

Master copy

Outcome based Syllabus and Scheme of Examination

For

B. Sc. (Honors) Food Processing Technology

Under

Choice Based Credit System

In

Department of Food Processing and Technology,
Atal Bihari Vajpayee Vishwavidyalaya, Bilaspur
(A Govt. State University)

Course Effective from Academic Session 2019-20

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Background:

Ministry of Human Resource Development (HRD), Govt. of India, has already initiated the process for developing New Education Policy (NEP) in our country to bring out reforms in Indian education system. University Grants Commission (UGC) participates more actively in developing National Education Policy, its execution and promotion of higher education in our country. The UGC has already initiated several steps to bring equity, efficiency and academic excellence in National Higher Education System. The important ones include innovation and improvement in course- curricula, introduction of paradigm shift in learning and teaching pedagogy, examination and education system. The education plays enormously significant role in building of a nation. There are quite a large number of educational institutions, engaged in imparting education in our country. Majority of them have entered recently into semester system to match with international educational pattern. However, our present education system produces young minds lacking knowledge, confidence, values and skills. It could be because of complete lack of relationship between education, employment and skill development in conventional education system. The present alarming situation necessitates transformation and/or redesigning of education system, not only by introducing innovations but developing "learner-centric approach in the entire education delivery mechanism and globally followed evaluation system as well. Majority of Indian higher education institutions have been following marks or percentage-based evaluation system, which obstructs the flexibility for the students to study the subjects/courses of their choice and their mobility to different institutions. There is need to allow the flexibility in education system, so that students depending upon their interests and aims can choose interdisciplinary, intra-disciplinary and skill-based courses. This can only be possible when choice-based credit system (CBCS), an internationally acknowledged system, is adopted.

Choice Based Credit System (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill-based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

The choice-based credit system not only offers opportunities and avenues to learn core subjects but also exploring additional avenues of learning beyond the core subjects for holistic development of an individual. The CBCS will undoubtedly facilitate us bench mark our courses with best international academic practices. The CBCS has more advantages than disadvantages. Advantages of the choice-based credit system: Shift in focus from the teacher-centric to student-centric education.

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- Student may undertake as many credits as they can cope with (without repeating all courses in a given semester if they fail in one/more courses).
- CBCS allows students to choose inter-disciplinary, intra-disciplinary courses, skill-oriented papers (even from other disciplines according to their learning needs, interests and aptitude) and more flexibility for students)
- CBCS makes education broad-based and at par with global standards. One can take credits by combining unique combinations. For example, Physics with Economics, Microbiology with Chemistry or Environment Science etc. CBCS offers flexibility for students to study at different times and at different institutions to complete one course (ease mobility of students). Credits earned at one institution can be transferred.

Outline of Choice Based Credit System:

1. Core Course: A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. Elective Course: Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

2.1 Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

2.2 Dissertation/Project: An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.

2.3 Generic Elective (GE) Course: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective. P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.

3. Ability Enhancement Courses (AEC)/Competency Improvement Courses/Skill Development Courses/Foundation Course: The Ability Enhancement (AE) Courses may be of two kinds: AE Compulsory Course (AECC) and AE Elective Course (AEEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement. They ((i) Environmental Science, (ii) English/MIL Communication) are mandatory for all disciplines. AEEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

3.1 AE Compulsory Course (AECC): Environmental Science, English Communication/MIL Communication.

3.2 AE Elective Course (AEEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

Study Webs of Active-learning for Young Aspiring Minds (SWAYAM)

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As per 'Digital India' Initiative, MHRD has initiated to develop & make available 'Massive Online Open Courses (MOOCs)' to the learners throughout the country. The Ministry of HRD, has accordingly embarked on a major and new initiative called 'Study Webs of Active Learning for Young Aspiring Minds' (SWAYAM), which will provide one integrated platform and portal for online courses, using information and communication technology (ICT) and covering all higher education subjects and skill sector courses to ensure that the every student in our country has access to the best quality higher education at the affordable cost.

SWAYAM is initiated by Government of India, to take best teaching learning resources to all, including the most disadvantaged. The three cardinal principles of Education Policy viz., access, equity and quality shall be achieved by providing high quality e-content to all learners in the country through SWAYAM. Courses delivered through SWAYAM are available free of cost to the learners, are delivered by best of the teaching fraternity.

The MHRD has developed a detailed "MOOCs Guidelines, 2017" (Page 71-86) and funding for development & delivery of MOOCs is being provided by MHRD through institutions. The courses hosted on SWAYAM are developed in 4 quadrants –

(i) e-Tutorial: video lecture using audio-video, multi-media, animation and state of the art pedagogy / technology)

(ii) e-Text: specially prepared reading material that can be downloaded / printed

(iii) Discussion forum: for raising doubts and clarifying them on a near real time basis by Course Coordinator or his team and

(iv) Assignments: which shall contain; Problems and Solutions that could be in the form of Multiple Choice Questions, Fill in the blanks, Matching Questions, Short Questions, Long Questions, Quizzes, Assignments and solutions, FAQs and providing Clarifications on general misconceptions. Assignments are checked & assessment/ feedback made available to registered students.

UGC and AICTE have issued 'Credit Framework for online learning courses through SWAYAM, Regulation 2016 (http://www.ugc.ac.in/pdfnews/0272836_moocs.pdf); allowing upto 20% Online courses taken through SWAYAM, to be counted for credit. Grades earned by successful students studying in conventional Institutes shall be transferred to the academic record of such Students. The MHRD, with effect from 16th November 2016, has on Trial basis, made public the SWAYAM portal "<https://swayam.gov.in>".

The proposed scheme and syllabus is as per strict guidelines of UGC and SWAYAM regulation and also based on outcome of each subject along with overall outcome of the program.

PREAMBLE

The course in Choice Based Credit System would be of 3 year duration having 6 semesters, divided into 14 Core papers, 4 Discipline Specific Elective courses, 2 Skill Enhancement Elective Courses and 4 Generic Elective Courses. Each Year would consist of 2 semesters. The new course has been prepared keeping in view, the unique requirements of B.Sc. (H) Food Processing Technology students. The objectives of the course are-

- To impart knowledge of various areas related to Food Science and Technology,

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- To enable the students to understand food composition and its physicochemical, nutritional, microbiological and sensory aspects,
- To familiarize the students about the processing and preservation techniques of pulses, oilseeds, spices, fruits and vegetables, meat, fish, poultry, milk & milk products,
- To emphasize the importance of food safety, food quality, food plant sanitation, food laws and regulations, food engineering and packaging in food industry.

The contents have been drawn-up to accommodate the widening horizons of the discipline of Food Technology. They reflect the current changing needs of the students. For the Generic elective (GE) to be chosen by Food Technology students, It is recommended that subjects like Biochemistry, Biology, Chemistry, Maths and statistics, Biostatistics, Physics be chosen as they are synergistic to the curriculum. However, students are free to pick up any of the Generic Elective Courses offered by other departments.

- For each paper, the objectives have been listed and the contents divided into units.
- The detailed syllabus for each paper is appended with the list of suggested readings.
- Teaching time allotted for each paper shall be 4 periods for each theory paper and 4 periods for each practical class per week for each paper per week.
- Each practical batch should ideally be between 15-20 students so that each student receives individual attention.

Programme Learning Outcomes (PLO) for B.Sc. (Honors) Food Processing Technology

On completion of this programme, the students are expected to

Students can initiate their start-up projects and be Entrepreneurs in Food Processing Sector.

1. They can be employed as product development managers in a food research company to devise new food products.
2. They can be placed as food technologists to ensure and monitor the quality and hygiene of food products in their contamination and adulteration prevention units in food production units.
3. A Food Technologist can hold various positions of responsibility in public and private sectors such as Supervisors, Assistant Managers, Production Managers, Food Packaging Manager, R & D personnel, Food Scientist, Food Development Manager, etc.
4. A Food Technologist is welcomed in the R&D departments in various food manufacturing companies to work as a sensory scientist to monitor organic properties like aroma, flavor, etc.
5. Quality Assurance Manager, Production Manager, Laboratory Supervisor, Food Packaging Manager or as a technician in food processing and packaging industry or even as a research associate in premier institutes, universities and research and development units are some of the other job opportunities for a Food Technologist.
6. This course is also beneficial for higher studies such as M. Sc. and Ph.D.

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B.Sc. (Honors) Food Processing Technology
Scheme under CBCS as per UGC guideline

Semester I															
Course Category	Course Code	Subject Code	Subject Name	Credit			T O T A L	Marks							
				L	P	T		Theory			Practical				
								SEE Max	CIA Max	Total Max	SEE Max	CIA Max	Total Max		
Core	C-1	FPT-101	Fundamentals of Food Technology	4	2	-	6	75	25	100	40	35	15	50	20
				4	2	-	6	75	25	100	40	35	15	50	20
AECC	AECC-1	FPT-103	English Communication	4	-	-	4	75	25	100	40	-	-	-	-
GE	GE-1	FPT-104	Food Microbiology and Food Safety	4	2	-	6	75	25	100	40	35	15	50	20
ECA	-	FPT-105	ECA/ General Interest/Hobby/ Sports/NCC/NSS/ Swachh Bharat internship/ Summer Internship/ Others	-	2	-	2	-	-	-	-	-	50	50	20
Total Credit				16	8	-	24	Total Marks	Theory	400	Total Marks	Practical	200		
Total Marks – 600															

Abbreviations :- C – Core Course, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, ECA – Extra Curricular Activity, L – Lecture, P – Practical, T – Tutorial, SEE – Subjective External Evaluation, CIA – Continuous Internal Evaluation.

Note:

1. Student can obtain online course of any one subject from the list of the SWAYAM courses selected by the department before the commencement of each semester in lieu of that particular subject.
2. The credit earned from the MOOC course will be reflected under the CBCS as per the credit assigned to that particular subject.
3. ECA is offered as a choice only two times out of four available options.

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Semester II														
Course Category	Course Code	Subject Code	Subject Name	Credit			Marks							
				L	P	T	Theory		Practical		Total			
							SEE Max	CIA Max	SEE Max	CIA Max				
Core	C-3	FPT-201	Technology of Food Preservation	4	2	-	75	25	100	40	35	15	50	20
	C-4	FPT-202	Food Processing Technology	4	2	-	75	25	100	40	35	15	50	20
AECC	AECC-2	FPT-203	Environmental Science	4	-	-	75	25	100	40	-	-	-	-
GE (Any one)	GE-2	FPT-204	Food Processing and Preservation	4	2	-	75	25	100	40	35	15	50	20
	GE-3	FPT-205	Chemistry of Food	4	2	-	75	25	100	40	35	15	50	20
ECA	-	-	ECA/ General Interest/Hobby/ Sports/NCC/NSS/ Swachh Bharat Internship/ Summer Internship/ Others	-	2	-	-	-	-	-	-	50	50	20
	Total Credit				16	8		Total Marks	Theory	400	Total Practical Marks	200		
Total Marks: 600														

Abbreviations :- C – Core Course, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, ECA – Extra Curricular Activity, L – Lecture, P – Practical, T – Tutorial, SEE – Subjective External Evaluation, CIA – Continuous Internal Evaluation.

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3. ECA is offered as a choice only two times out of four available options.

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Semester III

Course Category	Course Code	Subject Code	Subject Name	Credit			Marks							
				L	P	T	Theory			Practical				
							SEE Max	CIA Max	Total	SEE Max	CIA Max	Total		
Core	C-5	FPT-301	Food Quality and Sensory Evaluation	4	2	-	75	25	100	40	35	15	50	20
	C-6	FPT-302	Food and Nutrition	4	2	-	75	25	100	40	35	15	50	20
	C-7	FPT-303	Principles of Food Science	4	2	-	75	25	100	40	35	15	50	20
SEC	SEC-1	FPT-304	Food Fermentation Technology	-	2	-	75	25	-	-	35	15	50	20
GE	GE-4	FPT-305	Sensory Evaluation of Food	4	2	-	75	25	100	40	35	15	50	20
ECA	-	FPT-105	ECA/ General Interest/Hobby/ Sports/NCC/NSS/ Swachh Bharat Internship/ Summer Internship/Others	-	2	-	-	-	-	-	-	50	50	20
Total Credit				16	10	-	26	400	400	400	250	250	250	250
Total Marks 650														

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Note:

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2. The credit earned from the MOOC course will be reflected under the CBCS as per the credit assigned to that particular subject.
3. ECA is offered as a choice only two times out of four available options.

Semester IV

Course Category	Course Code	Subject Code	Subject Name	Credit			T O	Marks							
				L	P	T		Theory			Practical				
								SEE Max	CIA Max	Total	SEE Max	CIA Max	Total		
Core	C-8	FPT-401	Food Engineering	4	2	-	6	75	25	100	40	35	15	50	20
	C-9	FPT-402	Technology of Fruits, Vegetables and Plantation Crops	4	2	-	6	75	25	100	40	35	15	50	20
	C-10	FPT-403	Technology of Cereals, Pulses and Oilseeds	4	2	-	6	75	25	100	40	35	15	50	20
SEC	SEC-2	FPT-404	New Product Development		2	-	2	-	-	-	-	35	15	50	20
GE (Any one)	GE-5	FPT-405	Food Engineering and Packaging	4	2	-	6	75	25	100	40	35	15	50	20
	GE-6	FPT-406	Technology of Plant and Animal Foods	4	2	-	6	75	25	100	40	35	15	50	20
ECA	-	FPT-105	ECA/General Interest/Hobby/Sports/NCC/NSS/Swachh Bharat internship/Summer Internship/Others	-	2	-	2	-	-	-	-	-	50	50	20
			Total Credit	16	10		26	Total Marks	Theory	400		Total Marks	Practical	250	

Total Marks: 650

Abbreviations :- C – Core Course, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, ECA – Extra Curricular Activity, L – Lecture, P – Practical, T – Tutorial, SEE – Subjective External Evaluation, CIA – Continuous Internal Evaluation.

Note:

1. Student can obtain online course of any one subject from the list of the SWAYAM courses selected by the department before the commencement of each semester in lieu of that particular subject.
2. The credit earned from the MOOC course will be reflected under the CBCS as per the credit assigned to that particular subject.
3. ECA is offered as a choice only two times out of four available options.

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Semester V

Course Category	Course Code	Subject Code	Subject Name	Credit			T O T A L	Marks							
				L	P	T		Theory			Practical				
								SEE Max	CIA Max	Total	SEE Max	CIA Max	Total		
Core	C-11	FPT-501	Technology of Dairy and Sea Food	4	2	-	6	75	25	100	40	35	15	50	20
	C-12	FPT-502	Food Chemistry -I	4	2	-	6	75	25	100	40	35	15	50	20
DSE	DSE-1	FPT-503	Food Safety	4	2	-	6	75	25	100	40	35	15	50	20
	DSE-2	FPT-504	Nutraceutical and Functional Foods	4	2	-	6	75	25	100	40	35	15	50	20
Total Credit				16	8		24	Total Theory Marks	400		Total Practical Marks	200			
Total Marks -600															

Abbreviations :- C – Core Course, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, ECA – Extra Curricular Activity, L – Lecture, P – Practical, T – Tutorial, SEE – Subjective External Evaluation, CIA – Continuous Internal Evaluation.

Note:

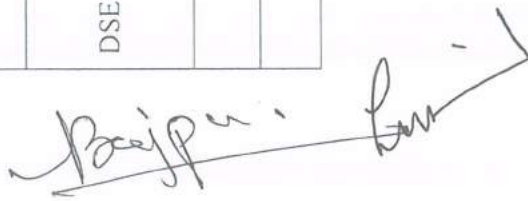
1. Student can obtain online course of any one subject from the list of the SWAYAM courses selected by the department before the commencement of each semester in lieu of that particular subject.
2. The credit earned from the MOOC course will be reflected under the CBCS as per the credit assigned to that particular subject.

Semester VI															
Course Category	Course Code	Subject Code	Subject Name	Credit			T O T A L	Marks							
				L	P	T		Theory			Practical				
								SEE	CIA	Total	SEE	CIA	Total		
Max	Max	Max	Max	Max	Min	Max	Max	Min							
Core	C-13	FPT-601	Technology of Meat, Poultry and Eggs	4	2	-	6	75	25	100	40	35	15	50	20
	C-14	FPT-602	Food Chemistry- II	4	2	-	6	75	25	100	40	35	15	50	20
DSE	DSE-3	FPT-603	Food Quality Management	4	2	-	6	75	25	100	40	35	15	50	20
	DSE-4	FPT-604	Food Packaging	4	2	-	6	75	25	100	40	35	15	50	20
Total Credit				16	8	-	24	Total Theory Marks	400	Total Practical Marks	200				
Total Marks – 600															

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Syllabus of B. Sc. (H) Food Processing Technology

First Semester

Course Name: Fundamentals of Food Technology Cc (4+2)

Course Learning Outcome:

1. Understand the history and evolution of food processing.
2. Obtain knowledge on the structure, composition, nutritional quality and post-harvest changes of various plant foods.
3. Obtain good understanding of the structure and composition of various animal foods.

Course Content

Unit 1: Introduction

Historical evolution of food processing technology.

Unit 2: Compositional, Nutritional and Technological aspects of Plant foods

I. Cereals and Millets

- Structure & composition of cereals
- Wheat – structure and composition, types [hard, soft\strong, weak] diagrammatic representation of longitudinal structure of wheat grain.
- Malting, gelatinization of starch, types of browning – Maillard and Caramelization.
- Rice- Structure and composition, parboiling of rice –advantages and disadvantages.

II. Pulses

- Structure and composition of pulses, toxic constituents in pulses, processing of pulses – soaking, germination, decortications, cooking and fermentation.

III. Fats and Oils :

- Classification of lipids, types of fatty acids –saturated fatty acids, unsaturated fatty acids, essential fatty acid, trans fatty acids.
- Refining of oils, types- steam refining, alkali refining, bleaching, steam deodorization, and hydrogenation.
- Rancidity –Types- hydrolytic and oxidative rancidity and its prevention.

IV. Fruits and Vegetables

- Classification of fruits and vegetables, general composition, enzymatic browning, names and sources of pigments, Dietary fibre.
- Post-harvest changes in fruits and vegetables – Climacteric rise, horticultural maturity, physiological maturity, physiological changes, physical changes, chemical changes, pathological changes during the storage of fruits and vegetables.

Unit 3: Compositional, Nutritional and Technological aspects of Animal foods

I. Flesh Foods – Meat, Fish, Poultry

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- Meat - Definition of carcass, concept of red meat and white meat, composition of meat, marbling, post-mortem changes in meat- rigor mortis, tenderization of meat, ageing of meat.
- Fish - Classification of fish (fresh water and marine), aquaculture, composition of fish, characteristics of fresh fish, spoilage of fish- microbiological, physiological, biochemical.
- Poultry - Structure of hen's egg, composition and nutritive value, egg proteins, characteristics of fresh egg, deterioration of egg quality, difference between broiler and layers.

II. Milk and milk products

- Definition of milk, chemical composition of milk, its constituents, processing of milk, pasteurization, homogenization. An overview of types of market milk and milk products.

Practical

1. Study different types of browning reactions: enzymatic and non-enzymatic.
2. To study gelatinization behavior of various starches
3. To study the concept of gluten formation of various flours.
4. To study malting and germination.
5. To study dextrinization in foods.
6. Identification of pigments in fruits and vegetables and influence of pH on them.

Recommended Readings

1. Bawa. A.S, O.P Chauhan et al. Food Science. New India Publishing agency, 2013
2. Roday, S. Food Science, Oxford publication, 2011.
3. B. Srilakshmi, Food science, New Age Publishers, 2002
4. Meyer, Food Chemistry, New Age, 2004
5. De Sukumar., Outlines of Dairy Technology, Oxford University Press, 2007

Course Name: Food Microbiology Cc (4+2)

Course Learning Outcome:

1. To know the important genera of microorganisms associated with food and their characteristics.
2. Obtain a good understanding of pure culture technique for isolating and transferring.
3. Understand the principles for controlling microorganisms in foods

Course Content

Unit 1: Introduction to Food Microbiology (Chapter 1, Garbutt, Chapter 1, Pelczar et. al)

History and Development of Food Microbiology

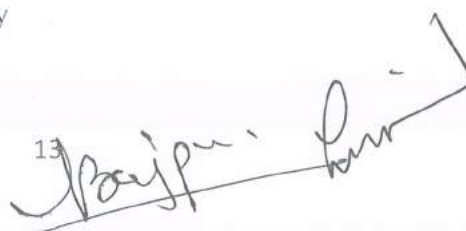
Definition and Scope of food microbiology


Inter-relationship of microbiology with other sciences

Unit 2: Characteristics of Microorganisms in Food (Chapter 1, Jay)

Types of microorganisms associated with food, their morphology and structure

Significance of spores in food microbiology

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Unit 3: Microbial Growth in Food (Chapter 4 and 6, Garbutt)

Bacterial growth curve and microbial growth in food
Factors affecting the growth of microorganisms in food

Unit 4: Cultivation of Micro-organisms (Chapter 5, Garbutt)

Pure culture technique
Methods of isolation and cultivation
Enumeration of Microorganisms- qualitative and quantitative

Unit 5: Control of Microorganisms in Foods

Principles and methods of preservation
Physical Methods of Food Preservation- Dehydration, Freezing, Cool Storage, Heat Treatment (esp. thermobacteriology), Irradiation,
Biopreservatives esp. Bacteriocins
Introduction to Hurdle concept and Non Thermal methods (Part 2, Frazier)

Unit 6: Trends in Food Microbiology (Chapter 11, Garbutt)

Rapid Methods of Detection, Recent Advances

Practical

1. Functioning and use of compound microscope
2. Cleaning and sterilization of glassware
3. Cultivation and sub-culturing of microbes
4. Preparation of slant, stab and plates using nutrient agar
5. Morphological study of bacteria and fungi using permanent slides
6. Simple staining
7. Gram's staining
8. Standard Plate Count Method

Recommended Readings

1. Frazier William C and Westhoff, Dennis C. Food Microbiology, TMH, New Delhi, 2004
2. Jay, James M. Modern Food Microbiology, CBS Publication, New Delhi, 2000
3. Garbutt, John. Essentials of Food Microbiology, Arnold, London, 1997
4. Pelczar MJ, Chan E.C.S and Krieg, Noel R. Microbiology, 5thEd., TMH, New Delhi, 1993

Course Name: English Communication AECC (4)

Course Learning Outcome:

1. To help learners use English Language for contemporary academic and social needs.
2. Students develop all the four language skills which will enhance their communication abilities taking support from literary texts.
3. Students will also learn to use language creatively and critically.

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Course Content

Unit 1: Introduction

Theory of Communication, Types and modes of Communication

Unit 2: Language of Communication

Verbal and Non-verbal (Spoken and Written)

Personal, Social and Business Barriers and Strategies

Intra-personal, Inter-personal and Group communication

Unit 3: Speaking Skills

Monologue, Dialogue, Group Discussion, Effective Communication/ Mis- Communication,

Interview, Public Speech

Unit 4: Reading and Understanding:

Close Reading, Comprehension, Summary Paraphrasing, Analysis and Interpretation,

Translation (from Indian language to English and vice-versa)

Literary/Knowledge Texts

Unit 5: Writing Skills

Documenting, Report Writing, Making notes, Letter writing

Recommended Readings

1. Fluency in English - Part II, Oxford University Press, 2006.

2. Business English, Pearson, 2008.

3. Language, Literature and Creativity, Orient Blackswan, 2013.

4. Language through Literature (forthcoming) ed. Dr. Gauri Mishra, Dr Ranjana Kaul, Dr Brati Biswas

Course Name: Food Microbiology and Food Safety Cc (4+2)

Course Learning Outcome:

1. To know the important genera of microorganisms associated with food and their characteristics.
2. To understand the role of microbes in fermentation, spoilage and food borne diseases.
3. To understand Food safety and hygiene, types of hazards associated with food
4. To understand current Food regulations and Food Safety Management Systems.

Course Content

Unit 1: Sources of Microorganisms in foods and Microbial Food Spoilage

Some important food spoilage microorganisms, Spoilage of specific food groups- Milk and dairy products, Meat, poultry and seafoods, Cereal and cereal products, Fruits and vegetables and Canned products (Part 3, Frazier and Westhoff, Chapter 8, Garbutt)

Unit 2: Food Fermentations

Definition and types

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Yashvardhan

Microorganisms used in food fermentations

Dairy Fermentations-starter cultures and their types, concept of probiotics,

Fermented Foods-types, methods of manufacture for vinegar, sauerkraut, tempeh, miso, soya sauce, beer, wine and traditional indian foods

(Part 4, Frazier and Westhoff, Chapter 10, Garbutt)

Unit 3: Food Borne Diseases

Types – foodborne infections, foodborne intoxications and toxin infections, Origin, symptoms and prevention of some commonly occurring food borne diseases

(Ch-23, 24, 25, Frazier and Westhoff) (Chapter 9, Garbutt)

Unit 4: Introduction to Food Safety

Definition, Types of hazards, biological, chemical, physical hazards, Factors affecting Food Safety (Ch-1, Forsythe)

Unit 5: Hygiene and Sanitation in Food Service Establishments

Introduction, Sources of contamination, Control methods using physical and chemical agents, Waste Disposal, Pest and Rodent Control, Personnel Hygiene (Ch- 1, Marriot)

Unit 6:

Food Safety Management Tools

Basic concept, Prerequisites, HACCP, ISO series, TQM and Risk Analysis (Ch-7, Forsythe)

Practical

1. Introduction to the Basic Microbiology Laboratory Practices and Equipments
2. Preparation and sterilization of nutrient broth and media
3. Bacteriological analysis of water
4. Assessment of surface sanitation by swab/rinse method
5. Assessment of personal hygiene
6. Scheme for the detection of food borne pathogens
7. Implementation of FSMS – HACCP, ISO : 22000

Recommended Readings

1. Frazier William C and Westhoff, Dennis C. 2004 Food Microbiology, TMH, New Delhi,
2. Jay, James M. 2000 Modern Food Microbiology, CBS Publication, New Delhi,
3. Garbutt, John. 1997 Essentials of Food Microbiology, Arnold, London,
4. Pelczar MJ, Chan E.C.S and Krieg, Noel R 1993 Microbiology, 5th Ed., TMH, New Delhi
5. Lawley, R., Curtis L. and Davis, J., 2004 The Food Safety Hazard Guidebook, RSC publishing.
6. De Vries, 1997, Food Safety and Toxicity, CRC, New York,
7. Marriott, Norman G., 1985, Principles of Food Sanitation, AVI, New York,
8. Forsythe, S J, 1987, Microbiology of Safe Food, Blackwell Science, Oxford, 2000 65 & Sons; USA,

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Second Semester

Course Name: Technology of Food Preservation Cc (4+2)

Course Learning Outcome:

1. To understand the importance microorganisms in food preservation
2. To understand the basics of various food processing and preservation technologies.

Course Content

Unit 1: Food Microbiology

Principle of Food Preservation, microorganism associated with foods –bacteria, yeast and mold, importance of bacteria, yeast and molds in foods, classification of microorganism based on temperature, pH, water activity, nutrient and oxygen requirement, typical growth curve of microorganism. Classification of food based on pH, Food infection, food intoxication, definition of shelf life, perishable foods, shelf stable foods.

Unit 2: Food Preservation by Low temperature

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 3: Food Preservation by High temperature

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

Unit 4: 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.

Unit 5: 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.

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 pHmeter.
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.

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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 et al. Food Science. New India Publishing agency, 2013
4. Frazier W C and Westhoff D C, Food Microbiology, TMH Publication, New Delhi, 2004

Course Name: Food Processing Technology Cc (4+2)

Course Learning Outcome:

To demonstrate basic knowledge of:

1. Cold Preservation and freezers
2. Dehydration
3. Irradiation
4. Food Packaging
5. Thermal Processing

Course Content

Unit 1: Cold Preservation

Freezing: requirements of refrigerated storage - controlled low temperature, air circulation and humidity, changes in food during refrigerated storage, progressive freezing, changes during freezing - concentration effect and ice crystal damage, freezer burn. Refrigeration load, factors determining freezing rate - food composition and non compositional influences (Ch 9, Potter)

Unit 2: Freezing - Mechanism and freezers

Freezing methods - direct and indirect, still air sharp freezer, blast freezer, fluidized freezer, plate freezer, spiral freezer and cryogenic freezing. (Ch 9, Potter)

Unit 3: Dehydration

Normal drying curve, effect of food properties on dehydration, change in food during drying, drying methods and equipment's air convection dryer, tray dryer, tunnel dryer, continuous belt dryer, fluidized bed dryer, spray dryer, drum dryer, vacuum dryer, freeze drying, foam mat drying. (Ch 10, Potter)

Unit 4: Food Irradiation and Microwave Heating

Ionizing radiation and sources, direct and indirect radiation effects, safety and wholesomeness of irradiated food. Microwave heating and application. (Ch. 11, Potter)

Unit 5: Packaging of foods

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Packaging: Properties of packaging material, factors determining the packaging requirements of various foods and brief description of packaging of frozen products, dried products, fats and oils and thermally processed foods (Ch 1, 9-12, Paine and Paine)

Unit 6: Material handling

Elementary concept of material handling in food industry, equipment and functioning of belt conveyor, screw conveyor, bucket elevator and pneumatic conveyor. (Ch 26, Rao)

Unit 7: Thermal processing

Introduction, classification of Thermal Processes, Principles of thermal processing, Thermal resistance of microorganisms, Thermal Death Time, Lethality concept, characterization of heat penetration data, Thermal process Calculations (Ch 3, Ramaswamy)

Unit 8: Separation processes

Principles and methods of: distillation, extraction, washing, filtration, sedimentation, sieving and centrifugation (Ch 13, 14 Toledo)

Practical.

1. Comparison of conventional and microwave processing
2. Preservation of food by the process of freezing
3. Preservation of food by canning (fruit\vegetable\meat)
5. Cut-out analysis of canned food
6. Osmotic dehydration


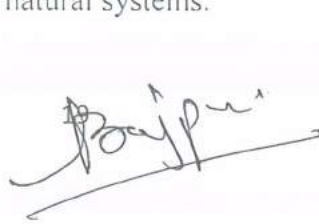
Recommended Readings:

1. Desrosier N W and Desrosier JN, The Technology of Food Preservation, CBS Publication, New Delhi, 1998
2. Paine FA and Paine HY, Handbook of Food Packaging, Thomson Press India Pvt Ltd, New Delhi- 1992
3. Potter NH, Food Science, CBS Publication, New Delhi, 1998
4. Ramaswamy H and Marcott M, Food Processing Principles and Applications CRC Press, 2006
5. Rao PG, Fundamentals of Food Engineering, PHI Learning Pvt Ltd, New Delhi, 2010
6. Toledo Romeo T, Fundamentals of Food Process Engineering, Aspen Publishers, 1999

Course Name: Environmental Science AECC (4)

Course Learning Outcome:

1. Understand core concepts and methods from ecological and physical sciences and their application in environmental problem-solving.
2. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.



3. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

Course Content

Unit 1: Introduction to environmental studies

Multidisciplinary nature of environmental studies;

Scope and importance; Concept of sustainability and sustainable development. (2 lectures)

Unit 2: Ecosystems

What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems:

- a) Forest ecosystem
- b) Grassland ecosystem
- c) Desert ecosystem
- d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)(6 lectures)

Unit 3: Natural Resources: Renewable and Non-renewable Resources

- Land resources and land use change; Land degradation, soil erosion and desertification.
- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
- Water: Use, and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).
- Energy resources: Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Unit 4: Biodiversity and Conservation

- Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots
- India as a mega-biodiversity nation; Endangered and endemic species of India
- Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value. (8 lectures)

Unit 5: Environmental Pollution

- Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution
- Nuclear hazards and human health risks
- Solid waste management: Control measures of urban and industrial waste.
- Pollution case studies. (8 lectures)

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Unit 6: Environmental Policies & Practices

- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture
- Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context. (7 lectures)

Unit 7: Human Communities and the Environment

- Human population growth: Impacts on environment, human health and welfare.
- Resettlement and rehabilitation of project affected persons; case studies.
- Disaster management: floods, earthquake, cyclones and landslides.
- Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan.
- Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
- Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi). (6 lectures)

Unit 8: Field work

- Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds and basic principles of identification.
- Study of simple ecosystems-pond, river, Delhi Ridge, etc.

Recommended Readings:

1. Carson, R. 2002. Silent Spring. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R. 1993. This Fissured Land: An Ecological History of India. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
4. Gleick, P.H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of Conservation Biology. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339: 36-37.
7. McCully, P. 1996. Rivers no more: the environmental effects of dams (pp. 29-64). Zed Books.
8. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.

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9. Odum, E.P., Odum, H.T. & Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.
10. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.
11. Rao, M.N. & Datta, A.K. 1987. Waste Water Treatment. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. Environment. 8th edition. John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M. L. 2001. Environmental law and policy in India. Tripathi 1992.
14. Sengupta, R. 2003. Ecology and economics: An approach to sustainable development. OUP.
15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.
16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. Conservation Biology: Voices from the Tropics. John Wiley & Sons.
17. Thapar, V. 1998. Land of the Tiger: A Natural History of the Indian Subcontinent.
18. Warren, C. E. 1971. Biology and Water Pollution Control. WB Saunders.
19. Wilson, E. O. 2006. The Creation: An appeal to save life on earth. New York: Norton.
20. World Commission on Environment and Development. 1987. Our Common Future. Oxford University Press.

Course Name: Food Processing and Preservation Cc (4+2)

Course Learning Outcome:

1. To impart basic knowledge of Technology of colloids
2. To understand problem and importance of Water disposal and sanitation
3. To understand use of different food additives, contaminants, Minimal Processing and hurdle technology

Course Content

Unit 1: Technology of Colloids in Food

Characteristics, sols, gels, pectin gels, colloidal sols, stabilization of colloidal system, syneresis, emulsions, properties of emulsions, formation of emulsion, emulsifying agents, food foams, formation stability and destruction of foam, application of colloidal chemistry to food preparation. (Ch.11, Manay N S and Shadaksharaswamy M)

Unit 2: Water Disposal and Sanitation

Waste water, hardness of water, break point chlorination, physical and chemical nature of impurities, BOD, COD, waste water treatment, milk plant sanitation, CIP system, sanitizers used in food industry. (Ch.22, Potter N)

Unit 3: Food Additives and Regulations

Food Additives - Introduction, need of food additives in food processing and preservation, Characteristics and classification of food additives, Chemical, technological and toxicological aspects.

Food Laws and Regulations- Codex, HACCP, ISO, FSSAI etc.

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Unit 4: Minimal processing

Minimal processing of foods with thermal methods and non thermal methods-safety criteria in minimally processed foods-Minimal processing in practice-fruits and vegetables-seafood-effect on quality-Future developments(Ch 3, Ramaswamy)

Practical

1. Canning of foods
2. Preservation of food by the process of freezing
3. Drying of food using Tray dryer/other dryers
4. Estimation of Chemical Oxygen Demand (Demonstration)
5. Preparation of brix solution and checking by hand refractometer
6. Analysis of water
7. Minimal Processing of food
8. Application of colloidal chemistry in food preparation

Recommended Readings

1. Potter NH, 1998, Food Science: CBS Publication, New Delhi
2. Ramaswamy H and Marcotte M, 2009, Food Processing Principles and Applications CRC Press
3. Deman JM, 2007, Principles of Food Chemistry, 3rd Ed. Springer
4. Manay NS and Shadaksharaswamy M, 1987, Food-Facts and Principles, New Age International (P) Ltd. Publishers, New Delhi.

Third Semester

Course Name: Food Quality and Sensory Evaluation Cc (4+2)

Course Learning Outcome:

1. Student will understand the quality attributes of food.
2. Students will understand gustation and olfaction and how taste and odour is perceived.
3. Students will understand how colour and texture is perceived subjectively and objectively.

Course Contents

Unit 1: Introduction to quality attributes of food

Appearance, flavour, textural factors and additional quality factors.

Unit 2: Gustation

Introduction and importance of gustation

Structure and physiology of taste organs- tongue, papillae, taste buds, salivary glands.

Mechanism of taste perception

Chemical dimensions of basic tastes- sweet, salt, sour, bitter and umami

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Factors affecting taste quality, reaction time, taste modification, absolute and recognition threshold

Unit 3: Olfaction

Introduction, definition and importance of odour and flavor
Anatomy of nose, physiology of odour perception
Mechanism of odour perception
Theories of odour classification, chemical specificity of odour.

Unit 4: Colour

Introduction and importance of colour
Dimensions of colour and attributes of colour; gloss etc.
Perception of colour.
Colour abnormalities

Unit 5: Texture

Introduction, definition and importance of texture
Phases of oral processing
Texture perception, receptors involved in texture perception
Rheology of foods
Texture classification

Practical

1. Training of sensory panel.
2. To perform sensitivity tests for four basic tastes
3. To perform analytical and affective tests of sensory evaluation.
4. Recognition tests for various food flavours.
5. Sensory evaluation of milk and milk products.

Recommended Readings:

1. Rao E. S. (2013). Food Quality Evaluation. Variety Books.
2. Pomeranz Y and Meloan CE (2002). Food Analysis – Theory and Practice, CBS Publishers and Distributors, New Delhi.
3. deMan L. (2007). Principles of Food Chemistry, 3rd ed., Springer.
4. Meilgard (1999). Sensory Evaluation Techniques, 3rd ed. CRC Press LLC, 1999.
5. Amerine, Pangborn & Roessler (1965). Principles of Sensory Evaluation of food, Academic Press, London.

Course Name: Food and Nutrition Cc (4+2)

Course Learning Outcome:

1. Understand the relationship between food, nutrition and health.
2. Understand the functions of food and concepts of meal planning.
3. Learn about various food groups and balanced diet.

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Course Content

Unit 1: Introduction to Food and Nutrition

Basic terms used in study of food and nutrition, BMI and Nutritional Status, Understanding relationship between food, nutrition and health.

Unit 2: Balanced diet

Functions of food-physiological, psychological and social, Concept of Balanced Diet, Food Groups, Food Pyramid.

Unit 3: Nutrients

Classification, digestion, functions, dietary sources, RDA, clinical manifestations of deficiency and excess and factors affecting absorption of the following in brief: Energy, Carbohydrates, lipids and proteins

Fat soluble vitamins – A, D, E and K

Water soluble vitamins – thiamin, riboflavin, niacin, pyridoxine, folate, vitamin B12 and vitamin C

Minerals – calcium, iron, iodine, fluorine, copper and zinc

Unit 4: Concepts of meal planning

Factors affecting meal planning, understanding specific considerations for planning meal for different groups of people.

Unit 5: Methods of cooking

Dry, moist, frying and microwave cooking, advantages, disadvantages and the effect of various methods of cooking on foods.

Unit 6: Nutritional Labeling

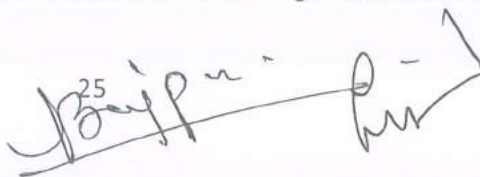
Importance, global trends, codex guidelines, nutritional labelling in India, FSSAI guidelines

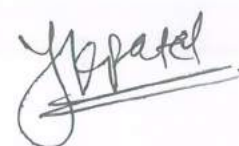
Practical

1. Identification of food sources for various nutrients using food composition tables.
2. Record diet of self using 24 hour dietary recall and its nutritional analysis.
3. Introduction to meal planning, concept of food exchange system.
4. Planning of meals for adults of different activity levels for various income groups.
5. Planning of nutritious snacks for different age and income groups.
6. Preparation of nutritious snacks using various methods of cooking.
7. Nutritional labeling of food products.

Recommended Readings:

1. Bamji MS, Krishnaswamy K, Brahmam GNV (2009). Textbook of Human Nutrition, 3rd Edition. Oxford and IBH Publishing Co. Pvt. Ltd.
2. Srilakshmi (2007). Food Science, 4th Edition. New Age International Ltd.
3. Srilakshmi, (2005), Dietetics, Revised 5th edition. New Age International Ltd.

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4. Wardlaw MG, Paul M Insel Mosby (1996). Perspectives in Nutrition, Third Edition.
5. Codex Guidelines on Nutrition Labelling (CAC/GL 2_1985) (Rev.1_1993). Rome, Food and Agriculture Organisation of the United Nations / World Health Organisation, 1993.
6. Food Safety and Standards Authority of India portal, Government of India
7. Gopalan, C., (1990). NIN, ICMR. Nutritive Value of Indian Foods.
8. Seth V, Singh K (2005). Diet planning through the Life Cycle: Part 1. Normal Nutrition. A Practical Manual, Fourth edition, Elite Publishing House Pvt Ltd.
9. Introduction to Human Nutrition ed. Gibney et al, Blackwell Publishers, 2005
10. Khanna K, Gupta S, Seth R, Mahna R, Rekhi T (2004). The Art and Science of Cooking: A Practical Manual, Revised Edition. Elite Publishing House Pvt Ltd.
11. ICMR (2010). Nutrient Requirements and Recommended Dietary Allowances for Indians.

Course Name: Principles of Food Science

Course Learning Outcome:

1. Understand different food dispersion systems
2. Understand the role of different packaging materials in the preservation of foods
3. Understand factors affecting the growth of micro-organisms and application of Hurdle Technology for controlling growth of micro-organisms.

Course Content

Unit 1: Food dispersions

Characteristics, sols, gels, pectin gels, colloidal sols, stabilization of colloidal system, syneresis, emulsions, properties of emulsions, formation of emulsion, emulsifying agent, food foams, formation stability and destruction of foam, application of colloidal chemistry to food preparation. (Ch 11 Manay, Ch 3 Meyer and Ch 2 Deman)

Unit 2: Sensory evaluation of food

Objectives, type of food panels, characteristics of panel member, layout of sensory evaluation laboratory, sensitivity tests, threshold value, paired comparison test, duo- trio test, triangle test, hedonic scale, chemical dimension of basic tastes, Amoore's classification of odorous compounds. Sherman and Szczniak classification of food texture. (Ch 19 Ranganna and Ch 7, 8 Deman)

Unit 3: Growth of microorganisms in foods

Food as a substrate for microorganism, factors affecting growth of microbes: pH, water activity, O-R potential, nutrient contents, inhibitory substance and biological structure. (Ch 1, Frazier)

Unit 4: Hurdle technology

Principles and applications, Hurdle effect in fermented foods, shelf stable products, intermediate moisture foods, application of hurdle technology.

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Unit 5: Ohmic heating and High Pressure processing

Principles, equipment and processing, effect on food. (Ch 11 Potter and Ch 3 Ramaswamy)

Unit 6: Packaging

Objectives of packaging, flexible packaging, properties of the following packaging materials- low density polyethylene, high density polyethylene, polypropylene, polyvinyl chloride, polyvinylidene chloride, ethylene vinyl alcohol, polystyrene, polyethylene terephthalate, nylon, ethylene vinyl acetate, ethylene acrylic acid, ethylene methacrylic acid, ionomers. (Ch 21 Potter, Ch 4 Jenkins and Ch 7 Coles)

Practical

1. Estimation of reducing sugar by Fehlings procedure
2. Estimation of salt content in brine
3. Estimation of salt content in butter
4. Preparation of brix solution and checking by hand refractometer
5. Demonstration of the Soxhlet method for determination of fat content
6. Determination of acidity of water
7. Determination of alkalinity/ hardness of water
8. Demonstration of the Kjeldahl's method for estimation of protein content

Recommended Readings

1. Coles R, McDowell D and Kirwan MJ, Food Packaging Technology, CRC Press, 2003
2. De S, Outlines of Dairy Technology, Oxford Publishers, 1980
3. Deman JM, Principles of Food Chemistry, 2nd ed. Van Nostrand Reinhold, NY 1990
4. Frazier WC and Westhoff DC, Food Microbiology, TMH Publication, New Delhi, 2004
5. Jenkins WA and Harrington JP, Packaging Foods with Plastics, Technomic Publishing Company Inc., USA, 1991
6. Manay NS and Shadaksharaswamy M, Food-Facts and Principles, New Age International (P) Ltd. Publishers, New Delhi, 1987
7. Meyer LH, Food Chemistry, CBS Publication, New Delhi, 1987
8. Potter NH, Food Science, CBS Publication, New Delhi, 1998
9. Ramaswamy H and Marcott M, Food Processing Principles and Applications CRC Press, 2006
10. Ranganna S, Handbook of Analysis and Quality Control for Fruits and Vegetable Products, 2nd ed, TMH Education Pvt. Ltd, 1986

Course Name: Food Fermentation Technology

Course Learning Outcome:

1. To understand the principles of food fermentation technology
2. To study the types of starters used in Food Industry
3. To study the production of various fermented food

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Unit 4: Texture

Texture measurement – basic rheological models, forces involved in texture measurement and recent advances in texture evaluation.

Application of texture measurement in cereals, fruits and vegetables, dairy, meat and meat products

Practical

1. Flavor defects in milk
2. Measurement of colour by using Tintometer/ Hunter Colour Lab etc.
3. Texture evaluation of various food samples- cookies/ biscuits/ snack foods
4. Textural measurement of various food products using Texture Analyzer
5. Qualitative tests for hydrogenated fats, butter, ghee
6. Quality evaluation of various food stuffs- cereals, pulses, honey, jaggery, sugar, tea, coffee etc

Recommended Readings

1. Rao E. S. (2013). Food Quality Evaluation, Variety Books.
2. Amerine, Pangborn & Roessler (1965). Principles of Sensory Evaluation of food, Academic Press, London.
3. Meilgard (1999). Sensory Evaluation Techniques, 3rd ed. CRC Press LLC, 1999
4. deMan J. (2007). Principles of Food Chemistry, 3rd ed., Springer. 62
5. Brannen and et al., (1990) Food Additives, Marcel Dekker, New York, 1990

Fourth Semester

Course Name: Food Engineering

Course Learning Outcome:

1. To understand the principle of Unit operation
2. To acquaint with fundamentals of food engineering and its process
3. To understand the basics of designing of food plant and systems

Course Content

Unit 1: Introduction

Concept of Unit operation,
Units and dimensions, Unit conversions, dimensional analysis
Mass and Energy Balance.
Related numericals

Unit 2: Design of food plant (Rao 2010) (2 Lectures)

- Important considerations for designing of food plants
- Types of layout

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Unit 3: Grinding and mixing (Fellow 1988) (2 Lectures)

Principle and equipments used in food industry

Unit 4: Fluid Flow in food processing (Singh and Heldman 1993)

- Liquid Transport systems
- Properties of Liquids
- Newton's Law of Viscosity
- Principle of Capillary tube and rotational viscometer
- Properties of Non-Newtonian fluids,
- Flow characteristics, Reynolds Number, Bernoulli's Equation
- Concept of Flow Measurement devices
- Related basic numerical

Unit 5: Refrigeration and Freezing (Singh and Heldman 2003) (8 Lectures)

- Concept and selection of a refrigerant
- Description of a Refrigeration cycle
- Pressure Enthalpy charts and Tables

Mathematical expressions useful in analysis of vapour compression refrigeration cycle

Numericals based on VCR system, Freon 12 and R-717, superheating and sub cooling

Freezing time calculation using Plank's Equation

Frozen food storage

Related basic numerical

Unit 6: Heat and Mass Transfer (Singh and Heldman 2003) (12 Lectures)

Systems for heating and cooling food products

Thermal Properties of Food

Modes of heat transfer

Application of steady state heat transfer- estimation of conductive heat transfer coefficient, convective heat transfer coefficient, overall heat transfer coefficient and, design of tubular heat exchanger. Related basic numericals

Fick's Law of Diffusion

Membrane separation systems-Electro dialysis system, Reverse Osmosis

Membrane System, and Ultrafiltration Membrane System

Membrane devices used for RO and UF: Plate and Frame, Tubular, Spiral wound and hollow fiber devices.

Unit 7: Psychrometrics (Singh and Heldman 2003) (4 Lectures)

- Properties of Dry Air
- Properties of water vapour
- Properties of air vapour mixture
- Psychrometric Chart
- Related basic numericals

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Unit 8: Steam, Evaporation and Dehydration (Singh and Heldman 1993, Rao 2006)

- Generation of steam
- Construction and functions of fire tube and water tube boilers
- Thermodynamics of Phase change
- Steam tables
- Boiling point elevation
- Types of evaporations
- Design of single effect evaporators
- Basic Drying Process
- Moisture content on wet basis and dry basis
- Dehydration systems
- Dehydration system Design.
- Related basic numericals

Practical

1. Determination of drying characteristics
2. Determination of viscosity of Newtonian and non-Newtonian fluids
3. Study of effect of temperature on viscosity
4. Screen analysis of food sample
5. Freezing time calculation
6. Psychrometrics- use and application.

Recommended Readings

1. Rao DG. 2010. Fundamentals of food engineering. PHI learning private ltd.
2. Singh RP, and Heldman DR. 1993, 2003, 2009. Introduction to food engineering. Academic press 2nd, 3rd and 4th edition.
3. Rao C G 2006 Essentials of food process engineering. B S publications
4. Fellow P. 1988 Food processing technology

Course Name: Technology of Fruits, Vegetables and Plantation Crops

Course Learning Outcome:

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

Course Content

Technology of Fruits and Vegetables

Unit 1: Introduction

Importance of fruits and vegetable, history and need of preservation, reasons of spoilage, method of preservation (short & long term). (Chapter 1-Girdharilal)

Unit 2: Canning and Bottling of Fruits and Vegetables

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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. (Chapter 2 – 7 Girdharilal)

Unit 3: Fruits Beverages

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. (Chapter 9–Girdharilal).

Unit 4: Jams, Jellies and Marmalades

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. (Chapter 11–Girdharilal).

Unit 5: Pickles, Chutneys and Sauces

Processing, Types, Causes of spoilage in pickling. (Chapter 14–Girdharilal).

Unit 6: Tomato Products

Selection of tomatoes, pulping & processing of tomato juice, tomato puree, paste, ketchup, sauce and soup. (Chapter 13–Girdharilal).

Unit 7: Dehydration of Foods and Vegetables

Sun drying & mechanical dehydration, process variation for fruits and vegetables, packing and storage. (Chapter 16–Girdharilal).

Technology of Plantation Products

Unit 8: Spices

Processing and properties of major and minor spices, essential oils & oleoresins, adulteration. (Chapter 20–Manay)

Unit 9: Tea, Coffee and Cocoa

Processing, Variety and Products. (Chapter 12–Manay)

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.

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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 Cruseess.2004. Commercial Unit and Vegetable Products, W.V. Special Indian Edition, Pub: Agrobios India
3. Manay, S. &Shadaksharaswami, M.2004. Foods: Facts and Principles, New Age Publishers
4. Ranganna S.1986. Handbook of analysis and quality control for fruits and vegetable products, Tata Mc 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.

Course Name: Technology of Cereals, Pulses and Oilseeds Cc (4+2)

Course Learning Outcome:

1. To teach technology of milling of various cereals
2. To impart technical knowhow of pulses and oilseeds refining

Course Content

Unit 1: Technology of Cereals

Introduction (chap 1,2&3, Kent)

Wheat --Types, milling, flour grade, flour treatments (bleaching, maturing), flour for various purposes, Products and By-products. (Chap 4,6,7,8& 9, Kent)

Rice --Physicochemical properties, milling (mechanical & solvent extraction), parboiling, ageing of rice, utilization of by-products. (Chap 15, Kent)

Corn -- Milling (wet & dry), cornflakes, corn flour (Chap 16, Kent) (4 lectures)

Barley- Milling(pearl barley, barley flakes & flour) (Chap 12, Kent)

Oats -- Milling (oatmeal, oat flour & oat flakes) (chap 13, Kent)

Sorghum and millets -- Traditional & commercial milling (dry & wet) (Chap 17, Kent)

Rye and triticale --milling (flour), uses (Chap 14, Kent)

Unit 2: Technology of Pulses (Chap 13, Chakraverty)

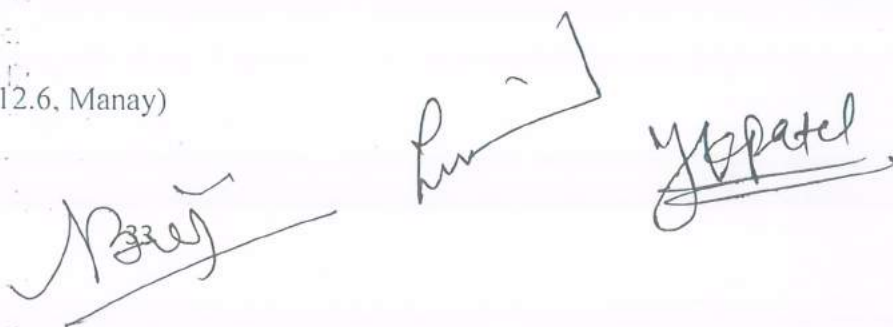
Milling of pulses, Dry milling, Wet milling, Improved milling method

Unit 3: Technology of Oilseeds

Introduction, Extraction of oil and refining, Sources of protein (defatted flour, protein concentrates and isolates), properties and uses, protein texturization, fibre spinning (Chap 14, 15, 16, Chakraverty)

Unit 4: Alcoholic Beverages

Beer, Wine, Distilled Spirits (Chap 12.6, Manay)



Manay
Kumar
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Practical:

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 Oilseeds, 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.

Course Name: Food Product Development Cc (4+2)

Course Learning Outcome:

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.

PROJECTS

Development of New Product (Chapter-3,4,5,6,14,15,19, Anil Kumar et al. and Chapter 13,14 Moskowitz and Saguy)

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

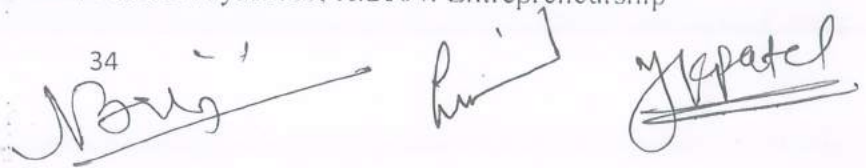
Projects on:

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 on the basis of 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 on the basis of above mentioned lines /steps and would submit a project report

Recommended Readings

1. Fuller, Gordon W. 2004. New Product Development- From Concept to Marketplace, CRC Press.
2. Anil Kumar, S., Poornima, S.C., Abraham, M.K. & Jayashree, K. 2004. Entrepreneurship



Development, New Age International Publishers.

3. Moskowitz, Howard and Saguy, R. I. Sam 2009. An Integrated Approach to New Food Product, CRC Press.

Course Name: Food Engineering and Packaging GE (4+2)

Course Learning Outcome:

1. To understand the principles of unit operation
2. To acquaint with fundamentals of food engineering and its process
3. To develop an understanding of different food packaging materials and packaging design and techniques used for various foods

Course Content

Unit 1: Unit Operations and Processes (Singh and Heldman)

Introduction, Units and Dimensions, Heat Transfer-Conduction, Convection and Radiation, Mass transfer-Diffusion, membrane separation processes, Steam generation and Boilers, Evaporation, Drying and dehydration, Refrigeration, Freezing, Psychometrics and Fluid flow.

Unit 2: Separation and Size Reduction Processes

Principles and equipments used in separation Extraction, sedimentation, filtration, centrifugation,

Size reduction – Milling, grinding and mixing of foods

Unit 3: Introduction to Food Packaging (Paine and Paine, Robertson)

Objectives and functions of food packaging, Requirements for effective food packaging, Types of packaging Materials, General properties of packaging materials

Unit 4: Packaging of Foods (Paine and Paine)

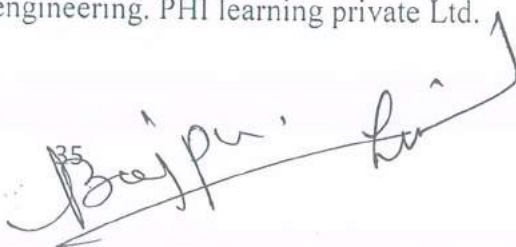
Packaging of fresh produce and processed foods, Aseptic packaging, Advances in food packaging

Practical

1. Study the dehydration process
2. Study the freezing characteristics of foods
3. Determination of viscosity of foods
4. Identification of packaging materials
5. Testing of packaging materials

Recommended Readings

1. Paine FA and Paine HY, 1992 A Handbook of Food Packaging, Blackie Academic Professional.
2. Rao CG. 2006, Essentials of food process engineering. B S publications
3. Rao DG, 2010, Fundamentals of food engineering. PHI learning private Ltd.

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4. Robertson GL, 2012, Food Packaging – Principles and Practice, CRC Press Taylor and Francis Group

5. Singh RP and Heldman DR, 1993, 2003, 2009, 2nd, 3rd and 4th Ed., Introduction to Food Engineering. Academic press.

Fifth Semester

Course Name: Technology of Dairy and Sea Food Cc (4+2)

Course Learning Outcome:

1. Students will understand the need and importance of dairy and fishery industry
2. Students will know the compositional and technological aspects of milk and fish.
3. Understand and study processed milk and fish products.

Course Content

Unit 1: Introduction

Status of fishery industry in India.

Unit 2: Chilling and Freezing of fish

Relationship between chilling and storage life, MAP, general aspects of freezing, freezing systems (air blast freezing, plate or contact freezing spray or immersion freezing, freezing on board, onshore processing, changes in quality in chilled and frozen storage, thawing.

Unit 3: Fish Curing and Smoking

Drying and salting of fish, water activity and shelf-life, salting process, salting methods (brining, pickling, kench curing, gaspe curing), types of salts, dried and salted fish products- pindang, fishwood, dried shrimp. Preservation by smoking, smoke production, smoke components, quality, safety and nutritive value of smoked fish, processing and equipment, pre-smoking processes, smoking process control. Traditional chimney kiln, modern mechanical fish smoking kiln, examples of smoked and dried products.

Unit 4: Canning of fish

Principles of canning, classification based on pH groupings, effect of heat processing on fish, storage of canned fish, pre-process operations, post process operations, cannery operations for specific canned products. (Tuna, Mackerel, Sardine).

Unit 5: Fishery by-products

Surimi- Introduction, fish muscle proteins, the surimi process, traditional and modern surimi production lines, quality of surimi products, comparison of surimi and fish mince products. (Ch- 3 Hall)

Fish protein concentrates (FPC), fish protein extracts (FPE), fish protein hydrolysis (FPH)

Unit 6: Fermented fish

Flowchart of Indigenous products- Fish sauce and Paste

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Technology of Milk and Milk Products

Unit 7: Physical properties of milk

Color, taste, pH and buffering capacity, refractive index, viscosity, surface tension, freezing, boiling point, specific heat, OR, electrical conductivity.

Unit 8: Lactose

Lactose (alpha and beta forms and their differences), Significance of lactose in dairy industry. (Chapter 6 of Fundamentals of dairy chemistry by Webb & Johnson)

Unit 9: Milk fat

Composition and structure, factors affecting melting point, solubility and refractive index, fat constant (saponification value, iodine value, RM value, Polenske value, Peroxide value). Chemical reactions of fat (hydrolysis, auto-oxidation), condition favouring auto oxidation, prevention, measurement of auto oxidation.

(Chapter 4 of Fundamentals of dairy chemistry by Webb & Johnson)

Unit 10: Protein and Enzymes

General structure, amphoteric nature, difference between casein and serum protein, different type of casein (acid and rennet), uses of casein, fractionations of protein. Enzymes – catalase, alkaline phosphatase, lipases and proteases.

Unit 11: Market milk industry and milk products

Systems for collection of milk Reception, Platform testing, Various stages of processing Filtration, Clarification, Homogenization, Pasteurization

Description and working of clarifier, cream separator, homogenizer and plate heat exchanger. Flow diagram of following milk products–

Butter, ghee, flavored milk, yoghurt, dahi, shrikhand, ice-cream, condensed milk, milk powder, channa, paneer, cheese (cheddar).

Practical

1. To perform platform tests in milk. (Acidity, COB, MBRT, specific gravity, SNF)
2. To estimate milk protein by Folin method.
3. To estimate milk fat by Gerber method.
4. Preparation of Flavoured milk/ Pasteurization of milk.
5. To prepare casein and calculate its yield.
6. Subjective evaluation of Fresh Fish
7. Cut out examination of canned fish (Sardine, Mackerel, Tuna)

Recommended Readings

1. De Sukumar, Outlines of Dairy Technology, Oxford University Press, Oxford. 2007.
2. Hall GM, Fish Processing Technology, VCH Publishers Inc., NY, 1992
3. Sen DP, Advances in Fish Processing Technology, Allied Publishers Pvt. Limited 2005
4. Shahidi F and Botta JR, Seafoods: Chemistry, Processing, Technology and Quality, Blackie Academic & Professional, London. 1994

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5. Webb and Johnson, Fundamentals of Dairy Chemistry, 3rd ed., CBS Publishers, New Delhi 1988

Course Name: Food Chemistry – I Cc (4+2)

Course Learning Outcome:

1. To understand the chemistry of foods - composition of food, role of each component and their interaction.
2. To understand the functional aspects of food components and to study their role in food processing.

Course Content

Unit 1: Introduction to Food Chemistry

Definition, Composition of food (Chapter-1-3, Potter)

Unit 2: Water

Definition of water in food, Structure of water and ice, Types of water, Sorption phenomenon, Water activity and packaging, Water activity and shelf-life. Chapter-1, DeMan

Unit 3: Lipids

Classification of lipids,

Physical properties – melting point, softening point, specific gravity, refractive index, smoke, flash and fire point, turbidity point.

Chemical properties – Reichert-Meissel value, Polenske value, Iodine value, peroxide value, saponification value.

Effect of frying on fats

Changes in fats and oils – rancidity, lipolysis, flavour reversion,

Auto-oxidation and its prevention,

Technology of edible fats and oils – Refining, Hydrogenation and Interesterification, Fat Mimetics (Chapter-2, DeMan)

Unit 4: Proteins Chapter-3, DeMan

Protein classification and structure,

Nature of food proteins (plant and animal proteins),

Properties of proteins (electrophoresis, sedimentation, amphotericism and denaturation)

Functional properties of proteins e.g., organoleptic, solubility, viscosity, binding gelation / texturization, emulsification, foaming.

Unit 5: Carbohydrates

Classification (mono, oligo and polysaccharides), Structure of important polysaccharides (starch, glycogen, cellulose, pectin, hemicellulose, gums), Chemical reactions of carbohydrates – oxidation, reduction, with acid & alkali, Modified celluloses and starches

Unit 6: Vitamins

Structure, Importance and Stability, Water soluble vitamins, Fat soluble vitamins

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Impact on health, Control measures

Unit 3: Food Hazards of Biological Origin

Introduction, Indicator Organisms, Food borne pathogens: bacteria, viruses and eukaryotes, Seafood and Shell fish poisoning, Mycotoxins

Unit 4: Management of hazards

Need, Control of parameters, Temperature control, Food storage

Unit 5: Hygiene and Sanitation in Food Service Establishments

Introduction, Sources of contamination, Control methods using physical and chemical agents, Waste Disposal, Pest and Rodent Control, Personnel Hygiene

Unit 6: Food Safety Management Tools

Basic concepts, prerequisites – GHPs, GMPs, HACCP, ISO Series, TQM – concept and need for quality, components and need for quality, components of TQM, Kaizen, Risk Analysis, Accreditation and Auditing

Unit 7: Microbiological criteria

Microbiological standards and limits (for processed food, water), Sampling, Basic steps in detection of food borne pathogens, Water Analysis

Unit 8: Food laws and Standards

Indian Food Regulatory Regime, Global Scenario, Other laws and standards related to food

Unit 9: Recent concerns

New and Emerging Pathogens, Genetically modified foods\Transgenics, Organic foods, Newer approaches to food safety

Practical

1. Preparation of different types of media (complex, differential and selective)
2. Enumeration of aerial microflora using PDA
3. Identification of Molds by lactophenol blue staining
4. Negative Staining
5. Microbiological Examination of food
6. Bacteriological analysis of Water by MPN method
7. Assessment of surface sanitation by swab and rinse method
8. Assessment of personal hygiene

Recommended Readings

1. Lawley, R., Curtis L. and Davis, J. The Food Safety Hazard Guidebook, RSC publishing, 2004
2. De Vries, Food Safety and Toxicity. CRC, New York, 1997
3. Marriott, Norman G. Principles of Food Sanitation, AVI, New York, 1985

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4. Forsythe. S.J. Microbiology of Safe Food, Blackwell Science, Oxford, 2000
5. Forsythe. S.J. The Microbiology of Safe Food, second edition, Wiley-Blackwell, U.K., 2010
6. Mortimore S. and Wallace C. HACCP, A practical approach, Chapman and Hill, London, 1995
7. Blackburn CDW and Mc Clure P.J. Food borne pathogens. Hazards, risk analysis & control. CRC Press. Washington, U.S.A. 2005

Course Name: Nutraceutical and Functional Foods DSE (4+2)

Course Learning Outcome:

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

Course Content

Unit 1: Introduction

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

Types of nutraceutical compounds – Phytochemicals, phytosterols and other bioactive compounds, peptides and proteins, carbohydrates (dietary fibers, oligosaccharides and resistant starch), prebiotics, probiotics and synbiotics, 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

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

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

Practical

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

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The egg industry, its techniques of working, General management, structure, composition and nutritive value of egg and its products.

Unit 7: Preservation of eggs

Refrigeration and freezing, thermal processing, dehydration, coating. Chapter 11 and 14, Stadelman

Unit 8: Quality identification of shell eggs

Factors affecting egg quality and measures of egg quality.

Practical

1. Estimation of moisture content of meat
2. Cut-out analysis of canned meats/retort pouches
3. Estimation of protein content of meat
4. To study shelf-life of eggs by different methods of preservation
5. Evaluation of eggs for quality parameters (market eggs, branded eggs)
6. Meat/Egg product formulation

Recommended Readings

1. Lawrie R A. Lawrie's Meat Science, 5th Ed, Woodhead Publisher, England, 1998
2. Parkhurst & Mounney, Poultry Meat and Egg Production, CBS Publication, New Delhi, 1997
3. Pearson & Gillet Processed Meats, 3rd ed, CBS Publication, New Delhi, 1997
4. Shai Barbut, Poultry Products Processing, CRC Press 2005
5. Stadelman WL, Owen J Cottrell Egg Science and Technology, 4th Ed. CBS Publication New Delhi, 2002

Course Name: Food Chemistry- II Cc (4+2)

Course Learning Outcome:

1. To understand the chemistry of food components and their interactions.
2. To know about the role of enzymes and various processing treatments in food industry.
3. To understand the concept of new product development.

Course Content

Unit 1: Minerals

Major and minor minerals, Metal uptake in canned foods, Toxic metals

Unit 2: Natural Food Pigments

Introduction and classification, Food pigments (chlorophyll, carotenoids, anthocyanins and flavonoids, beet pigments, caramel)

Unit 3: Browning Reactions in Food

Brijendra Kumar

Y. K. Patel

Bottling machines, Cartoning systems, Seal and Shrink-packaging machine; Form, Fill and Sealing machine (FFS).

Vacuum, Controlled and Modified atmosphere packaging systems; Aseptic packaging systems;

Retort packaging, Active and Intelligent packaging systems

Practical

1. Testing of physical/mechanical properties of food packaging material.
2. Gas/Vacuum packaging of foods and shelf life studies.
3. Determination of Water Vapor Transmission rate of Packaging Material.
4. Edible packaging of Food Samples.
5. Packaged food cut-out analysis.
6. To study the operation of FFS machine.

Recommended Readings

1. Robertson GL, Food Packaging – Principles and Practice, CRC Press Taylor and Francis Group, 2012
2. Paine FA and Paine HY, A Handbook of Food Packaging, Blackie Academic and Professional, 1992
3. Coles R, McDowell D, Kirwan MJ Food Packaging Technology. Blackwell, 2003

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