

**REVISED UG SYLLABUS UNDER CBCS
(Implemented from Academic Year 2020-21) PROGRAMME: FOUR YEAR B.Sc.,**

**Domain Subject: Food Technology
Skill Enhancement Courses (SECs) for Semester V, from 2022-23(Syllabus-Curriculum)**

**Structure of SECs for Semester-V
(To choose One pair from the Four alternate pairs of SECs)**

Univ.Co de	Courses6 &7	Name ofCourse	Th.Hrs. / Week	IE Mar-ks	EE Mar- ks	Credits	Prac.Hr s/ Wk	Mar-ks	Credits
	6A	Technology of Fruits, Vegetablesand Plantation Crops	4	25	75	4	2	50	1
	7A	Technology of Cereals, Pulses and Oil Seeds	4	25	75	4	2	50	1

OR

	6B	Nutraceuticals and Functional Foods	4	25	75	4	2	50	1
	7B	Food Plant Sanitation	4	25	75	4	2	50	1

OR

	6C	Entrepreneurship Development and Food Product Development	4	25	75	4	2	50	1
	7C	Technology of Food Preservation	4	25	75	4	2	50	1

Semester-wise Revised Syllabus under CBCS, 2020-21

Four-year B.Sc.

Domain Subject: Food Technology III Year B. Sc., Semester– V

Course6: 6A-Technology of Fruits, Vegetables and Plantation Crops

(Skill Enhancement Course (Elective), 05 Credits)

Max Marks: Theory: 100 +Practical: 50

THEORY

Out comes

1. To impart knowledge of different methods of fruits and vegetable processing.
2. To learn about processing of various spices, tea, coffee and cocoa.

I. **Syllabus:** (Total Hours: 90 including Teaching, Lab, Field Training and unit tests etc.)

CONTENTS

UNIT1 INTRODUCTION (3 Lectures)

Importance of fruits and vegetable, history and need of preservation, reasons of spoilage, method of preservation (short & long term).

UNIT2 CANNING AND BOTTLING OF FRUITS AND VEGETABLES (8 Lectures)

Selection of fruits and vegetables, process of canning, factors affecting the process- time and temperature, containers of packing, lacquering, syrups and brines for canning, spoilage in canned foods.

UNIT3 FRUITS BEVERAGES (7 Lectures)

Introduction, Processing of fruit juices (selection, juice extraction, deaeration, straining, filtration and clarification), preservation of fruit juices (pasteurization, chemically preserved with sugars, freezing, drying, tetra-packing, carbonation), processing of squashes, cordials, nectars, concentrates and powder.

UNIT4 JAMS, JELLIES AND MARMALADES (6 Lectures)

Introduction, Jam: Constituents, selection of fruits, processing & technology, Jelly: Essential constituents (Role of pectin, ratio), Theory of jelly formation, Processing & technology, defects in jelly, Marmalade: Types, processing & technology, defects.

UNIT 5 PICKELS, CHUTNEYS AND SAUSES (5 Lecturers)

Processing, Types, Causes of spoiling in pickling

UNIT: 6 TOMATO PRODUCTS (4 Lectures)

Selection of tomatoes, pulping & processing of tomato juice, tomato puree, paste, ketchup, sauce and soup.

UNIT: 7 DEHYDRATION OF FOODS AND VEGETABLES (4 Lectures)

Sun drying & mechanical dehydration, process variation for fruits and vegetables, packing and storage.

UNIT: 8 SPICES TECHNOLOGY OF PLANTATION PRODUCTS: (6Lectures)

Processing and properties of major and minor spices, essential oils&oleoresins, adulteration.

UNIT: 9 TEA, COFFEE AND COCOA

(5Lectures)

Processing, Variety and Products.

TECHNOLOGY OF FRUITS, VEGETABLES AND PLANTATION CROPS

PRACTICAL

1. Estimation of total soluble solids (TSS).
2. Estimation of pH and acidity of products.
3. Estimation of brix:acidity ratio
4. Estimation of ascorbic acid and effect of heat treatment on it.
5. To study the steps of can making process.
6. Preparation and evaluation of pectin products.
7. Adulteration of spices.
8. Dehydration of fruits and vegetables.
9. Rehydration of fruits and vegetables.

Recommended Readings

1. Girdharilal, Siddappaa, G.S and Tandon, G.L.1998. Preservation of fruits & Vegetables, ICAR, New Delhi
2. W B Crussess.2004. Commercial Unit and Vegetable Products, W.V. Special Indian Edition, Pub: Agro bios India
3. Manay, S.&Shadaksharaswami,M.2004.Foods:Factsand Principles, New Age Publishers
4. Ranganna S.1986. Handbook of analysis and quality control for fruits and vegetable products, TataMc Graw-Hill publishing company limited, Second edition.
5. Srivastava, R.P. and Kumar, S. 2006. Fruits and Vegetables Preservation- Principles and Practices.3rd Ed. International Book Distributing Co.

II. Co-Curricular Activities:

a) Mandatory:*(Training of students by teacher on field related skills: 15hrs)*

1. **For Teacher:** Training of students by teacher in laboratory and field for a total of 15 hours on processing of canning, processing of fruit juices, pickles, pasteurization techniques, preservation techniques like freezing drying and making of jams and jellies
2. **For Student:** Individual visit to a local processing center or related field or to a laboratory in a university/research organization/private sector and study of processing practices. Submission of a hand-written Fieldwork Report not exceeding 10 pages in the given format.
3. Max marks for Field Work Report: 05.
Suggested Format for Field work: *Title page, student details, content page, introduction, work done, findings, conclusions and acknowledgements.*
4. Unit tests (IE).

b) Suggested Co-Curricular Activities

1. Training of students by related industrial experts.
2. Assignments (including technical assignments like identifying tools in processing, drying of vegetables, fruits and spices with safety and security. Plant biotechnology and their handling,

operational techniques with safety and security, IPR)

3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on tools and techniques in processing of vegetables, fruits and spices
5. Collection of material/figures/photos related to technology of fruits, vegetables and crop plants, writing and organizing them in a systematic way in a file.
6. Visits to fruit and vegetables processing centers research organization etc. plant tissue culture/biotechnology facilities, firms, research organizations etc.
7. Invited lectures and presentations on related topics by field/industrial experts.

III. Suggested Question Paper Pattern:

Max.Marks:75

Time:3 hrs

SECTION-A (Total: 15 Marks)

Very Short Answer Questions (10Marks:5 x2)

SECTION-B (Total: 5x5=25Marks)

**(Answer any four questions. Each answer carries 5 marks
(Atleast1 question should be given from each Unit)**

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SECTION-C (Total: 4x10 = 40 Marks)

**(Answer any four questions. Each answer carries 10 marks
(Atleast 1question should be given from each Unit)**

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Suggested Question Paper Model for Practical Examination
Semester–V Food Technology–6 (Skill Enhancement Course)
Technology of Vegetables, Fruits, and Plantation Products

Max.Time: 3Hrs.

Max. Marks: 50

1. Demonstration of a sterilization technique ‘A’ 8 M
 2. Preparation of MS medium ‘B’ 8M
 3. Demonstration of callus culture technique/growth measurements ‘C’ 12 M

 4. Scientific observation and data analysis 4 x 3 =12 M
 - A. Tissue culture equipment/photograph
 - B. Morphogenesis or organogenesis-photograph
 - C. Bioreactor/Secondary metabolite
 - D. Transgenic plant/photograph
 5. Record+Viva-voce 6+4 =10M
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7A. TECHNOLOGY OF CEREALS, PULSES AND OIL SEEDS

(CREDITS: (THEORY– 4; PRACTICAL- 1)

UNIT: 1 INTRODUCTION

(2lectures)

Wheat--Types, milling, flour grade, flour treatments (bleaching, maturing), flour for various purposes, Products and By-products. (7lectures)

Rice–Physicochemical properties, milling (mechanical solvent extraction), parboiling, ageing of rice, utilization of byproducts. (6 lectures)

Corn – Milling (wet & dry), cornflakes, corn flour (4 lectures)

Barley- Milling (pearl barley, barley flakes & flour) (3 lectures)

Oats – Milling (oatmeal, oat flour&oat flakes) (3 lectures)

Sorghum and millets – Traditional & commercial milling (dry&wet) (4 lectures)

Rye and triticale—milling (flour), uses

UNIT: 2 TECHNOLOGY OF PULSES (4lectures)

Milling of pulses, Dry milling, Wet milling, improved milling method

UNIT: 3 TECHNOLOGY OF OIL SEEDS (9lectures)

Introduction, Extraction of oil and refining, Sources of protein (defatted flour, protein concentrates and isolates), properties and uses, protein texturization, fibrespinning

UNIT: 4 ALCOHOLIC BEVERAGES (4lectures)

Beer, Wine, Distilled Spirits

TECHNOLOGY OF CEREALS, PULSES AND OIL SEEDS

PRACTICAL

CONTENTS

1. Physical characteristics of Wheat.
2. Estimation of Gluten Content of flour.
3. Estimation of Pelenske Value of flour.
4. Estimation of Potassium Bromate in flour.
5. Fermenting power of yeast.
6. Physical Characteristics of Rice and paddy.
7. Cooking characteristics of rice.
8. Determination of sedimentation power of flour

Recommended Readings:

1. Kent, N.L.2003. Technology of Cereal, 5th Ed.Pergamon Press.
2. Chakraverty.1988.Post Harvest Technology of Cereals, Pulses and Oil seeds, revised Ed., Oxford & IBH Publishing Co. Pvt Ltd.
3. Marshall, Rice Science and Technology.1994.Wadsworth Ed., Marcel Dekker, New York.
4. Manay.S. and Sharaswamy, M.1987. Food Facts and Principles. Wiley Eastern Limited.

IV. Co-Curricular Activities:

c) Mandatory: *(Training of students by teacher on field related skills: 15hrs)*

5. **For Teacher:** Training of students by teacher in laboratory and field for a total of 15hours on physical characteristics of cereals, pulses, procedures of milling, fermentation of yeast, oil extraction and refining procedures, Etc
6. **For Student:** Individual visit to a local plant tissue culture facility or related field or to a laboratory in a university/research organization/private sector and study of different techniques in technology of cereals, pulses and oil seeds and submission of a hand-written Fieldwork Report not exceeding 10 pages in the given format.
7. Max marks for Field Work Report: 05.
8. Suggested Format for Field work: *Title page, student details, content page, introduction, work done, findings, conclusions and acknowledgements.*
9. Unit tests (IE).

d) Suggested Co-Curricular Activities

8. Training of students by related industrial experts.
9. Assignments (including technical assignments like identifying tools in milling
10. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
11. Preparation of videos on tools and techniques in milling of different millets
12. Collection of material/figures/photos related to technology of cereals, pulses and oil seeds, writing and organizing them in a systematic way in a file.
13. Visits to oil extraction and refining industries and beer and wine manufacturing industries
14. Invited lectures and presentations on related topics by field/industrial experts.

**V. Suggested Question Paper Pattern:
TECHNOLOGY OF CEREALS, PULSES AND OIL SEEDS**

Max.Marks:75

Time:3 hrs

SECTION - A (Total: 15 Marks)

Very Short Answer Questions (10Marks:5 x2)

SECTION - B (Total: 5x5=25Marks)

**(Answer any four questions. Each answer carries 5 marks
(Atleast 1 question should be given from each Unit)**

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SECTION – C (Total: 4x10 = 40 Marks)

**(Answer any four questions. Each answer carries 10 marks
(Atleast 1 question should be given from each Unit)**

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Suggested Question Paper Model for Practical Examination
Semester-V Food Technology-6 (Skill Enhancement Course)
TECHNOLOGY OF CEREALS, PULSES AND OIL SEEDS

Max.Time: 3Hrs.

Max. Marks: 50

1. Demonstration of a sterilization technique 'A' 8 M
 2. Preparation of MS medium 'B' 8M
 3. Demonstration of callus culture technique/growth measurements 'C' 12 M
 4. Scientific observation and data analysis 4 x 3 =12 M
 - a. Tissue culture equipment/photograph
 - b. Morphogenesis or organogenesis-photograph
 - c. Bioreactor/Secondary metabolite
 - d. Transgenic plant/photograph
 5. Record+Viva-voce 6+4 =10M
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6B: NUTRACEUTICALS AND FUNCTIONAL FOODS

(CREDITS: THEORY – 4; PRACTICAL - 1)

THEORY

Outcomes:

- To develop comprehensive understanding of different nutraceuticals and functional foods
- To understand the potential of various functional foods in promoting human health

CONTENTS

Unit 1: Introduction (8 lectures)

Background, status of nutraceuticals and functional food market, definitions, difference between nutraceuticals and functional foods, types of nutraceutical compounds and their health benefits, current scenario.

Unit 2: Nutraceuticals (17 lectures)

Types of nutraceutical compounds – Phytochemicals, phytosterols and other bioactive compounds, peptides and proteins, carbohydrates (dietary fibers, oligosaccharides and resistant starch), prebiotics, probiotics and symbiotic, lipids (Conjugated Linoleic Acid, omega-3 fatty acids, fat replacers), vitamins and minerals; their sources and role in promoting human health.

Unit 3: Functional Foods (17 lectures)

Cereal and cereal products, Milk and milk products, egg, oils, meat and products, sea foods, nuts and oilseeds, functional fruits and vegetables, herbs and spices, beverages (tea, wine etc), Fermented foods – their health benefits and role in conditions like cardiovascular diseases, hypertension, diabetes etc. Future prospects of functional foods and nutraceuticals and their potential for use in improving health. Development in processing of functional foods. Formulation and fabrication of functional foods.

Unit 4: Legal Aspects (6 lectures)

Stability of nutraceuticals. Safety, Consumer acceptance and assessment of health claims, labeling, marketing and regulatory issues related to nutraceuticals and functional foods.

Recommended readings:

1. Wildman REC, Handbook of Nutraceutical and Functional Foods, CRC Press 2001
2. Ghosh D et al, Innovations in Healthy and Functional Foods, CRC Press 2012
3. Pathak YV, Handbook of nutraceuticals Volume 2, CRC Press 2011
4. 4. Various journals of food technology, food science and allied subjects.

NUTRACEUTICALS AND FUNCTIONAL FOODS

PRACTICAL

CONTENTS

1. Identification of various nutraceuticals and functional foods available in the market
2. Estimation of chlorophyll content of green vegetable
3. Determination of lycopene in fruit/vegetable
4. Determination of total pectin in plant material
5. Estimation of crude fiber/dietary fibre content in cereals and their products
6. Estimation of anthocyanins in food sample
7. Preparation and evaluation of probiotic/prebiotic foods

Recommended Readings

Ranganna S.1986. Handbook of analysis and quality control for fruits and vegetable products, Tata McGraw-Hill publishing company limited, Second edition.

VI. Co-Curricular Activities:

e) **Mandatory:** *(Training of students by teacher on field related skills: 15hrs)*

10. **For Teacher:** Training of students by teacher in laboratory and field for a total of 15hours on identification of different nutraceuticals and functional foods, preparation of probiotics or prebiotic food, Development in processing of functional foods. Formulation and fabrication of functional foods. sterilization
11. **For Student:** Individual visit to a local plant tissue culture facility or related field or to a laboratory in a university/research organization/private sector and study nutraceuticals and functional foods. Submission of a hand-written Fieldwork Report not exceeding 10 pages in the given format.
12. Max marks for Field Work Report: 05.
13. Suggested Format for Field work: *Title page, student details, content page, introduction, work done, findings, conclusions and acknowledgements.*
14. Unittests (IE).

f) **Suggested Co-Curricular Activities**

15. Training of students by related industrial experts.
16. Assignments (including technical assignments like identifying tools in different types of nutraceutical compounds and functional foods and identifying their importance
17. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
18. Preparation of videos on tools and techniques in nutraceuticals and functional foods.
19. Collection of material/figures/photos related to nutraceuticals and functional foods, writing and organizing them in a systematic way in a file.
20. Visits to market and super markets
21. Invited lectures and presentations on related topics by field/industrial experts.

VII. Suggested Question Paper Pattern:

Max.Marks:75

Time:3 hrs

SECTION – A (Total: 15 Marks)

Very Short Answer Questions (10 Marks: 5x2)

SECTION - B (Total: 5x5=25Marks)

**(Answer any four questions. Each answer carries 5 marks
(Atleast1 question should be given from each Unit)**

1.	
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SECTION – C (Total: 4x10 = 40 Marks)

**(Answer any four questions. Each answer carries 10 marks
(Atleast1 question should be given from each Unit)**

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Suggested Question Paper Model for Practical Examination
Semester–V Food Technology–6 (Skill Enhancement Course)
NUTRACEUTICALS AND FUNCTIONAL FOODS

Max.Time: 3Hrs.

Max. Marks: 50

- | | | |
|----|---|-------------|
| 1. | Demonstration of a sterilization technique ‘A’ | 8 M |
| 2. | Preparation of MS medium ‘B’ | 8M |
| 3. | Demonstration of callus culture technique/growth measurements ‘C’ | 12 M |
| 4. | Scientific observation and data analysis | 4 x 3 =12 M |
| | a. Tissue culture equipment/photograph | |
| | b. Morphogenesis or organogenesis-photograph | |
| | c. Bioreactor/Secondary metabolite | |
| | d. Transgenicplant/photograph | |
| 5. | Record+Viva-voce | 6+4 =10M |

7B: FOOD PLANT SANITATION

(CREDITS: THEORY –4; PRACTICAL - 1)

THEORY

Objectives

1. To study design of plant and processing equipment.
2. To develop comprehensive understanding of waste product handling and management.

CONTENTS

UNIT 1 Food Plant Layout and Equipment Design (15 Lectures)

General principles of food plant Design and layout, Design of food processing equipment's: Size Reduction, mixing, separation, extraction, filtration, centrifugation, distillation and, gas absorption equipments.

UNIT: 2 Warehousing and Cold Chain Management (15 Lectures)

Food hygiene and safety in transportation, with a focus on warehouse storage and refrigerated ships- Safe food storage at shopping outlets: use of coolers/chillers/freezers, length of time in storage, Design of warehouses

Scope of Cold Chain for enhancing marketing potentials of perishables in domestic and international markets

Principles of Cold Chain Creation and Management.

Physicochemical changes in stored products during storage

Air tight, Non-air tight, Underground, Conventional & Modern storage structures for fruits, vegetables, meat and marine products.

Aerated, refrigerated and controlled atmospheric storage.

Layout and Design of storage structures, economics of storage structures

UNIT: 3 Food Plant Hygiene and Sanitation (18 Lectures)

Waste disposal, Control methods using Physical and Chemical Agents, Pest and Rodent Control, ETP Design and Layout. Food storage sanitation, transport sanitation and water sanitation.

By-products utilization obtained from dairy plant, egg& poultry processing industry and meat industry. Wastewater and solid waste treatment: - Waste-types-solid and liquid waste characterization, physical, chemical, biological, aerobic, anaerobic, primary, secondary and tertiary (advanced) treatments.

Recommended Readings:

1. Norman G. Marriott and Robert B. Gravani. (2006). Principles of Food Sanitation, 5th edition
2. Rao, D. G. (2010). Fundamentals of Food Engineering, PHI Learning Private Ltd.
3. Fellows P. (2000). Food Processing Technology, 2nd Edition. Woodhead Publishing Limited and CRC Press LLC
4. James A (2013) The supply chain handbook, distribution group.
5. FAO, US (1984) Design and operations of cold store in developing

FOOD PLANT SANITATION

PRACTICAL

CONTENTS:

1. Design and layout of various food processing systems and food service areas.
2. Design and layout of cold storage and warehouse.
3. Determination of physico-chemical properties of wastewater.
4. Preparation of a sanitation schedule for food preparation area.
5. Testing of sanitizers and disinfectants.
6. Study of Phenol coefficient of sanitizers.
7. Determination of BOD (biological oxygen demand)/ COD in wastewater.
8. Study of wastewater treatment system/ETP.

Recommended Readings:

1. Norman G. Marriot and Robert B. Gravani. 2006, 5th Ed., Principles of Food Sanitation
2. Forsythe, S.J. and Hayes, P.R. (1998). Food Hygiene, Microbiology and HACCP. Gaitersburg, Maryland: Aspen.
3. Hui, Y.H., Bruinsma, B., Gorham, R., Nip, W.-K. (2003). Food Plant Sanitation. New York: Marcel Dekker.
4. Rees, N. and D. Watson. (2000). International Standards for Food Safety. Gaitersburg, Maryland: Aspen

VIII. Co-Curricular Activities:

- g) **Mandatory:** (*Training of students by teacher on field related skills: 15hrs*)
9. **For Teacher:** Training of students by teacher in laboratory and field for a total of 15 hours on Design and layout of various food processing systems and food service areas, cold storage and water house, sanitation of food processing area and waste water system study.
15. **For Student:** Individual visit to a local plant tissue culture facility or related field or to laboratory in a university/research organization/private sector and study of food plant sanitation. Submission of a hand-written Field work Report not exceeding 10 pages in the given format.
16. Max marks for Field Work Report: 05.
17. Suggested Format for Field work: *Title page, student details, content page, introduction, work done, findings, conclusions and acknowledgements.*
18. Unit tests (IE).

h) Suggested Co-Curricular Activities

22. Training of students by related industrial experts.
23. Assignments (including technical assignments like identifying tools in food plant and processing centers and their sanitation handling, operational techniques with safety and security
24. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
25. Preparation of videos on tools and techniques in sanitation of food plant and processing centers
26. Collection of material/figures/photos related to products of plant tissue culture, writing and organizing them in a systematic way in a file.
27. Visits to food processing centers facilities, firms, research organizations etc.
28. Invited lectures and presentations on related topics by field/industrial experts.

IX. Suggested Question Paper Pattern:

Max.Marks:75

Time:3 hrs

SECTION - A (Total: 15 Marks)

Very Short Answer Questions (10Marks:5 x2)

SECTION - B (Total: 5x5=25Marks)

**(Answer any four questions. Each answer carries 5 marks
(Atleast1 question should be given from each Unit)**

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SECTION – C (Total: 4x10 = 40 Marks)

**(Answer any four questions. Each answer carries 10 marks
(Atleast1question should be given from each Unit)**

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Suggested Question Paper Model for Practical Examination
Semester–V: Food Technology–6 (Skill Enhancement Course)
FOOD PLANT SANITATION

Max. Time: 3Hrs.

Max. Marks: 50

1. Demonstration of a sterilization technique ‘A’ 8 M
2. Preparation of MS medium ‘B’ 8M
3. Demonstration of callus culture technique/growth measurements ‘C’ 12 M
4. Scientific observation and data analysis 4 x 3 =12 M
 - a. Tissue culture equipment/photograph
 - b. Morphogenesis or organogenesis-photograph
 - c. Bioreactor/Secondary metabolite
 - d. Transgenic plant/photograph
5. Record+Viva-voce 6+4 =10M

6C: ENTREPRENEURSHIP DEVELOPMENT AND FOOD PRODUCT DEVELOPMENT

(CREDITS: THEORY – 4; PRACTICAL-1)

Out comes

To understand the concept of development of a new product and prepare new products based on special dietary requirements, functionality, convenience, and improvisation of existing traditional Indian foods

CONTENTS

UNIT I: ENTREPRENEURIAL DEVELOPMENT (10 lectures) •

Case studies of successful entrepreneurs

- Exercises on ways of sensing opportunities – sources of idea, creating efforts, SWOT Analysis
- Entrepreneurial skill assessment test
- Techniques of development of entrepreneurial skills, positive self image and locus of control

UNIT II: FOOD BUSINESS MANAGEMENT (14 lectures)

- Case studies of Food Processing Business and its aspects
- Business opportunity Identification and Assessment techniques
- Business Idea Generation and evaluation exercise
- Market Assessment study Analysis of competitive situation
- SWOT Analysis for business and for competitors
- Preparation of business plan
- Preparation of project report
- Methods of Arrangement of inputs – finance and material

UNIT-III- Development of New Product

Definition, Importance, objectives & Need of product development, Reasons of failure, Types and Steps of product development, Product development Tools and their use

Practical or Projects on:

1. Market and literature survey to identify the concepts of new products based on special dietary requirements, functionality, convenience, and improvisation of existing traditional Indian foods.
 2. Screening of product concept based on techno-economic feasibility.
 3. Development of prototype product and Standardization of formulation process.
 4. Proximate Analysis of New Product
 5. Packaging, labeling and shelf-life studies
 6. Cost analysis and Final Project Report
- Each team/group of students would develop a food product based on above-mentioned lines /steps and would submit a project report

Recommended Readings

1. Vasant Desai (2012) Fundamentals of Entrepreneurship and Small Business Management, Himalya Publishing House Pvt. Ltd., Mumbai
2. Vasant Desai (2011) The Dynamics of Entrepreneurial Development and Management, Himalya Publishing House Pvt. Ltd., Mumbai
3. D. David and S Erickson (1987) Principles of Agri Business Management, Mc Graw Hill Book Co., New Delhi.
4. Acharya S S and Agarwal N L (1987) Agricultural Marketing in India, Oxford & ISH Publishing Co., New Delhi.
5. David H. Holt (2002) Entrepreneurship – Anew Venture Creation, Prentice Hall of India, New Delhi.
6. Phill Kottler (1994) Marketing Management, Prentice Hall of India Private Limited, New Delhi.
7. Chandra, Prasanna (1996) Projects, Planning, Analysis, Selection, Implementation and Review, Tata McGraw-Hill Publishing Company Limited, New Delhi.
8. Fuller, Gordon W. 2004. New Product Development- From Concept to Marketplace, CRC Press.
9. Anil Kumar, S., Poornima, S.C., Abraham, M.K. & Jayashree, K.2004. Entrepreneurship Development. New Age International Publishers.
10. Moskowitz, Howard and Saguy, R. I. Sam 2009. An Integrated Approach to New Food Product, CRC Press.

X. Co-CurricularActivities:

i) **Mandatory:***(Training of students by teacher on field related skills: 15hrs)*

19. **For Teacher:** Training of students by teacher in laboratory and field for a total of 15 hours on Screening of product concept on the basis of techno-economic feasibility. Development of prototype product and Standardization of formulation process and packing
20. **For Student:** Individual visit to a local plant tissue culture facility or related field or to laboratory in a university/research organization/private sector and study of entrepreneurship and food product development. Submission of a hand-written Fieldwork Report not exceeding 10 pages in the given format.
21. Max marks for Field Work Report: 05.
22. Suggested Format for Field work: *Title page, student details, content page, introduction, work done, findings, conclusions and acknowledgements.*
23. Unit tests (IE).

j) Suggested Co-Curricular Activities

29. Training of students by related industrial experts.
30. Assignments (including technical assignments like identifying tools in entrepreneurship and food product development)
31. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
32. Preparation of videos on tools and techniques in entrepreneurship.
33. Collection of material/figures/photos related to products of plant tissue culture, writing and organizing them in a systematic way in a file.
34. Visits to centers where food packing is done, firms, research organizations etc.
35. Invited lectures and presentations on related topics by field/industrial experts.

XI. Suggested Question Paper Pattern:

Max.Marks:75

Time:3 hrs

SECTION- A (Total: 15 Marks)

Very Short Answer Questions (10 Marks: 5 x2)

SECTION - B (Total: 5x5=25Marks)

**(Answer any four questions. Each answer carries 5 marks
(Atleast1 question should be given from each Unit)**

1.	
2.	
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SECTION – C (Total: 4x10 = 40 Marks)

**(Answer any four questions. Each answer carries 10 marks
(Atleast1question should be given from each Unit)**

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7C: TECHNOLOGY OF FOOD PRESERVATION

(CREDITS: THEORY – 4; PRACTICAL - 1)

THEORY

Out comes:

- To study the importance microorganisms in food preservation
- To introduce the basics of various food processing and preservation technologies.

CONTENTS

Unit 1 Food Microbiology (10 lectures)

Principles of Food Preservation, microorganisms associated with foods- bacteria, yeast and mold, Importance of bacteria, yeast and molds in foods. Classification of microorganisms based on temperature, pH, water activity, nutrient and oxygen requirements, typical growth curve of microorganisms. Classification of food based on pH, Food infection, food intoxication, definition of shelf life, perishable foods, semi perishable foods, shelf stable foods.

Unit II Food Preservation by Low Temperature (10 lectures)

Freezing and Refrigeration: Introduction to refrigeration, cool storage and freezing, definition, principle of freezing, freezing curve, changes occurring during freezing, types of freezing i.e. slow freezing, quick freezing, introduction to thawing, changes during thawing and its effect on food.

Unit III Food Preservation by high temperature (8 lectures)

Thermal Processing- Commercial heat preservation methods: Sterilization, commercial sterilization, Pasteurization, and blanching.

Unit IV Food Preservation by Moisture control

Drying and Dehydration - Definition, drying as a means of preservation, differences between sun drying and dehydration (i.e. mechanical drying), heat and mass transfer, factors affecting rate of drying, normal drying curve, names of types of driers used in the food industry.

(9 lectures)

Evaporation – Definition, factors affecting evaporation, names of evaporators used in food Industry.

(4 lectures)

Unit V Food Preservation by Irradiation

Introduction, units of radiation, kinds of ionizing radiations used in food irradiation, mechanism of action, uses of radiation processing in food industry, concept of cold sterilization.

(7 lectures)

TECHNOLOGY OF FOOD PRESERVATION

PRACTICAL

1. Methods of Sampling.
2. Concept of shelf life of different foods
3. To study the concept of Asepsis and sterilization
4. Determination of pH of different foods using pH meter.
5. Study quality characteristics of foods preserved by drying/dehydration/ freezing.
6. To perform pasteurization of fluids using different methods.
7. To perform blanching of different plant foods.

Recommended Readings

1. B. Srilakshmi, Food science, New Age Publishers,2002
2. Meyer, Food Chemistry, New Age,2004
3. Bawa. A.S, O.P Chauhan etal. Food Science. New India Publishing agency, 2013
4. Frazier WC and Westhoff DC, Food Microbiology, TMH Publication, New Delhi, 2004.

XII. Co-Curricular Activities:

- k) Mandatory:***(Training of students by teacher on field related skills: 15hrs)*
24. **For Teacher:** Training of students by teacher in laboratory and field for a total of 15hours on asepsis sterilization ,different methods of pasteurization of fluids, study on determination of pH of different foods and methods of sampling.
 25. **For Student:** Individual visit to a local plant tissue culture facility or related field or to a laboratory in a university/research organization/private sector and study of food preservation techniques. Submission of a hand-written Fieldwork Report not exceeding 10 pages in the given format.
 26. Max marks for Field Work Report: 05.
 27. Suggested Format for Field work: *Title page, student details, content page, introduction, work done, findings, conclusions and acknowledgements.*
 28. Unit tests (IE).
- l) Suggested Co-Curricular Activities**
36. Training of students by related industrial experts.
 37. Assignments (including technical assignments like identifying tools in preservation of food
 38. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
 39. Preparation of videos on tools and techniques in food preservation technology
 40. Collection of material/figures/photos related to products of plant tissue culture, writing and organizing them in a systematic way in a file.
 41. Visits to different food preservative facilities, firms, research organizations etc.
 42. Invited lectures and presentations on related topics by field/industrial experts.

XIII. Suggested Question Paper Pattern:

Max.Marks:75

Time:3 hrs

SECTION – A (Total: 15 Marks)

Very Short Answer Questions (10 Marks: 5 x2)

SECTION - B (Total: 5x5=25Marks)

**(Answer any four questions. Each answer carries 5 marks
(Atleast1 question should be given from each Unit)**

1.	
2.	
3.	
4.	
5.	

SECTION - C (Total: 4x10 = 40 Marks)

**(Answer any four questions. Each answer carries 10 marks
(Atleast1question should be given from each Unit)**

1.	
2.	
3.	
4.	
5.	
6.	

Suggested Question Paper Model for Practical Examination
Semester–V: Food Technology–6 (Skill Enhancement Course)
TECHNOLOGY OF FOOD PRESERVATION

Max.Time: 3Hrs.

Max. Marks: 50

1. Demonstration of a sterilization technique ‘A’ 8 M
2. Preparation of MS medium ‘B’ 8M
3. Demonstration of call us culture technique/growth measurements ‘C’ 12 M
4. Scientific observation and data analysis 4 x 3 =12 M
 - a. Tissue culture equipment/photograph
 - b. Morphogenesis or organogenesis–photograph
 - c. Bioreactor/Secondary metabolite
 - d. Transgenic plant/photograph
5. Record+Viva-voce 6+4 =10M