



UNIVERSITY OF CALICUT

Abstract

General and Academic - B.Voc Programme in Food Technology (Food Processing and Safety Management) under modified B.Voc Regulations 2014 - Scheme and Syllabus - Approved - Implemented w.e.f 2018 Admissions - Orders issued.

G & A - IV - J

U.O.No. 3927/2019/Admn

Dated, Calicut University.P.O, 18.03.2019

*Read:-*1. U.O.No. 7404/2018/Admn dated 19.06.2018

2. Item No.1 in the minutes of the B.Voc Regulations Committee held on 13.09.2018
3. Request from the Convenor, B.Voc Regulations Committee dated 06.10.2018
4. Item No.II in the minutes of the meeting of the Board of Studies in Food Technology held on 23.10.2018
5. Item No.I.3 in the Minutes of Faculty of Science held on 05.12.2018
6. Item No.II.F in the Minutes of Academic Council held on 18.12.2018

ORDER

The modified B.Voc Regulations has been implemented vide paper read as (1) and vide paper read as (2), the B.Voc Regulations Committee decided to place the syllabi of new B.Voc Programmes which are sanctioned by UGC, in various colleges under University of Calicut, before various Boards of Studies for approval.

The Convenor, B.Voc Regulations Committee vide paper read as (3), pointed out that UGC has directed to start the newly sanctioned programmes without delay and hence requested to initiate urgent steps to approve the syllabi of newly sanctioned B.Voc Programmes at various colleges with a suggestion to submit the syllabi to the Chairmen of Boards of Studies concerned with a request to approve the syllabi in circulation with other Board members (as provided under CUFS 1976) and the same has been approved by Vice Chancellor. Consequently the syllabus of B.Voc Programme in Food Technology (Food Processing and Safety Management) was forwarded to the Chairman, Board of Studies in Food Technology.

The Board of Studies in Food Technology vide paper read as (4) approved the syllabus for B.Voc Programme in Food Technology (Food Processing and Safety Management). The Faculty of Science vide paper read as (5) and the Academic Council vide paper read as (6) approved the same. The Vice Chancellor has accorded sanction to implement the Academic Council decision.

Sanction has therefore been accorded for implementing the Scheme and Syllabus of B.Voc Programme in Food Technology (Food Processing and Safety Management) under modified B.Voc Regulations 2014, in the University w.e.f 2018 admissions.

Orders are issued accordingly.(Syllabus is herewith appended)

Biju George K

Assistant Registrar

To

Principals of the Colleges offering BVoc Programme in Food Technology (Food Processing and Safety Management)

Copy to: PS TO VC/PA to R/PA TO CE/JCE VII/JCE 1/GA I F/Library/SF/DF/FC

Forwarded / By Order

Section Officer

UNIVERSITY OF CALICUT

Syllabus for B.Voc.

in

**Food Technology (Food Processing & Safety
Management)**

2018 -19 Admission onwards

Contents

Sl. No.	Description	Page No.
1.	Introduction	4
2.	Credit & Mark Distribution	5
3.	Examination	6
4.	External Evaluation	7
5.	Internal Evaluation	7
6.	Project/In Plant Evaluation	8
7.	Courses ,Hours distribution & Credit Details	10

The B.Voc degree programme aimed of the following objectives,

- a) To provide judicious mix of skills relating to a profession and appropriate content of General Education.
- b) To ensure that the students have adequate knowledge and skills, so that they are work ready at each exit point of the programme.
- c) To provide flexibility to the students by means of pre-defined entry and multiple exit points.
- d) To integrate NSQF within the undergraduate level of higher education in order to enhance employability of the graduates and meet industry requirements. Such graduates apart from meeting the needs of local and national industry are also expected to be equipped to become part of the global workforce.
- e) To provide vertical mobility to students coming out of 10+2 with vocational subjects.

INTRODUCTION

B.VOC. FOOD TECHNOLOGY (FOOD PROCESSING & SAFETY MANAGEMENT) DEGREE PROGRAMME (A MODEL PATTERN OF LANGUAGE REDUCED PATTERN OF UNIVERSITY OF CALICUT)

The B.Voc. Food Technology (Food Processing & Safety Management) Degree Programme (here after B.Voc Programme) means the entire course study and examinations for the award of degree which is a Bachelor of vocation, a scheme introduced by UGC for skill development based higher education as part of college/university education recommended by National Skills Qualification Framework(NSQF). The duration of B.Voc. under graduate programme shall be of 6 semesters distributed over a period of 3 years. A sequence of 18 academic weeks (90 working days) inclusive of examination with a unit of five working days consisting of six hours constitute one semester. Total credits in a semester: 30(equivalent to 450 hours). B. Voc has multiple exit points at each year and successfully completing first year (at the end of 2nd semesters) the candidate will be awarded Diploma in Baking, Fruits & vegetable Technology (Level 5). Higher Diploma in Food Processing Technology (Level 6) at the end of 4th Semester and or B.Voc. Degree in Food Processing & Safety Management (Level 7) will be awarded at the end of 6th Semester. Separate certificate will be awarded for each year for successful candidates. Students who fail in any course may be allowed to move the higher level but won't be eligible for any certificates until he/she clears previous courses

The B.Voc. Programme is designed to bridge the potential skill gap identified. The curriculum in each of the years of the programme would be a suitable mix of general education and skill development components. The general education component provides emphasis to Communication skill, Presentation skill, Health and Safety, Industrial Psychology, Environmental awareness, Entrepreneurship development and other relevant subjects in the field.

Course means a segment of subject matter to be covered in a semester (traditionally referred to as a paper). B.Voc. is a language reduced model pattern of University of Calicut (CUCBCSSUG 2014) has General Education Component (an abbreviation of GEC) of compulsory English in 1st & 2nd year and additional languages (an option for additional language has provided which enhances the employability outside the state) in 1st and 2nd semester which is taught by language teachers. Additional language course may be Hindi, Arabic or Malayalam. Additional language may be chosen by the students according to their wish. General Education Components are also included General Mathematics &

Statistics, General informatics, Environmental Science & Entrepreneur Development Programme. They are taught in 3rd& 4th semester by either core department or other department concern. Skill Development Component (an abbreviation of SDC) Core courses in B.Voc. programme are taught from 1st semester onwards.

Credits means a unit of academic input measured in terms of weekly contact hours/course contents assigned to a course. Each course shall have certain credits. For passing the degree programme the student shall be required to achieve a minimum of 180 credits of which 38 credits shall be from General Education Component (20 credits for common English courses, 8 credits for Additional language courses and 12 credits for General Courses.) 140 credits from Skill Development Component. Students of B.Voc programme should undergo a mini project work at 4th semester and internship cum project work at 6th semester (33 credits)

Credit Distribution of B.Voc. Food Tech.(Food Processing & Safety Management)Programme

Semester	General Education Component				Skill Development Component	Total
	English	Additional Language	General			
I	5	4			21	30
II	5	4			21	30
III	5	-	4		21	30
IV	5	-	3	5	17	30
V	-	-	-	-	30	30
VI	-	-	-	-	30	30
Total	20 Credits (400 Marks)	8 Credits (200 Marks)	12 credits (300 Marks)		140 Credits (2700 Marks)	180
	40 Credits (900 Marks)				140 credits(2700)	3600

Mark Distribution

General Education Component			
English	4x100	400	600
Additional: Mal/Hindi.....	2x100	200	
General	3x100	300	400
Core	25x100	2500	2500
Project	2x100	200	200
Total marks			3600

Examinations

There shall be Final end semester Examinations at the end of each semester. A student shall be permitted to appear for the semester examination, only if he or she secures not less than 75% attendance in each semester.

Evaluation & Grading

Mark System is followed instead of direct grading for each Question. For each course in the semester letter grade, grade point and % marks are introduced in 7 point. Indirect grading system is given below. Each course is evaluated by assigning marks with a letter grades (A+, A, B, C, D, E or F) to that course by method of indirect grading. E grade or 40% marks is required for a pass in each course.

% of Marks	Grade	Interpretation	Grade Point Average	Range of Grade Points	Class
90 and above	A+	Outstanding	6	5.5 – 6	First Class with Distinction
80 to below 90	A	Excellent	5	4.5 – 5.49	
70 to below 80	B	Very Good	4	3.5 – 4.49	First Class
60 to below 70	C	Good	3	2.5 – 3.49	
50 to below 60	D	Satisfactory	2	1.5 – 2.49	Second Class
40 to below 50	E	Pass/Adequate	1	0.5 – 1.49	Pass
Below 40	F	Failure	0	0 – 0.49	Failure

A student who fails to secure a minimum grade for a pass in a course is permitted to write the exam along next batch.

Assessment of Students

Assessment of students for each subject will be done by internal continuous assessment and Semester-End examinations. This dual mode assessment will be applicable to both Theory and Practical courses except for internship and project. Total marks in theory course reflect 80 marks external and 20 marks internal assessments. The mark division for practical courses are 20 marks internal and 80 marks external. For internship and project, there is no internal assessment.

SI No	Courses	Internal	External
1	Theory	20	80
2	Practical	20	80
3	Internship & Project	0	100

External Evaluation

External Evaluation carries 80% of marks. External Evaluation of each semesters done by College first with external examiner and then second evaluation done for 20% of the randomly selected scripts by the examiner of home college. If variation found more than 10% between the two evaluations on 20% of randomly selected scripts, then the entire scripts will be given to the third valuator and result will be declared according to him/her only and that will be a final and further valuation won't be done afterwards. The theory Exam has duration of 3 hours.

Questions Pattern for Core Courses (Theory)

Question Type	Part A	Number of Questions	Marks	Total Marks
Objective	A	10 out of 10	1	10x1= 10
Short Answer	B	10 out of 12	2	10x2 =20
Short Essay	C	5 out of 8	5	5x6 = 30
Essay	D	2 out of 4	10	10x2 = 20
Total Marks				80

Practical Examination

The external examination in practical courses shall be conducted by two examiners - one internal and an external, appointed by the office of controller examination of the college. The project evaluation can be conducted by external examiner only

Question Pattern of Practical Exam

Record	Procedure	Work done	Spot test	Viva-voce	Total
5	10	20x2	15(5x3)	10	80

Internal Evaluation

Internal evaluation will be of 20% in each course. The duration of examination will be 2 hours. The department has to send the marks obtained by the students in internal exam to the office of Controller of Examination of the College by head of department through principal of the college. Internal assessment marks should be published in the department notice board. A grievance committee is constituted at department level to look in to the matter of any discrepancy.

The internal assessment shall be based on a pre-determined transparent system involving written test, assignments, seminars and attendance in respect of theory course and on tests/records/viva-voce/attendance in respect of practical course. Internal assessment shall be conducted throughout the semester. Assignments of every semester shall preferably be submitted in Assignment Book, which is a bound book similar to laboratory record.

Questions Pattern for Core Courses (Theory)

Question Type	Part A	Number of Questions	Marks	Total Marks
Objective	A	6 out of 6	1	6x1= 6
Short Answer	B	8 out of 10	2	8x2 = 16
Short Essay	C	3 out of 5	6	5x6 = 18
Essay	D	1 out of 2	10	1x10 = 10
Total Marks				50

Distribution of Marks for Theory (Core)

Attendance		Test paper (1 st & 2 nd)		Seminar/Assignment/Viva	
Above 90%	5 marks	Above 90%	5 marks	Excellent	5 marks
85 to 89%	4 marks	80 to <90%	4.5 marks	Very good	4 marks
80 to 84%	3 marks	70 to <80%	4 marks	Good	3 marks
76 to 79%	2 marks	60 to <70%	3.5 marks	Average	2 marks
75%	1 mark	50 to <60%	3 marks	Poor	1 mark
Maximum	5 marks	40 to <50%	2 marks	Maximum	5 marks
		35 to <40%	1 marks		
		Maximum	5+5 =10marks		

Distribution of Marks for Practical (Core)

Components	Maximum 20 Marks
Attendance	5
Lab performance	5
Viva-voce	10

Internship & Project

Internship and the major project will be carried out in the industry, not necessarily with industry partner. The major idea for internship is to implement the things learned and to get a real life experience. The Evaluation process follows 100% external assessment

- There will be internship at the end of 2nd and 6th semesters and project and internship for the whole sixth semester.
- Every student will be assigned an internal guide, allotted from the parent department concerned or an expert available in the college appointed by the principal or the head of the department.
- The student has to make regular discussions with the guide while choosing the subject/area and throughout the life time of the project.
- At least three reviews should be conducted to evaluate the progress of work.
- An evaluation team is constituted for conducting the evaluation. The team consist of external examiner, allotted by the controller of examination from the approved examination panel, representative from the industry and a faculty.

- Students should submit a report of their work. A valid certificate from the organization should be produced as a proof that the work is carried out in the respective organization.
- Students are required to demonstrate the working model of their work (if possible) to the panel of examiners. A viva will be conducted based on the report and students are supposed to clarify the queries regarding their work.
- Mark distribution for internship assessment

Distribution	Marks
Content and relevance	60 for Dissertation
Viva	20
Presentation	20

Minimum for Pass

The successful completion of all the courses prescribed for the diploma/degree programme with E grade (40 %) shall be the minimum requirement for the award of diploma/degree.

- For Project/internship, the minimum for a pass shall be 50% of the total marks assigned to the respective examination.
- A student who does not secure this pass marks in a subject will have to repeat the respective subject.
- If a candidate has passed all examinations of B.Voc. Course (at the time of publication of results of last semester) except project/internship in the last semester, a re-examination for the same should be conducted within one month after the publication of results. Each candidate should apply for this Save-A-Year examination within one week after the publication of last semester results.

Moderation

- Moderation shall be awarded subject to a maximum of 5 % of external total marks to be awarded in Semester.
- For a course concerned, the maximum of moderation awarded shall be limited to 10 of the total marks to be awarded for the external course concerned.
- If a student fails for a single course, this limit can be enhanced to 15 % of external in the course.
- However Board of examiners/B. Voc consortium concerned shall have the liberty to fix low percentage of marks for moderation subjected to the conditions mentioned above.

B.Voc. Programme – Structure, Work load and Credit distribution

Sem No	Course No.	Course code	Name of the course	Credits	Marks		
					Internal	External	Total
1	1.1	GEC1ENG1	Transactions: Essentials English language skills A01	5	20	80	100
	1.2	GEC1ML/ARB1A01/A(07)03	Malayalam, Arabic, Hindi	4	20	80	100
	1.3	SDC1FPT01	Introduction to Food Science & Technology	3	20	80	100
	1.4	SDC1FPT02	Food Chemistry	5	20	80	100
	1.5	SDC1FPT03	Food Microbiology	5	20	80	100
	1.6	SDC1FPT04	Basic Food Quality & Safety	3	20	80	100
	1.7	SDC1FPT05	Basic Management	5	20	80	100
2	2.1	GEC2ENG2	Ways with words: Literature in English A02	5	20	80	100
	2.2	GEC2ML/ARB2A02/A909)3	Malayalam, Arabic, Hindi	4	20	80	100
	2.3	SDC2FPT06	Cereals, Pulses, oilseeds & Confectionery Technology	5	20	80	100
	2.4	SDC2FPT07	Technology of Fruits, Vegetable products and Post Harvest Management	5	20	80	100
	2.5	SDC2FPT08(P)	Basic concepts in Laboratory Practices, Techniques and Food chemistry Practical	4	20	80	100
	2.6	SDC2FPT09(P)	Plant Food Products Practical	4	20	80	100
	2.7	SDC2FPT10 Pr	Mini Project	3	0	100	100
3	3.1	GEC3ENG3	Writing for academic & Professional success A03	5	20	80	100
	3.2	GEC3IT01	General informatics	4	20	80	100
	3.3	SDC3FPT11	General Mathematics & Statistics	5	20	80	100
	3.4	SDC3FPT12	Food & Nutrition	4	20	80	100
	3.5	SDC3FPT13	Food Preservation Technology	4	20	80	100
	3.6	SDC3FPT14	Food Packaging Technology	3	20	80	100
	3.7	SDC3FPT15	Dairy Technology	5	20	80	100
4	4.1	GEC4ENG4	Zeitgeist: Readings on Contemporary Culture A04	5	20	80	100
	4.2	GEC4EVS01	Environmental Science	3	20	80	100
	4.3	GEC4EDP01	Entrepreneur Development Programme	5	20	80	100
	4.4	SDC4FPT16	Spices & Plantation Products Technology	4	20	80	100
	4.5	SDC4FPT17	Beverage Technology	4	20	80	100
	4.6	SDC4FPT18	Technology of Animal Products	5	20	80	100
	4.7	SDC4FPT19	Animal & Dairy Products Practical	4	20	80	100
5	5.1	SDC5FPT20	Food Engineering	4	20	80	100
	5.2	SDC5FPT21	Food Toxicology	2	20	80	100
	5.3	SDC5FPT22	Food Analysis & Its Technique	4	20	80	100
	5.4	SDC5FPT23	Food Safety Regulation & Standards	5	20	80	100
	5.5	SDC5FPT24	Food Supply Chain & Marketing Management	5	20	80	100
	5.6	SDC5FPT25	Food Quality Management & Auditing	5	20	80	100
	5.7	SDC5FPT26(P)	Analysis of Foods Practical	5	20	80	100
6	6.1	SDC6FPT27Pr	Internship & Project Work	30	0	100	100
Total				180	680	2920	3600

SEMESTER I
SDC1FPT01 INTRODUCTION TO FOOD SCIENCE & TECHNOLOGY
(3 CREDITS)

Unit I (10 hrs)

Introduction-Scope of food science and Technology. Functions of food. Nutrients, Water, Carbohydrates, Proteins, Lipids, Vitamins and Minerals.

Unit II (10 hrs)

Composition and nutritive value

Pulses & Legumes, Nuts & Oilseeds, Meat, Fish, Egg and Milk Structure and composition of wheat and Rice. Classification and Composition of Fruits, Vegetables and Spices.

Unit III (10 hrs)

Food Quality Assessment -Sensory assessment-Appearance of food- visual perception, colour of foods, smell, flavour and taste.Threshold tests, difference tests, ranking test & hedonic scale

Unit IV (10 hrs)

Food Additives-Preervatives, coloring agents, flavour and flavour enhancer, Anti-oxidants, Artificial sweeteners, stabilizers, thickening agents, anticaking agents, bleaching and maturing agents, flour improvers, leavening agents, surface active agents

Unit V (4 hrs)

Health foods Functional foods, Prebiotics, Probiotics, Nutraceuticals, organic foods, GM foods

Unit VI (10 hrs)

Food Research & Food Technology updates-Major centres of food research in India – CFTRI, DFRL, NIFTEM, IIFPT & CIFT. Major Food Industries in India. Journals of Food Science & Technology, Indian Food Industry, Beverage Food World, Indian Food Packer, AFST (I)

References

1. Potter NN , Hotchkiss JH. Food Science. CBS publishers and distributors
2. S. Manany, N S. Swamy Food Facts and Principles. New Age International Publishers
3. Murano, Peter S. Understanding Food Science and Technology .Thomson
4. Sumati R Mudambi , Rajagopal M V. Fundamentals of Food and Nutrition. New Age International Publishers
5. Shubhangini A Joshi . Nutrition and Dietics. Tata McGraw Hill Education Private Limited
6. Vijaya Khader. Text Book of Food Science and Technology. ICAR
7. Swaminathan M. Food Science Chemistry and Experimental Foods. Bappco

Journals:

- a. Indian Food Industry
- b. Food packer
- c. Journal of Food Science and Technology

Unit I (20 hrs)

Carbohydrates -Classification , properties and reactions of

1) Monosaccharides:Glucose& Fructose

2)Oligosaccharides : Maltose, lactose. Sucrose- properties- crystallization and inversion.

3) Polysaccharides:starch : components of starch, gelatization, retrogradation, modified starch.Cellulose, hemicellulose, pectic substances, gums, dietary fibre

Unit II (15 hrs)

Proteins-Introduction to food protein, structure of protein, classification of proteins, amino acids, physicochemical properties, denaturation, reactions, protein determination.

Qualitative analysis of protein, Protein estimation-Kjeldahl's method

Unit III (15 hrs)

Lipids-Classification, fatty acids, saturated, unsaturated, polyunsaturated fatty acids, chemical properties, reactions, rancidity, auto-oxidation, antioxidants.

Unit IV (20 hrs)

Water-Introduction, physical & chemical properties of water, moisture in foods, methods of moisture determination,hydrogen bonding, Free & bound water

Pigments-Properties and Occurrence: Chlorophyll, Carotenoids,.Flavanoids,Anthocyanins,Anthoxanthins, Myoglobin

Unit V (20 hrs)

Enzymes-Introduction,Definition,Occurrence, Classification. Properties of Enzymes-Specificity, Factors affecting enzyme activity. Enzymes in food Industry

Colloids -Colloidal chemistry, Properties of solutions, Sols & Suspensions, Food colloids.

Emulsion-Emulsion, Types, Emulsifying Agents

References

1. Food and Nutrition M. Swaminathan
2. Fundamentals of Food & Nutrition S R. Mudambi, M.V. Rajagopal
3. A text book of foods, Nutrition and Dietetics M. Raheena Begum
4. Handbook of Food and Nutrition M Swaminathan
5. Food Chemistry O R. Fennema
6. Food Chemistry L H Meyer
7. Foods Facts and Principles N. Shakuntalamanay & M. Shadaksharaswamy
8. Food Science Norman N. Potter
9. Hand book of Analysis and Quality Control of Fruits & Vegetable Products S. Ranganna
10. Fats in Food Technology K K Rajah

SDC1FPT03 FOOD MICROBIOLOGY (5 CREDITS)

Unit I (15 hrs)

Evolution

History of Microbiology, - theory of spontaneous generation, Germ theory of disease, Koch's postulates, Pure culture concept.

Microscopy

Parts of microscope, Resolving power, Limits of resolution, Refractive index, Magnification.

Light microscope – Bright field, Dark field. Electron microscope-Transmission Electron microscope, Scanning electron microscope

Unit II (15 hrs)

Microorganisms

Bacteria

Structure, Morphology, Physical condition required for growth, growth curve. Reproduction – Binary fission, Transformation, Transduction and Conjugation. Nutritional requirements- Phototrophs, Chemotrophs, Autotrophs, Heterotrophs.

Fungi

Morphology, Classification, Phycomycetes, Ascomycetes, Basidiomycetes

Yeasts

Structure, Morphology, Reproduction – Budding. Deutromycetes Reproduction-Sexual and Asexual

Virus

Classification, Composition, Morphology, Replication of virus

Unit III (10 hrs)

Culture Media

Bacteriological Media – Selective, Differential, Enrichment Media.

Methods of isolating Pure culture

Serial dilution, Pour plate, streak plate, stroke Culture

Unit IV (10 hrs)

Control of Microorganism

Physical agents – high temperature, low temperature, desiccation, osmotic pressure radiation, filtration.

Chemical agents-Characteristics of an ideal antimicrobial chemical agent, Alcohols, Aldehydes, Dyes, Halogens, Phenols, Acids, Alkalis, Gases

Unit V (15 hrs)

Food spoilage

Sources of contamination, factors responsible for spoilage, factors affecting kinds and number of microorganisms in food. Chemical changes due to spoilage.

Effect of spoilage

Contamination and spoilage of Fruits and Vegetables, Meat & Meat products, Milk & Cream, Cereal & Cereal products, Spoilage of canned food

Unit VI (15 hrs)

Microbial intoxications & Infections

Definition, Exotoxin, Endotoxin, intoxications and infections – sources, symptoms
Methods of Prevention and investigation of food borne disease outbreak

Microbes in fermented foods

Fermented vegetable products, Sauer Kraut, pickles, soy sauces, idli Fermented dairy products – Cheese, yoghurt

Unit VII (10 hrs)

Water & Milk testing 6

Microbiological testing of water & milk

References

1. Banwart GJ ,1989. Basic Food Microbiology. AVI publishers
2. Jay JM, Loessner MJ & Golden D A,2005. Modern Food Microbiology .Springer Verlag
3. Ananthanarayanan R Jayaram Paniker CK ,2009 Text book of microbiology.University Press Pvt Ltd, Hyderabad
4. Prescott, L.M, Harley, J.P and Klein, D.A Microbiology . McGraw Hill New York
5. Frazier J& Westhoff DC,1988. Food Microbiology. McGraw Hill, New York.
6. Pelczar JM & Reid RD . Microbiology. Tata McGraw Hill
7. Stainer R. General Microbiology. MacMillan
8. Black, JG. Microbiology .Principles and Explorations John Wiley

SDC1FPT04 BASIC FOOD QUALITY & SAFETY (3 CREDITS)

Unit I (10 hrs)

Concept of quality: Quality attributes- physical, chemical, nutritional, microbial, and sensory; their measurement and evaluation; Sensory *vis-à-vis* instrumental methods for testing quality. Food Safety and Quality Assurance: quality control of raw materials, in –process food control, quality control of finished products

Unit II (10 hrs)

Importance of Food Safety, Food Hygiene, High risk food, Low risk food, Danger Zone, Personal hygiene. Importance and significance of microorganisms in food safety, intrinsic and extrinsic factors affecting the growth of micro organisms in food.

Unit III (10 hrs)

Food Sanitation and safety: Factors contributing to physical, chemical and biological contamination in food chain, prevention and control of food borne hazards, definition and regulation of food sanitation, sources of contamination, personal hygiene-food handlers, cleaning compounds, sanitation methods, waste disposal strategy (solid and liquid waste) and pest control

Unit IV (14 hrs)

History of food regulations in India. Legislations- Prevention of Food Adulteration act 1954, Food product order (1955), Solvent Extracted Oil, De-oiled Meal and Edible Flour (Control) Order, 1967, Meat Food Products Order (1973), Edible Oils Packaging, 1998, Edible Oils Packaging, 1998, Vegetable Oil Products Order, 1998, Milk & Milk Product Amendment Regulations – 2009

Unit V (10 hrs)

Food adulteration: common adulterants, simple tests for detection of adulteration. Food additives- classification, functional role and safety issues, types of adulteration and recent trends in food adulteration.

References

1. Early, R. (2006) Guide to Quality Management Systems for the Food Industry, Blackie, Academic and professional, London.
2. Gould, W.A and Gould, R.W. (2005) Total Quality Assurance for the Food Industries, CTI Publications Inc. Baltimore.
3. Pomeraz, Y. and MeLoari, C.E. (2008) Food Analysis: Theory and Practice, CBS publishers and Distributor, New Delhi.
4. Bryan, F.L. (2007) Hazard Analysis Critical Control Point Evaluations A Guide to Identifying Hazards and Assessing Risks Associated with Food Preparation and Storage. World Health Organization, Geneva.
5. Kirk, R.S and Sawyer, R. (2005) Pearson's Composition and Analysis of Foods, Longman Scientific and Technical. 9th Edition, England.
6. FAO (2006) Manuals of Food Quality Control. 2-Additives Contaminants Techniques, Rome.

SDC1FPT05 BUSINESS MANAGEMENT (5 CREDITS)

Unit I (15 Hours)

Concepts of Management – Characteristics of management – Schools of management thought Management and administration – Functions of management – Management by objectives –Management by participation – Management by exception – Management by motivation

Unit II (20 Hours)

Functions of Management: Planning – concept and importance - Decision making – barriers to effective planning – Organizing – concept and importance – different organization models Span of management – Departmentation – Delegation.

Unit III (20 Hours)

Functions of Management: Motivation: – concept and importance – Contributions of McGregor, Maslow and Herzberg – Leadership: – Concept and styles – Leadership traits - situational theory of leadership - Communication: – process and barriers – Control: – concept steps – tools – Coordination: Concept – Principles – Techniques

Unit IV (20 Hours)

Business Ethics: Meaning and scope – Types of ethics – Characteristics – Factors influencing business ethics – Arguments for and against business ethics – Basics of business ethics -Corporate social responsibility - Environmental issues in business – Ethics in advertising –Globalization and business ethics.

Unit V (15 Hours)

Emerging concepts in management – Kaizen – TQM – TPM – MIS – ISO – Change management– Stress management – Fish bone (ISHIKAWA) Diagram – Business eco system – Logistic management.

Reference Books:

1. Boatwright. John R: Ethics and the Conduct of Business, Pearson Education, New Delhi.
2. Gupta. CB; Business management, Sultan Chand & sons
- 3 Koontz, H and Wehrick, H: Management, McGraw Hill Inc, New York.
- 4 Prasad. LM; Principles and Practicd of Management; Sultan Chand & sons
- 5 Stoner. AF and Freeman RE; Management; Prentice Hall of India
- 6 Drucker, Peter, F., Management: Tasks, Responsibilities and Practices, Allied Publishers, New Delhi.
5. R.S Davar; Management Process
6. Rustum & Davan, Principles and Practice of Management.
7. Srinivasan & Chunawalla, Management Principles and Practice.
8. S. V. S. Murthy. Essentials of Management.

SEMESTER II

SDC2FPT06 CEREALS, PULSES AND OIL SEEDS TECHNOLOGY (5 CREDITS)

Unit I (25 hrs)

Technology of Wheat and Rice milling and their products

Wheat Milling of wheat, by-products – Whole wheat flour, Maida, semolina, Gluten.

Rice Milling of rice, by-products of rice milling – Husk, Bran, Broken rice Parboiling-Merits and demerits, Curing, Aging of rice, Rice products – Flaked rice, Puffed rice.

Technology of Oats and Barley

Milling and their products

Unit II (30 hrs)

Technology of Bakery products and confectionery

Baking Principles of baking, classification of baked foods.

Bread: Bread making –Role of ingredients, Bread faults & remedies, staling of bread.

Cake: Cake making, Role of ingredients, Types of making, cake faults and remedies.

Biscuit: Biscuits & Cookies, Crackers and Wafers, technology of Biscuits, faults & Remedies.

Confectionary: Raw materials, Hard candy, Toffee, Caramel.

Unit III (5 hrs)

Millets-Pearl millet, Finger millet

Unit IV (10 hrs)

Pulses-Processing- Soaking, Germination, Decortication, Cooking and Fermentation.Changes during germination, Antinutritional factors, Factors affecting cooking time.

Unit V (20 hrs)

Nuts & Oil seeds-Sources, Composition, Processing of oil seeds – Soya bean, coconut. Hydrogenation. Refining of fats & oils, bleaching, de-odourising, hydroxylation, shortening, margarine.Protein isolates, Texturised vegetable protein

References

1. Hui, Y.H, Bakery products, Science and Technology , Black Well publishing, 2006
2. Matz S.A; Bakery Technology and Engineering; 3 edn, CBS Publishers and distributors
3. Faridi H, The science of cookie and cracker production; CBS Publishers and distributors
4. Dendy D A V & Dobraszczyk BJ Cereals and cereal products, Aspen
5. Kent NL 1983Technology of cereals Pergamon press
6. E J Pyler. Bakery science Technology. Vol I, II. Sosland Publications.
7. Manley D. 2000. Technology of Biscuits, Crackers and Cookies. CRC press.
8. Faridi H. Science of Cookie & Cracker Production
9. S. Manany, N S. Swamy Food Facts and Principles. New Age International Publishers

10. Srivastava RP & Kumar S .2003 Fruit and Vegetable preservation Principles and Practices. Interntional Book Distributors

SDC2FPT07 TECHNOLOGY OF FRUITS, VEGETABLE PRODUCTS AND POST HARVEST MANAGEMENT (5 CREDITS)

Unit I (Lectures 9)

Indian and global scenario on production and processing of fruits and vegetable; Quality requirements of raw materials for processing; sourcing and receiving at processing plants; primary processing: grading, sorting, cleaning, washing, peeling, slicing and blanching; minimal processing.

Unit II (Lectures 9)

Processing for pulp, puree and concentrates, especially from mango, tomato, guava, papaya, apple, pineapple, pomegranate, grapes etc. Using aseptic packaging, canning, RTS fruit beverages, IQF and frozen fruits and vegetables; for peas, mango pulps etc.

Unit III (Lectures 9)

Technology for processed products like pickles, chutneys, sauces particularly from raw mango, lime and other regional fruits and vegetables of importance.

Unit IV (Lectures 9)

Processing of fruits for candies, bars, toffees, jams and jellies, squashes and syrups using locally available fruits like papaya, mango, anola and other under-utilized fruits.

Unit V (Lectures 9)

Dehydration of fruits and vegetables using various drying technologies like sun drying, solar drying (natural and forced convection), osmotic, tunnel drying, fluidized bed drying, freeze drying, convectional and adiabatic drying; applications to raisins, dried figs, vegetables, intermediate moisture fruits and vegetables. Fruit powders using spray drying.

Unit VI (Lectures 9)

Importance & scope of post harvest management of fruits and vegetables in Indian economy.

Unit VII (Lectures 9)

Morphology, structure and composition of fruits and vegetables; maturity indices and standards for selected fruits and vegetables; methods of maturity determinations.

Unit VIII (Lectures 9)

Harvesting and handling of important fruits and vegetables, various Harvesting tools ; Field heat of fruits and vegetables and primary processing for sorting and grading at farm and cluster level; factors affecting post harvest losses

Unit IX (Lectures 9)

Post-harvest physiological and biochemical changes in fruits and vegetables; ripening of climacteric and non-climacteric fruits; regulations, methods; Storage practices: CA and MA, hypobaric storage, pre-cooling and cold storage, Zero energy cool chamber; Commodity pre treatments - chemicals, wax coating, pre packaging, VHT and irradiation.

Unit X (Lectures 9)

Physiological post harvest disorders - chilling injury and disease; prevention of post harvest diseases and infestation; Handling and packaging of fruits and vegetables; Post

Harvest handling system for fruits and vegetables of regional importance such as citrus, mango, banana, pomegranate, tomato, papaya and carrot, jackfruit etc., principles of transport and commercial transport operations.

Reference

1. Kadar AA. 1992. Post-harvest Technology of Horticultural Crops. 2nd Ed. University of California.
2. Lal G, Siddapa GS & Tandon GL. 1986. Preservation of Fruits and Vegetables. ICAR.
3. Pantastico B. 1975. Post Harvest Physiology, Handling and Utilization of Tropical and Subtropical Fruits and Vegetables. AVI Publ.
4. Salunkhe DK, Bolia HR & Reddy NR. 1991. Storage, Processing and Nutritional Quality of Fruits and Vegetables. Vol. I. Fruits and Vegetables. CRC.
5. Thompson AK. 1995. Post Harvest Technology of Fruits and Vegetables. Blackwell Sci.
6. Verma LR. & Joshi VK. 2000. Post Harvest Technology of Fruits and Vegetables. Indus Publ.
7. Barret DM, Somogyi LP & Ramaswamy H. 2005. Processing of Fruits. CRC Press
8. FAO. 2007. Handling and Preservation of Fruits and Vegetables by Combined Methods for Rural Areas- Technical Manual. FAO Agr. Ser. Bull., 149.
9. Fellows P. 2007. Guidelines for Small-Scale Fruit and Vegetables Processors. FAO Agr. Ser. Bull., 127.
10. Salunkhe DK & Kadam SS. 1995. Handbook of Fruit Science & Technology: Production, Composition and Processing. Marcel Dekker.
11. Somogyi LP. et al. 1996. Processing Fruits - Science and Technology. Vols I, II. Technomic Publ.
12. Srivastava RP & Kumar S. 2003. Fruit and Vegetable Preservation - Principles and Practices. International Book Distributors.
13. Verma LR & Joshi VK. 2000. Post Harvest Technology of Fruits and Vegetables. Indus Publ.

**SDC2FPT08 (P) BASIC CONCEPTS IN LABORATORY PRACTICES,
TECHNIQUES AND FOOD CHEMISTRY PRACTICAL (4 CREDITS)**

- **Safety measures while in Lab;** Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccumets; washing, drying and sterilization, of glassware; Drying of solvents/chemicals. Weighing and preparation of solutions of different strengths and their dilution; Handling techniques of solutions; Preparation of solutions of acids; Neutralisation of acid and bases; Preparation of buffers of different strengths and pH values. Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sandbath, waterbath, oilbath; Electric wiring and earthing. Preparation of media and methods of sterilization;
- Standardization of NaOH
- Standardization of HCl
- Determination of Moisture using
 - Hot air oven
 - Distillation method
 - Infrared method
- Determination of Acidity & pH
- Determination of T S S
 - Qualitative test for carbohydrates – Molisch’s test, Benedict’s test, Iodine test,
 - Anthrone test, Selivanoff’s test
- Qualitative Test of Proteins
 - Staining techniques – simple staining, gram staining
- Qualitative determination of SO₂
- Qualitative determination of benzoic acid
- Sensory evaluation
- Analysis of Lipids -Determination of Iodine value
- Determination of saponification value
- Determination of peroxide value
- Determination of Free Fatty Acid
- Analysis of Protein -Kjeldahl’s methods
- Analysis of Water- Total solids, Acidity of water, Alkalinity of water, Determination of Chloride, Hardness of water.
- Paper chromatography
- Ash content

**SDC2FPT09 (P) TECHNOLOGY OF PLANT PRODUCTS PRACTICAL
(4 CREDITS)**

- Determination of Moisture
- Determination of Ash
- Sedimentation value
- Determination alcoholic acidity
- Estimation of Gluten
- Determination of Water absorption power
- Qualitative analysis of gluten – Belshanke value
- Determination of falling number
- Preparation of Bread
- Preparation of Biscuit
- Preparation of Cake
- Determination of Physical parameters of wheat and rice
- Industrial Visit- Bakery Unit
- Industrial Visit –Confectionery Unit
- Industrial Visit- Cereal ,pulses & oilseeds Milling and extraction Unit
- Determination of Sulphur dioxide
- Estimation of Vitamin C
- Estimation of tannin – colorimetric method
- Estimation of alcohol content
- Determination of salt content in pickles
- Determination of reducing sugar
- Lye peeling
- Adequacy of blanching
- Preparation of ketchup
- Preparation of Jam & Jelly
- Preparation of squash

SEMESTER III

SDC3FPT11 GENERAL MATHEMATICS & STAISTICS (5 CRDITS)

Unit I (15 hours)

Linear Algebra :Matrix Definition, Order of a Matrix, Types of Matrices, Addition of Matrices, Multiplication of Matrices, Various Kinds of Matrices, Transpose of a Matrix. Linear System of equations and Solutions Using Gauss Elimination, Linear Independence and Rank, Determinants, Inverse

UnitII (15hours)

Differentiation:Derivative at a Point, Derivative of a Function, Differentiation From First Principle, Differentiation of Important Functions, Product Rule, Quotient Rule, Differentiation of a Function of a Function (Problem Based), Higher Order Derivatives.

UnitIII (15hours)

Integration: Integral as Anti-Derivative, Indefinite Integral & Constant of Integration, Fundamental Theorems, Elementary Standard Results, Methods of Integration-integration of the product or the quotient of two functions-Integration by substitution, Some special integrals.

UnitIV (15hours)

Integration through Partial Fractions, Integration by Parts. Definite Integral: Evaluation by Substitution, Properties of Definite Integrals (Problem Based)

Unit V (15 hours)

Data and its nature; data representation; diagrams and graphs using MSEXcel,Measures of Central tendency; Dispersion, Swekness and Kurtosis;

Unit VI (15 hours)

Descriptive statistics, Mean, variance, probability, conditional probability,Probability distribution.Binomial and Normal Distributions.

References:

1. Advanced Engineering Mathematics , Erwin Kreyszig, Wiley
2. Higher Engineering Mathematics, John Bird, Elsevier Direct
3. Skills in Mathematics: Algebra , S.K.Goyal
4. Higher Engineering Mathematics , B S Grewal, Khanna Publishers
5. Higher Engineering Mathematics , Ramana, Tata McGraw Hill
6. Engineering Mathematics , P Kandasamy, S. Chand Group
7. Aggarwal BL. 2003. Basic Statistics. New Age.
8. Brookes CJ, Betteley IG &Loxston SM. 1966. Mathematics and Statisticsfor Chemists. John Wiley & Sons.
9. Gupta SC &Kapoor VK. 2003. Fundamentals of Mathematical Statistics.S. Chand & Sons.
10. Gupta SP. 2004. Statistical Methods. S. Chand & Sons.

\SDC3FPT12 FOOD & NUTRITION (4 CRDITS)

Unit I (10 hrs)

Concept of Health -Definition of physical health, mental health, social health, spiritual health-determinants of health, indication of health

Concept of Nutrition -Definition of terms: Nutrition, under nutrition, Malnutrition, Health & Nutritional status – adequate, optimum & good nutrition. Relation of good nutrition to normal physical development & sound health

Unit II (10 hrs)

Energy-Definition of Caloric & Joule.Measurement of calorific values of food, basal metabolism, specific dynamic action of foods, energy needs of body, measurement of energy balance of body

Food Guide -Nutrients supplied by foods. Basic food groups

Unit III (22 hrs)

Carbohydrates -Sources, Classification, digestion, absorption, transportation & utilization, functions, sources, requirements and effect of deficiency. Dietary Fibre- Definition, classification, sources, role of fibre in human nutrition

Proteins -Classification, digestion absorption, transportation & utilization, functions, sources & requirements. Essential aminoacids, evaluation of protein quality, supplementation and deficiency.

Lipids -Classification, saturated and unsaturated fatty acids, digestion, absorption, transportation & utilization, functions, sources & requirements and effect of deficiency

Unit IV (20 hrs)

Minerals -Functions, sources, absorption and factors affecting the utilization of Calcium, Phosphorus, Iron, Iodine, Copper and Flouride, effects of deficiency

Vitamins -Classification, functions, sources, factors affecting destruction, factors enhancing vitamins in foods, absorption, requirements & deficiency conditions – Vit A, D, E, K, Ascorbic acid, Thiamine, Riboflavin, Niacin, Pyridoxine, Folic acid, Pantothenic acid

Unit V (10 hrs)

Water -Importance, distribution in body, function sources, requirements, water balance

References

1. Essential of food & Nutrition –Vol. 1 M. Swaminathan,Bappco,Bangalore.
2. Human Nutrition and Dietetics –Davidson S. Passmore

3. Normal and Therapeutic Nutrition- Corinne .H.Robinson & Marilyn Lawler
4. Contemporary Nutrition - Gordon M. Wardlaw, Paul Insel et, al., (2000) Mosby,Chicago.
5. Nutrition- concepts and controversies- Eleanor Whitney –Eighth Edition (2000)
6. Basic principles of Nutrition- Seema Yadav, First edition (1997)
7. Essentials of Nutrition and Diet therapy -Sue Rodwell Williams, fifth edition, Times Mirror Mosby College Publishing, 1990.
8. Understanding Nutrition -Whitney P.N. and Roes S.R., West Publication Co, 1996.
9. Swaminathan,M.Essential of Food & Nutrition,1974.Bappco,Bangalore.
10. Jussawalla,JM.Natural Dietics,A hand book on Food,Nutrition and Health.Wikas publishing house.
- 11.Sumati R Mudambi,Rajogopal,M.V.Fundamentals Food,nutrition & Diet Therapy,1982.New Age PLtd.
12. Education planning group.Food & Nutrition,1980.Arya publishing group, New Delhi
13. National Institute of Nutrition, Food & Health,I.C.M.R,Hydrabad

SDC3FPT13 FOOD PRESERVATION TECHNOLOGY (4 CRDITS)

Unit I (10 hrs)

Thermal Processing-Principles and application–Blanching, Pasteurization, Sterilization, Ultra high temperature sterilization, Aseptic processing

Unit II (10 hrs)

Drying-Significance: Natural drying- Sun and Solar drying, Artificial drying- Hot air drying, Drum drying, Spray drying, Dehydrofreezing, Freeze drying, Drying pre-treatments – blanching & sulphuring.

Unit III (10 hrs)

Low Temperature Processing-

Refrigeration, Low temperature preservation of Fresh Fruits, Vegetables, Meat & Fish products. Chilling injury.

Freezing, Principle, Freezing rate, Quick freezing, Slow freezing, Types of freezers- Air blast, Contact, Immersion, Fluidized bed and Cryogenic freezers.

Quality of frozen foods- Retrogradation, Protein denaturation, Freezer burn

Unit IV (5 hrs)

Irradiation-Source of ionization irradiation, Dose and Dosimetry, Mode of action, Scope of irradiation.

Unit V (7 hrs)

Fermentation-Principles, Significance, Types of fermentation- Acetic, Lactic and Alcoholic.

Unit VI (10 hrs)

Chemical Preservation-Natural preservatives-Mode of action. Chemical Preservatives - Sulphur dioxide, Benzoic acid, Sorbic acid, Propionic acid, Acetic acid.

Unit VII (10 hrs)

Recent Trends Food preservation applications– Pulsed electric fields, High pressure technology, Ohmic heating, Microwave heating, Ultrasonics, Nanotechnology, Hurdle technology.

Unit VIII (10 hrs)

New Product Development Food needs, consumer preference and Market survey, Steps in new product development

References

1. Fennema Owen R. Principles of food Science. Marcel Dekker, Inc
2. Murano, Peter S. Understanding Food Science and Technology .Thomson
3. Khader, Vijaya Textbook on Food Storage and Preservation Kalyani Publishers
4. Pruthi JS Quick Freezing Preservation of Foods Allied publishers Limited
5. Potter N N.& Hotchkiss 1997 Food Science CBS Publishers
6. Desrosier NW James N,1977 Technology of Food Preservation CBS Publishers
7. Arti Sanhla Food Preservation. Principles and practices
8. Manay,N.S,Shadaksharaswamy,M.,Foods:New Age international (P) publishers, New Delhi 2004
9. Shafiur Rahman M., 1999, Hand book of food preservation. Marcel Dekker, Inc, New York.
10. Subbulakshmi G and Udippi S.A Food Processing and PreservationI Foods:New Age international (P) publishers, New Delhi 2001

SDC3FPT14 FOOD PACKAGING TECHNOLOGY (3 CREDITS)

Unit I (4 hrs)

Introduction-Introduction to Food packaging, Definition, functions & properties

Unit II (10 hrs)

Classification-Classification of Packaging - Primary Secondary and Tertiary packaging, Flexible, rigid and semi rigid packaging Materials

Unit III (10 hrs)

Types of packages-Different forms of food containers, Boxes, Jars, Bottles, Cans, Metal cans, glass containers, plastic containers, pouches, Retort pouches, paper and paperboard. Films and Laminates, Edible films in packaging

Unit IV (10 hrs)

Packing Technologies-Aseptic, Retort, Vacuum, Inert gas, Form –Fill – Seal, Active, Controlled Atmosphere & Modified Atmosphere packaging

Unit V (10 hrs)

Shelf life evaluation- Shelf Life Estimation of packaged foods- oxygen transmission, water

Unit VI (10 hrs)

Food labelling Standard Weights and Measures Act, Packaging Commodity Regulatory Order for food commodities, Packaging symbols, Nutrition labelling

References

1. Gordon L. Robertson, “Food Packaging and Shelf life –A Practical Guide”, CRC Press, ISBN-9781420078442, 2010.
2. Coles, R., Dowell, D.M., Kirwan, J. “Food Packaging Technology”, Wiley-Blackwell Publishing Ltd, ISBN-9781405147712, 2009.
3. Chiellini, E., “Environmentally Compatible Food Packaging”, Wood Head Publishing Ltd and CRC press, ISBN-9781845691943, 2008.
4. M.L.Rooney, “Active Food Packaging”, Blackie Academic & Professional Publisher, London, 2012.
5. Gordon L. Robertson, “Food Packaging Principles & Practice”, CRC Press, 2006.
6. NIIR Board, “Food Packaging Technology Handbook”, National Institute of Industrial Research, New Delhi
7. Davis , E.G Evaluation of tin & plastic containers for foods, CBS publishers New Delhi
8. Mathlouthi, M Food Packaging and Preservation . Aspen
9. Larousse, Jean Food Canning Technology Wiley-VCH

10. Mahadeviah M & Gowramma RV 1996 Food Packaging Materials. Tata McGraw Hill

SDC3FPT15 DAIRY TECHNOLOGY (5 CRDITS)

Unit I (10 hrs)

Composition- Composition of milk from various sources, factors affecting composition of milk.

Unit II (15 hrs)

Properties-Physical and Chemical properties- Flavour, Colour, acidity, viscosity, Specific gravity, Freezing point, Boiling point, Effect of- heat, enzymes, acids and alkali.

Unit III (10 hrs)

Types of Milk Toned, Double toned milk, Standardized milk, Homogenized milk, and Recombined milk.

Unit IV (15 hrs)

Processing of Milk Processing, distribution and storage of liquid milk

Unit V (25 hrs)

Dairy Products

Cream and Butter Composition, Processing and Technology

Ice cream Technology of Ice cream: Ingredients, formulations, Freezing, Hardening, storage, Distribution and defects. Frozen dessert.

Cheese Introduction, Classification of cheese.Processing of cheese: Cottage and Cheddar.

Fermented milk Products Curd, yoghurt, Acidophilus milk, Kefir, koumiss, Probiotic

Milk powder Whole and skim milk powders, Instant milk powder

Unit VI (5 hrs)

Technology of Dairy by-products Whey protein products

Unit VII (10 hrs)

Dairy plant sanitation Objectives, CIP, Sanitizers

References

1. Sukumar D E. Outlines of Dairy Technology, Oxford University Press.
2. Johnson, Webb .Fundamentals of Dairy Chemistry.CBS Publishers and Distributers
3. Eckles, Clarence, Henry Milk and Milk Products, Tata MCGraw Hill publishers
4. Kurmann, Joseph A. Encyclopedia of Fermented Fresh Milk Products, CBS Publishers and Distributers
5. Atherton, Henry V. Chemistry and Testing of Dairy Products CBS Publishers and Distributers
6. Johnson, Webb Fundamentals of Dairy Chemistry CBS Publishers

7. Ananthkrishnan C P, Khan A Q, Padmanabhan P N. Technology of Milk Processing. Srilakshmi Publishers.
8. Walstra P, Geurts T. Dairy Technology. Marcel Dekker
9. Edgar Spreer. Milk and dairy product technology. Marcel Dekker

SEMESTER IV

GEC4EVS01 ENVIRONMENTAL SCIENCE (BOT6B12T) (3 CREDITS)

Unit I (15 hrs)

1. Ecosystem – Definition ; abiotic and biotic factors; trophic structure; Food chain and food web; Ecological pyramids; Energy flow; Productivity of ecosystems.
2. Biogeochemical cycles (Carbon, Nitrogen, Phosphorous)
3. Plant adaptations: Adaptations in Hydrophytes, Xerophytes, Halophytes, Epiphytes and Parasites.
4. Plant Succession: Definition – Primary and Secondary succession; Autogenic and allogenic succession; Mechanism of plant succession–Xerosere and Hydrosere 15 hrs.

Unit II (10hrs)

1. Biodiversity and Conservation: Definition; Biodiversity Global and Indian Scenario; Megadiversity nations and hotspots: Biosphere reserves; Biodiversity centres in India.
2. Threats to biodiversity; Endangered and endemic plant species – Red data book Exotic and indigenous plant species – Keystone species – Flagship species.
3. Conservation strategies ex situ and in situ methods. Organizations – IUCN, UNEP & WWF; (NBPGR) Biodiversity Board of Kerala (KSBDB).

Unit III (15 hrs)

1. Pollution: Sources and types of pollution – air, water, soil, thermal and noise; biodegradable and nonbiodegradable pollutants; biomagnifications; BOD.
2. Global environmental changes – climatic changes – global warming and greenhouse gases – acid rains – elnino – Efforts of world organizations in the regulation of green house gases emission.
3. Management of environmental pollution – conventional and phytotechnological approaches – solid wastes management including ewastesenvironmental legislations in India (Prevention and Control of Pollution act, 1981).

Unit IV (14 hrs)

1. Major ecosystems of the Biosphere; Sea; Estuarine ecosystem; Lentic ecosystem: lake, Pond; Lotic ecosystem: river; Desert; Forest; grass land.
2. Techniques in plant community studies – Quadrat and transect methods – species area curve – density, frequency, abundance, dominance of populations – importance value index – construction of phytographs.

References

1. Ahluvalia V.K. Malhotra S. 2009. Environmental Science. Ane Books – New Delhi.
2. Ambasht R.S. 1988. A text book of Plant Ecology. Students Friends Co. Varanasi.
3. Beeby A. & Brennan A.M. First Ecology. Ecological Principles and Environmental Issues. International Student Edition.
4. Benon E. Plant Conservation Biotechnology. Taylor & Francis Ltd. II New Felter Lane, London. EC4P4EE.

5. Cunningham W.P. and M.A. Cunningham 2003. Principles of Environmental Science: Inquiry and Applications. Tata McGraw Hill Pub. N.D.
6. Dash M.C. 1993. Fundamentals of Ecology. Tata McGraw Hill Publishing Company Ltd. New Delhi.
7. Dix J.H. 1989. Environmental Pollution. Atmosphere, Land, Water and Noise. Wiley Chichester.
8. Khitoliya R.K. 2007. Environmental Pollution – Management and Control for Sustainable development S. Chand and Company Ltd., New Delhi.
9. Kumar H.D. 1977. Modern Concepts of Ecology. Vikas Publications. New Delhi.
10. Michael S. 1996. Ecology. Oxford University Press, London.
11. Mishra D.D 2008. Fundamental Concepts in Environmental Studies. S. Chand & Co., New Delhi.
12. Mishra S.P. & S.N. Pandey 2008. Essential Environmental Studies. Ane Books Pvt. Ltd. Thiruvananthapuram.
13. Odum E.P. 1983. Basics of Ecology. Saunders International UN Edition.
14. Shukla R.S. & P.S. Chandel 2005. A Text Book of Plant Ecology S. Chand & Co. Ltd. New Delhi.

SDC4FPT16 SPICES & PLANTATION PRODUCTS TECHNOLOGY (4 CRDITS)

Unit I (Lectures 15)

Coffee: Occurrence, chemical constituents; harvesting, fermentation of coffee beans; changes taking place during fermentation; drying; roasting; process flow sheet for the manufacture of coffee powder; instant coffee types of coffee – drip, percolator, vacuum, instant and decaffeinated coffee. technology; chicory chemistry; quality grading of coffee.

Unit II (Lectures 15)

Tea: Occurrence, chemistry of constituents; harvesting; types of tea –green, oolong and CTC; chemistry and technology of CTC tea; manufacturing process for green tea and black tea manufacture; instant tea manufacture; quality evaluation and grading of tea. bio-tea, spiced tea, iced tea.

Unit III (Lectures 15)

Cocoa: Occurrence, chemistry of the cocoa bean & Composition; changes taking place during fermentation of cocoa bean; processing of cocoa bean; cocoa powder; cocoa butter, cocoa liquor manufacture; chocolates –types, chemistry and technology of chocolate manufacture; quality control of chocolates.,

Unit IV (Lectures 15)

Spices: Definition, classification, chemical composition, uses of spices

Major spices: Processing of pepper & Pepper products .

Processing of Turmeric, Ginger, Chillies and Cardamom.

Spice oils & oleoresins and method of manufacture; chemistry of the volatiles; fumigation and irradiation of spices.

Unit V (Lectures 12)

Other spices: Cumin, coriander, cinnamon, fenugreek, garlic, mace, clove, mint and vanilla

References

1. Pruthi JS Major Spices of India
2. Pruthi JS Quality Assurance in Spices and Spice Products
3. Banerjee B 2002 Tea production and Processing Oxford university press
4. Minifie BW . 1999 Chocolate , Cocoa and Confectionery Technology Aspen Publ
5. Sivetz M & Foote HE 1963 Coffee Processing Technology. AVI Publ.
6. Amit Krishna De. Spices; Traditional uses and Medicinal Properties
7. S. Manany, N S. Swamy Food Facts and Principles. New Age International Publishers
8. Sanjeev Kumar Sharma, Madhava Naidu M. Science of Coca Processing. Jain Brothers
9. NIIR. 2004. *Handbook on Spices*. National Institute of Industrial Research
10. Board, Asia Pacific Business Press Inc.
11. H Panda, Hand Book on Spices and Condiments, Asia Pacific Business Press Inc

SDC4FPT17 BEVERAGES TECHNOLOGY (4 CRDITS)

Unit I (Lectures 20)

Types of beverages and their importance; status of beverage industry in India; Manufacturing technology for juice-based beverages; synthetic beverages; technology of still, carbonated, low-calorie and dry beverages; isotonic and sports drinks; role of various ingredients of soft drinks, carbonation of soft drinks.

Unit II (Lectures 15)

Specialty beverages based on tea, coffee, cocoa, spices, plant extracts, herbs, nuts, dairy and imitation dairy-based beverages.

Unit III (Lectures 25)

Alcoholic beverages- types, manufacture and quality evaluation; the role of yeast in beer and other alcoholic beverages, ale type beer, lager type beer, technology of brewing process, equipments used for brewing and distillation, wine and related beverages, distilled spirits.

Unit IV (Lectures 12)

Packaged drinking water- definition, types, manufacturing processes, quality evaluation and raw and processed water, methods of water treatment, BIS quality standards of bottled water; mineral water, natural spring water, flavoured water, carbonated water.

References

1. Hardwick WA. 1995. Handbook of Brewing. Marcel Dekker.
2. Hui YH. et al 2004. Handbook of Food and Beverage Fermentation Technology. Marcel Dekker.
3. Priest FG & Stewart GG. 2006. Handbook of Brewing. 2nd Ed. CRC.
4. Richard P Vine. 1981. Commercial Wine Making - Processing and Controls. AVI Publ.
5. Varnam AH & Sutherland JP. 1994. Beverages: Technology, Chemistry and Microbiology. Chapman & Hall.
6. Woodroof JG & Phillips GF. 1974. Beverages: Carbonated and Non Carbonated. AVI Publ.

SDC4FPT18 TECHNOLOGY OF ANIMAL PRODUCTS (5 CRDITS)

Unit I (20 hrs)

Slaughter and Inspection of Meat-Humane method, Inspection of meat- Ante mortem and post-mortem inspection.

Slaughter of sheep, pigs, poultry.

Post mortem changes, ageing. Structure of meat, Factors affecting tenderness of meat, Effect of cooking on texture, colour and flavour

Unit II (20 hrs)

Cured Meat-Role of ingredients, Methods of curing, smoking, Processing of Ham, Bacon. Sausage - classification, emulsion, ground sausage, processing, casings, Factors affecting quality of cured meat

Unit III (10 hrs)

By products-Rendering, Feeds, Hides, Skins, Hoofs, Horns.

Unit IV (20 hrs)

Egg-Grading, Changes during storage.

Egg quality- Factors affecting egg quality, Measures of egg quality, Effect of cooking, Factors affecting coagulation, Industrial use of egg.

Preservation of egg Refrigeration, Freezing, Thermal processing, Dehydration, Coating.

Unit V (20 hrs)

Fish & Fish Products-Introduction, Spoilage indices

Preservation Cold storage, freezing, smoking, pickling, canning of fish, drying

Fish products Fish protein concentrate, Fish oils- Body oil, Liver oil, Fish meal, Fish Ensilage, Chitosan, pearl Essence, Glue, Gelatin

References

1. Gracey JF Collins DS Meat Hygiene ELBS
2. Person AM Gillet T A Processed Meats. CBS publishers
3. Lawrie R A Lawries Meat Science Tata McGraw Hill
4. Mountney T. Carmen G Parkhurst R Poultry Products Technology CBS Publishers
5. Ockerman HW Hancin CL Animal Byproduct Processing Elis Horwood
6. Gopakumar K Tropical Fishery Products Oxford
7. Jhingran VG Fish & Fisheries of India Hindustan Publishing Company
8. Biswas KP A Text Book of Fish and Fisheries Technology Tata McGraw Hill
9. Stadelman, William J.. Egg Science and Technology. CBS.
10. Parkhurst, Carmen R .Poultry Meat and Egg Production. CBS

SDC4FPT19 (P) ANIMAL & DAIRY PRODUCTS PRACTICAL (4 CREDITS)

- Acidity of Milk & curd
- Fat content in Milk
- Determination of total solids, SNF and specific gravity of milk
- Determination of Total ash in milk
- Acidity of butter
- Moisture content of butter
- Salt content in butter
- Adulteration in milk
- Preparation of Khoa, Peda
- Moisture content in Ghee
- Internal & External quality of egg
- Proximate composition of Meat & Fish

SEMESTER V

SDC5FPT20 FOOD ENGINEERING (4 CRDITS)

Unit I (10 hrs)

Unit operations & Heat transfer Mode of heat transfer– Conduction, Convection, Radiation

Unit II (15 hrs)

Heat exchanger-Classification, contact type heat exchange - Immersion, Non-contact type heat exchanger, Plate Heat exchanger, Scraped surface Heat exchanger, Tubular Heat exchanger, Double & Triple tube Heat exchanger, Shell & Tube Heat exchanger.

Pasteurization: LTLT, HTST, UHT, Pasteurizing equipments

Unit III (10 hrs)

Refrigeration & Freezing

Refrigeration Principle of refrigeration, Vapour compression refrigeration cycle.

Freezing Principle of freezing & freezing rate.

Unit IV (10 hrs)

Evaporation-Principle, single effect evaporation, multiple effect evaporation.

Types of evaporators - Horizontal tube, Vertical tube, Falling film evaporator, Raising film Evaporator.

Unit V (15 hrs)

Driers & Boilers-Driers Principle , constant rate & falling rate of period of drying.

Types of driers –working principles-types-Drum drier, Cabinet drier, Tunnel drier, Spray drier, Fluidized bed drier.

Boiler- Principle, working of water tube & fire tube boiler.

Unit VI(12 hrs)

Rheology Definition, Rheological characteristics of foods, viscosity, apparent viscosity-Newtonian and Non Newtonian

References

1. Rao D G. Fundamentals of Food Engineering. PHI learning private limited
2. Sahay KM &. Singh KK, 1994. Unit operations of Agricultural processing Vikas Publishing House
3. R S Khurmi & J K Gupta, A Textbook of Refrigeration & Air conditioning, S Chand
4. Singh RP, Heldman DR 1993 Introduction to Food Engineering Academic Press
5. Romeo. Toledo T Fundamentals Food Process Engineering CBS Publishers
6. Charm SE, Macabe, WL Smith JC & Hariot P 1993. Unit Operations of Chemical Engineering. McGraw Hills.

SDC5FPT21 FOOD TOXICOLOGY (2 CREDITS)

Unit I (Lectures 8)

Definition scope and general principles of food toxicology; manifestation of toxic effects; classification of food toxicants; factors affecting toxicity of compounds; methods used in safety evaluation-risk assessments.

Unit II (Lectures 12)

Toxicants and allergens in foods derived from plants, animals, marine, algae & mushroom; Microbial toxins; Food Poisoning; Food borne infections and disease.

Unit III (Lectures 8)

Derived Food toxicants- Processing & Packaging; Toxicants generated during food processing such as nitrosamines, acrylamide, benzene, dioxins and furans; persistent organic pollutants.

Unit IV (Lectures 8)

Toxicology & food additives; Toxicological aspects of nutrient supplements; Chemicals from processing such as fumigants, chlorinated solvents, autoxidation products, carcinogens in smoked foods and pyrolysis, agrochemicals; heavy metals; intentional and unintentional additives.

References

1. Branen AL, Davidson PM & Salminen S. 1990. Food Additives. Marcel Dekker.
2. Concon JM. 1988. Food Toxicology - Principles & Concepts. Marcel Dekker.
3. Hathcock JN. (Ed.). 1982. Nutritional Toxicology. Vol. I. Academic Press.
4. Rechkigl M Jr. 1983. (Ed.). Handbook of Naturally Occurring Food Toxicants. CRC Press.
5. Shabbir S. 2007. Food Borne Diseases. Humana Press.
6. Steven T. 1989. Food Toxicology: A Perspective on Relative Risks.
7. Tweedy BG. 1991. Pesticide Residues and Food Safety. Royal Society of Chemistry.

SDC5FPT22 INSTRUMENTAL FOOD ANALYSIS & TECHNIQUES (4 CREDITS)

Unit I (Lectures 5)

Sampling techniques; Water activity, its measurements and significance in food quality; Calibration and standardization of different instruments.

Unit II (Lectures 25)

Spectroscopic techniques using UV/Vis, fluorescence, IR, FTIR, NIR, NMR, atomic absorption, ICP, polarimetry, refractometry, microscopic techniques in food analysis (light microscopy, SEM, TEM, XRD, particle size analysis, image analysis etc.).

Unit III (Lectures 25)

Chromatographic techniques: Adsorption, column, partition, affinity, ion exchange, size exclusion, GC, HPLC, GCMS, LCMS.

Unit IV (Lectures 10)

Separation techniques: Gel filtration, dialysis, electrophoresis, sedimentation, ultrafiltration and ultracentrifugation, solid phase extraction, supercritical fluid extraction, isoelectric focusing, isotopic techniques, manometric techniques.

Unit V (Lectures 7)

Special techniques: Immunoassay techniques; Isotopic, non-isotopic and enzyme immunoassays; surface tension; enzymatic methods of food analysis; thermal methods in food analysis.

References:

1. AOAC International. 2003. Official methods of analysis of AOAC International. 17th Ed. Gaithersburg, MD, USA, Association of Analytical Communities.
2. Kirk RS & Sawyer R. 1991. Pearson's Chemical Analysis of Foods. 9th Ed. Longman Scientific & Technical.
3. Leo ML. 2004. Handbook of Food Analysis. 2nd Ed. Vols. I-III. Linden G. 1996. Analytical Techniques for Foods and Agricultural Products. VCH.
4. Macleod AJ. 1973. Instrumental Methods of Food Analysis. Elek Sci. Marcel Dekker.
5. Nielsen S. (Eds.). 1994. Introduction to Chemical Analysis of Foods. Jones & Bartlett.
6. Pomrenz Y & Meloan CE. 1996. Food Analysis - Theory and Practice. 3rd Ed. CBS.
7. Ranganna S. 2001. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. 2nd Ed. Tata-McGraw-Hill.
8. Robinson JW. 1970. Undergraduate Instrumental Analysis. Marcel Dekker.

SDC5FPT23 FOOD SAFETY REGULATION & STANDARDS (5 CREDITS)

Unit I (10 hrs)

Codex Alimentarius Commission (CODEX): Introduction, standards, codex of practice, guidelines and recommendations, applying codex standards, Codex India, core functions of National Codex Contact Point, National Codex Committee of India

Unit II (15 hrs)

International Organization of Standardization (ISO): Overview, structure, interpretation and case studies of food safety and Quality management including ISO-22000, ISO-9001:2000, ISO22000:2005, ISO 17025/CODES/GLP, Retailers standards: BRC food and BRC IOP standards, IFS, SQF: 1000, SQF: 2000.

Unit III (15 hrs)

Hazard Analysis Critical Control Point (HACCP): History, structure, pre- requisites and Principles, HACCP applications, HACCP based SOPs.

Unit IV (15 hrs)

Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP), Good Agricultural Practice(GAP), Good Veterinary Practice (GVP),Storage and distribution of food, sanitation and safety in food services.

Unit V (15 hrs)

Evolution in Food laws and regulations- Essential commodity Act,PFA, FPO,etc.,. Other Food Regulations and Standards- FDA, AGMARK, BIS ,

Unit VI (20 hrs)

FSSA, 2006: Salient features of food safety and standards Act, 2006, licensing and registration. Food safety standards of packaging and labelling regulations, 2011, safety standards of food product standards and food additives regulations 2011, safety standards of licensing and registration of food Business regulations,2011, Food safety standards of prohibition and restriction sales regulations 2011, Food safety and standards of contaminants, toxins and residues regulation 2011-,. Food safety standards of laboratory and sample analysis, 2011

References

1. Pelczar, M.I., and Reid, R.D. (2009) Microbiology, 5th Ed., McGraw Hill Inc., New York.
2. Adams, M.R., and Moss, M.G., (2005) Food Microbiology, 1st Ed., New Age International (P) Ltd., New Delhi.
3. Frazier, W.C. (2008) Food Microbiology, 4th Ed., McGraw Hill Inc., New York.
4. The training manual for Food Safety Regulators. Vol.II- Food Safety regulations and food safety management. (2011) Food safety and Standards Authority of India. New Delhi
5. Surak, J.G., and Wilson, S. (2007) American Society for Quality, 2nd Ed., Quality Press

6. Gazette of Food Safety and Standards Act, (2006) Food Safety regulations and food safety management. Food Safety and Standards Authority of India. New Delhi .

SDC5FPT24 FOOD SUPPLY CHAIN & BUSINESS MARKETING (5 CREDITS)

Unit I (15 hrs)

Concept of supply chain-Definition of Supply Chain Management- Supply Chain Management as a Management Philosophy- Growth of Supply chain, Function of SCM Strategic decision in supply chain- Value chain for Supply Chain Management

Unit II (20 hrs)

Customer focus in Supply Chain Management, Buyers Perspective, Suppliers Perspective, Stages of Development in Supplier Relations. Supply Chain Strategies – (i) Cycle View (ii) Push & Pull View. Achievement of strategic fit through different steps, Obstacles to achieving Strategic Fit.

Unit III (20 hrs)

Concept and functions of marketing; concepts and scope of marketing management; concepts and elements of marketing mix, Environmental analysis customer relationship marketing. Consumer behaviour; consumerism-consumer segmentation-Targeting-positioning; Marketing opportunities Analysis & marketing research

Unit IV (20 hrs)

Market measurement- present and future demand; Market forecasting; Marketing Planning Process, Product policy and planning: Product-mix; product line; product life cycle, New product development process. Product brand, packaging, services pricing decisions, Marketing channel decisions, Retailing, wholesaling and distribution, Advertising, Personal Selling, Publicity; Sales Promotion

Unit V (15 hrs)

.Food Supply chain-relevance of food supply chain in Food marketing, storage and cold storage –food logistics-Food Packing

References

1. Supply Chain Management – Sunil Chapra & Peter Meindl, PHI
2. Essentials of Supply Chain Management – Dr. R.P. Mohanty & Dr. S.G. Deshmukh, Jaico publishing House
3. Designing & Managing The Supply Chain David Simchi-Levi , Philip Kamiusky, Edith Simchi-L
4. Chhabra TN & Suria RK. 2001. *Management Process and Perspectives*. Kitab Mahal.
5. Jhingan ML. 2005. *International Economics*. 5th Ed. Virmda Publ.
6. Kotler P. 2000. *Marketing Management*. Prentice Hall.
7. Reddy SS, Ram PR, Sastry TVN & Bhavani ID. 2004. *Agricultural Economics*. Oxford & IBH.

SDC5FPT25 FOOD QUALITY MANAGEMENT & AUDITING (5 CREDITS)

Unit I (Lectures 15)

Concepts of quality management: Quality management systems in India; Various organizations dealing with inspection, traceability and authentication, certification and quality assurance; labelling issues.

Unit II (Lectures 15)

Quality assurance, Total Quality Management; Quality manuals, documentation and audits; Indian & International quality systems and standards like ISO and Food Codex; Export import policy, export documentation; Laboratory quality procedures and assessment of laboratory performance; Applications in different food industries; IPR and Patent.

Unit III (Lectures 15)

Food surveillance: International and national practices, procedure and protocols, food alerts, traceability and food product recall. Risk analysis: risk assessment, management and communication. Food standards and Specification: need for auditing, increasing importance of HACCP based Codex Standards (GATT).

Unit IV (Lectures 15)

Export and import of food in India: Introduction, import and export policies, FDA import policy, export-import policy, export control systems. Import intelligence and alert systems, packaging and labelling, specifications and certifications. Case studies and judicial pronouncements, procedure for investigations and filing of cases by food safety regulator as per FSS act.

Unit V (Lectures 15)

Inspection of food establishments, manufacturing units: Food regulatory enforcement and compliance through inspection. Inspectional requirements for food business operators: general inspection procedures, biological inspection of establishments.

Unit VI (Lectures 15)

Special establishment inspection: Processing of fruits and vegetables, bakery products, milk and milk products, meat and meat products, fish and fish products and chocolate and cocoa. Candy and chocolate processing units, fats and oil processing units, frozen food establishments, food canning plants, beverage industry, retail meat shops, food ware houses and food service distribution

References

1. Amerine MA, Pangborn RM & Rosslos EB. 1965. Principles of Sensory Evaluation of Food. Academic Press.
2. Early R. 1995. Guide to Quality Management Systems for Food Industries. Blackie Academic.
3. Furia TE. 1980. Regulatory status of Direct Food Additives. CRC Press.
4. Jellinek G. 1985. Sensory Evaluation of Food - Theory and Practice. Ellis Horwood.

5. Krammer A & Twigg BA.1973. Quality Control in Food Industry. Vol. I,II. AVI Publ.
6. Macrae R, Roloson R & Sadlu MJ. 1994. Encyclopedia of Food Science &Technology & Nutrition. Vol. XVI. Academic Press.
7. Piggot J.R. 1984. Sensory Evaluation of Foods. Elbview Applied Science.
8. Ranganna S. 2001. Handbook of Analysis and Quality Control for Fruit
9. The training manual for Food Safety Regulators. (2011) Vol.III, Food Safety regulations and food safety management. Food Safety and Standards Authority of India. New Delhi.
10. Foreign Trade Policy (27th August 2009 to 31st March 2014), Department of Commerce, Ministry of Commerce and Industry, Government of India

SDC5FPT26 (P) ANALYSIS OF FOODS (5 CREDITS)

- Determination of reducing sugar, total reducing sugar in honey/ jaggery / sugar (Lane & Eynone Method).
- Determination of Fructose: glucose ratio in honey (Iodimetry).
- Determination of Gum Base Content in Bubble gum/ chewing gum/ Cocoa butter (soxhlet extraction method)
- Detection and identification of synthetic food colours (Paper chromatographic method/ TLC)
- Determination of Fat content in cocoa butter
- Determination of acidity of extracted fat in cashewnuts / biscuits (Soxhlet extraction method)
- Estimation of crude fibre in fruits
- Estimation of starch content in vegetables
- Estimation of Protein (Colorimetric method) content in food
- Estimation of invert sugar in Jaggery / Honey
- Test for chicory in coffee
- Determination of Peroxidase enzyme
- Rehydration ratio of dried foods

References

1. Ranganna S 2001. Hand book of analysis and quality control of fruits and vegetable products Tata- McGraw- Hill. .
2. Nielson S 1994 Introduction to Chemical Analysis of Foods Jones & Bartlett
3. Pomrenz Y& Meloan CE 1996 Food Analysis Theory and Practice CBS
4. Food Safety Standard authority of India site manual