Hrs**

Note: There are **nine** questions in all. Question No. 1 is compulsory, it consists of 5 short questions of 2 marks each. Students have to attempt **five** questions in all, selecting one question from each unit.

UNIT I

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

UNIT II

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

Modern techniques such as MAP, Ionizing Irradiation, to enhance shelf life of fresh fruit and vegetable. Fruits and Vegetables Processing Techniques: Advances in conventional canning, aseptic canning, dehydration and freezing.

UNIT IV

Fruit product 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.

TEXT / REFERENCE BOOKS:

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 McGrow 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.

Open Elective Course

Basic concepts in Food Technology
Paper code: OEC-FST-700

Credits: 2
Periods per week: 2 Hrs.

Max. Marks: 50
Duration of Exam.: 3Hrs

Note: There are **nine** questions in all. Question No. 1 is compulsory, it consists of 5 short questions of 2 marks each. Students have to attempt **five** questions in all, selecting one question from each unit.

UNIT I
Nutraceuticals and functional foods: classification, sources, properties, functions, scope & future prospectus.

UNIT II
Food infection and intoxication
Phytochemicals and proactive compounds in fruits and vegetables-health benefits

UNIT III
Instrumentation in food analysis: Spectroscopy, Chromatography, Texture analyzer, Differential scanning calorimetry and Rheology instruments.

UNIT IV
Food packaging: types, factors affeting selection of a food package, functions.
Active food packaging, Aseptic packaging.
Food package safety, package labeling, recycling of packaging materials.

TEXT / REFERENCE BOOKS:

1. Mazza, G (1988). Functional foods–biochemical and processing aspects, Technomic Publ. Lancaster, USA.
2. Wildman, REC (2007) Handbook of nutraceuticals and functional foods.
3. Pomeranz , Y. & Mrloan (1978) . *Food Analysis : Theory and Practice , Westport,* connectiant :
4. Birk, G.G., Herman, J.G. and Parker, K.J. Ed. -1977. Sensory Properties of Foods. Applied Science, London.
5. Sacharow, S. and Griffin, R. C. (1980) *Principles of food packaging,* 2nd Ed., Avi,Publication Co.Westport, Connecticut, USA.
6. Rooney, M.L (1995) *Active Food Packaging*, Blackie Academic & Professional, Glasgow, UK,
7. Bakker, M. (1986) *The Wiley Encyclopaedia* of Packaging Technology, john Willey Sons.inc: New York.