

The syllabus for undergraduate programme in Food Technology has been drafted in accordance with the recommendations of the Undergraduate Curriculum Framework-2022. The preamble, definitions and abbreviations, features and important aspects of UGCF have been incorporated in this document as mentioned in UGCF 2022. In step with the evolving trends and developments in higher education globally, UGCF-2022 distinctly integrates the objectives and underlying philosophy of National Education Policy (NEP) 2020 in its attributes. The salient features such as holistic development, academic flexibility, life-long learning, multidisciplinary education, multilingualism, intra- and inter- university mobility, apprenticeship, research, innovation, entrepreneurship, social outreach, aim to enrich the learning experience, creativity, innovation, and skill development of the youth of our nation.

-Drafting Committee

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Preamble

The objective of any programme at Higher Education Institute is to prepare their students for the society at large. The University of Delhi envisions all its programmes in the best interest of their students and in this endeavour, it offers a new vision to all its Under-Graduate courses. It imbibes a Undergraduate Curriculum Framework (UGCF) for all its Under Graduate programmes.

The UGCF approach is envisioned to provide a focused, outcome-based syllabus at the undergraduate level with an agenda to structure the teaching-learning experiences in a more student-centric manner. The UGCF approach has been adopted to strengthen students' experiences as they engage themselves in the programme of their choice. The Under-Graduate Programmes will prepare the students for both, academia and employability.

Each programme vividly elaborates its nature and promises the outcomes that are to be accomplished by studying the courses. The programmes also state the attributes that it offers to inculcate at the graduation level. The graduate attributes encompass values related to well-being, emotional stability, critical thinking, social justice and also skills for employability. In short, each programme prepares students for sustainability and life-long learning.

The new curriculum of B.Sc. (Hons) Food Technology offers the students to gain the requisite knowledge, skills and aptitude for the field of food technology. The efforts are made to measure cognitive as well as applied learning. Students are not only trained on the core components but also in areas which are need based, innovative and relevant keeping in pace with the fast growing food industry. The course is internationally competitive.

The University of Delhi hopes the UGCF approach of the programme B.Sc. (Hons) Food Technology will help students in making an informed decision regarding the goals that they wish to pursue in further education and life, at large.

1. UGCF-2022: Definitions and Abbreviations

(a) **Academic credit** – An academic credit is a unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week.

(b) **Courses of study** – Courses of the study indicate pursuance of study in a particular discipline. Every discipline shall offer four categories of courses of study, viz. Discipline Specific Core courses (DSCs), Discipline Specific Electives (DSEs), Skill Enhancement Courses (SECs) and Generic Electives (GEs). Besides these four courses, a student will select Ability Enhancement Courses (AECs) and Value-Added Courses (VACs) from the respective pool of courses offered by the University.

(i) **Discipline Specific Core (DSC):** Discipline Specific Core is a course of study, which should be pursued by a student as a mandatory requirement of his/her programme of study. In Undergraduate Programme in Food Technology, DSCs are the core credit courses of Food Technology which will be appropriately graded and arranged across the semesters of study, being undertaken by the student, with multiple exit options as per NEP 2020. A student will study three Core Courses each, in Semesters I to VI and one core course each in semesters VII and VIII.

(ii) **Discipline Specific Elective (DSE):** The Discipline Specific Electives (DSEs) are a pool of credit courses of Food Technology from which a student will choose to study based on his/her interest. A student in Undergraduate Programme in Food Technology gets an option of choosing one DSE of Food Technology in each of the semesters III to VI, while the student has an option of choosing a maximum of three DSE courses of Food Technology in semesters VII and VIII.

(iii) **Generic Elective (GE):** Generic Electives is a pool of courses offered by various disciplines of study (excluding the GEs offered by the parent discipline) which is meant to provide multidisciplinary or interdisciplinary education to students. In case a student opts for DSEs beyond his/her discipline specific course(s) of study, such DSEs shall be treated as GEs for that student. In semesters I, II, V and VI, a student has to compulsorily study one GE course from a pool of courses offered by the institution. However, in semesters III and IV a student has an option of choosing between a DSE course in discipline specific courses and a GE course of another discipline. Similarly, in semester VII and VIII a student can exercise an option of choosing a maximum of two Generic elective courses out of a combination of three DSE and GE courses.

(iv) **Ability Enhancement course (AEC), Skill Enhancement Course (SEC); Value Addition Course (VAC)**

These three courses are a pool of courses offered by all the Departments in groups of odd and even semesters from which a student can choose. A student who desires to make Academic Project/Entrepreneurship as Minor has to pick the appropriate combination of courses of GE, SEC, VAC; Internship/Apprenticeship/Project/ Community outreach (IAPC) which shall be offered

in the form of various modules as specified in the scheme of studies.

- **AEC courses** are the courses based upon the content that leads to knowledge enhancement through various areas of study. They are Language and Literature and Environmental Science and Sustainable Development which are mandatory for all disciplines. Every student has to study “Environmental Science and Sustainable Development” courses I and II of two credits each in the first year (I/II semester) and the second year (III/IV semester), respectively. The AEC pool consists of credit courses in languages listed in the Eighth Schedule of the Constitution of India, as updated from time to time.

- **SEC courses** are skill-based courses in all disciplines and are aimed at providing hands-on training, competencies, proficiency and skills to students. SEC courses may be chosen from a pool of courses designed to provide skill-based instruction. Some of these courses may be offered to students of Food Technology while the rest can be open to students of all other disciplines.

A student will study one Skill Enhancement Course of 2 credits each (following 1T+ 1P/ 0T+2P credit system) in all the semesters from I to VI. It is to be noted that in the semesters III, IV, V and VI, students can choose either one SEC paper or can join any Internship/ Apprenticeship/ Project /Community outreach (following two credit system).

- **VAC courses** are common pool of courses offered by different disciplines and aimed towards personality building, embedding ethical, cultural; constitutional values; promote critical thinking, Indian Knowledge Systems, scientific temperament, communication skills, creative writing, presentation skills, sports; physical education and team work which will help in all round development of students.

2. Features of UGCF-2022

The Undergraduate Curriculum Framework- 2022 (UGCF) is meant to bring about systemic change in the higher education system in the University and align itself with the NEP 2020. The objectives of the NEP 2020 have been reflected in the following features of UGCF:

a) Holistic Development

Holistic development of the students shall be nurtured through imparting life skills in initial years. These life skill courses shall include courses on ‘Environment and Sustainable Development Studies’, ‘Communication Skills’, ‘Ethics and Culture’, ‘Science and Society’, ‘Computational Skills’, ‘IT & Data Analytics’, and similar such skills which shall make the students better equipped to deal with the life’s challenges.

b) Academic Flexibility

Flexibility to the students to determine their learning trajectories and pursuance of programmes

of study has been well ingrained in the UGCF. The Framework allows students to opt for one, two or more discipline(s) of study as a core discipline(s) depending on his/her choice. He/she has been provided the option of focusing on studying allied courses of his/her selected discipline(s) (DSEs) or diversifying in other areas of study of other disciplines. Students have also been provided with the flexibility to study SECs or opt for Internships or Apprenticeship or Projects or Research or Community Outreach at an appropriate stage. In the fourth year, students are provided flexibility to opt for writing a dissertation (on major, minor or combination of the two) or opt for Academic Projects or Entrepreneurship depending upon their choice and their future outlook, post completion of their formal education.

c) Multiple Exits/ Re-entry/ Academic Bank of Credit (ABC)/ Academic Outreach

Given the extent of plurality of the Indian society and the diverse background to which students belong, multiple exits and provision of re-entry have been provided at various stages of the undergraduate programme to accommodate their requirement and facilitate them to complete their studies depending upon their priorities. The earning and accumulation of credits in the Academic Bank of Credit (ABC), and the flexibility to redeem the requisite credit for award of appropriate Certificate/ Diploma/ Degree, as per norms laid down by the UGC and the University, shall be made available to the students to provide the opportunity for lifelong learning as well as for availing academic outreach beyond the superstructure of the programme of study in another University/ Institution at the national /international level depending upon individual choice of the student(s).

d) Multidisciplinary Education

UGCF has incorporated multidisciplinary education by embedding within the framework the need to opt for at least four elective papers from any other discipline(s) other than the one opted as core discipline(s). In fact, a student who pursues a single-core discipline programme may obtain minor in a particular discipline, other than the core discipline, if he/she earns at least 28 credits in that particular discipline.

The framework does not maintain/support hierarchy among fields of study/disciplines and silos between different areas of learning. As long as a student fulfils the pre-requisites of a course of study, he/she shall be able to study it. Modules or systems of study shall be meaningfully laid down so as to guide the students in choosing the track/academic paths for the desired outcome.

e) Multilingualism

One of the significant hallmarks of the framework is a provision of pursuing multilingualism while studying any other discipline as core subject(s), which has no bearing with any language and linguistics. I and II semesters of the programme provides an opportunity to the students to study languages which are enshrined under the eighth schedule of the

Constitution of India, thereby allowing the students for their holistic development, including the ability to acquire proficiency in a language beyond their mother tongue.

f) Research and Innovation

The framework provides a mandatory programme on research methodologies as one of the discipline specific elective (DSE) courses at the VI & VII semester for students who opt for writing dissertation on major/ minor at VII and VIII semesters. Further, provision for internship/apprenticeship/project/community outreach right from the III semester up to VI semester provides ample opportunity to the students to explore areas of knowledge/activity beyond the four walls of the classroom and reach out to the world outside without any dilution of the academic feature of the course of study, he/she is pursuing. This also acts a precursor for the students to take up academic project or entrepreneurship at a later stage in VII & VIII semester. Such an initiative will help in skill development and laying a strong foundation for research and thus contribute towards overall national development through the development of skilled manpower and innovation.

g) Intra and Inter-University Mobility

Intra and inter University mobility of students is another element of critical importance which has been ingrained in the framework. A student, by virtue of such mobility, will be able to make lateral movement within the University as well as from the University to any other Institution and vice-versa. Such an attribute allows a student maximum flexibility in terms of pursuance of education with special reference to higher education and enables him/ her to achieve goal of life, the way he/she perceived it.

Based on the aforementioned features of UGCF-2022, the University expects maximum involvement of the student fraternity in utilizing the benefits of such a flexible yet rigorous curriculum framework at the undergraduate level and reaping the benefits of it through enrichment of their skills in their area of interest which will eventually help them in gaining employment, entrepreneurship, start-ups and various other ways of a dignified life and living as a global citizen with comparable skills and innovative ideas befitting to the contemporary global demands. The University expects the youthful nation to reap the maximum benefits out of the UGCF-2022 in developing skilled manpower to harness the youthful energy and expand the permeation of the skilled workforce globally, taking the demographic advantage..

3.Introduction to B.Sc. (Hons) Food Technology

History

The Food Technology course at the Bachelors level is being run in the University of Delhi since the last 25 years and was introduced by the Faculty of Science from the academic year 1989-1990. The new course has been prepared keeping in view, the unique requirements of B.Sc. (H) Food Technology students.

The objectives of the course are:

- To impart knowledge in areas related to Food Science and Technology.
- To enable the students to understand the food composition along with its physico- chemical, nutritional, microbiological and sensory aspects.
- To acquaint the students with the technologies of food processing and preservation of plant and animal foods; cereals, pulses, oilseeds, fruits vegetables, spices, meat, fish, poultry, sea food, milk and dairy products.
- To stress on the importance of food safety and quality management, national and international food laws and regulations as well as importance of food engineering and packaging in food industry.

The course contents have been so designed that it can keep pace with the rapidly growing food industry. Since, Food Technology is an interdisciplinary science it is recommended that subjects like Biochemistry, Biology, Chemistry, Maths, Statistics, Biostatistics, Physics etc be preferably chosen as the Generic elective (GE) by the students as they are synergistic to the curriculum. However, students are free to pick up any of the Generic Elective Courses offered by other departments.

UGCF 2022 Programme Duration and Exit Options

The minimum credit to be earned by a student per semester is 18 credits and the maximum is 26 credits. **However, students are advised to earn 22 credits per semester.** This provision is meant to provide students the comfort of the flexibility of semester-wise academic load and to learn at his/her own pace. However, the mandatory number of credits which have to be secured for the purpose of award of *Undergraduate Certificate/ Undergraduate Diploma/Appropriate Bachelor's Degree in Food Technology* are listed in **Table 1**.

Table 1: Qualification Type and Credit Requirements

S. No.	Type of Award	Stage of Exit	Mandatory Credits to be Secured for the Award
1	<i>Undergraduate Certificate in Food Technology</i>	After successful completion of Semester II	44
2	<i>Undergraduate Diploma in Food Technology</i>	After successful completion of Semester IV	88
3	<i>Bachelor of Science (Food Technology)</i>	After successful completion of Semester VI	132
4	<i>Bachelor of Science (Food Technology). with Research / Academic Projects/Entrepreneurship)</i>	After successful completion of Semester VIII	176

Nature and Extent of the Programme in B.Sc. (Hons) Food Technology

The undergraduate curriculum framework is based on the premise that every student and graduate is unique. Each student or graduate has his/her own characteristics in terms of previous learning levels and experiences, life experiences, learning styles and approaches to future career-related actions. The quality, depth and breadth of the learning experiences made available to the students while at the higher education institutions help develop their characteristic attributes.

3.1 Aim of Bachelor Degree Programme in B.Sc. (Hons) Food Technology

The key objectives that underpin curriculum planning and development at the undergraduate level include Programme Learning Outcomes, and Course Learning Outcomes. For the B.Sc. (H) Food Technology course it includes:

- To demonstrate comprehensive knowledge and understanding of the food technology curriculum.
- To apply the principles of food science to preserve, process and package to assure the quality and safety of food products.
- To understand the real-world problems in the food industry and learning to improvise the safety and quality of food or process.
- To analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.
- To acquire knowledge and skills, including “learning how to learn”, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.
- To use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources.
- To acquire professional competency and entrepreneurial skills for economic empowerment.
- To demonstrate the ability to acquire, analyze, interpret and appropriately present laboratory data.

Qualification Descriptors for B.Sc. (Hons) Food Technology

The following descriptors indicate the expectations from B.Sc. Hons Food Technology:

- The students will have a sound knowledge of Food Science and Technology.
- They will understand the technologies of food processing and preservation.
- They will understand composition, chemical, microbiology and shelf-life aspects of food.
- They will understand food safety and standards, both national and international.
- They will be versant with key principles of food engineering and packaging.

Programme Learning Outcome in B.Sc. (Hons) Food Technology

The learning outcome of the course are-

- Knowledge of various areas related to Food science and technology,
- Understanding of the food composition and its physico- chemical, nutritional, microbiological and sensory aspects,
- Knowledge of processing and preservation techniques of pulses, oilseeds, spices, fruits and vegetables, meat, fish, poultry, milk & milk products,
- Relevance and significance of food safety, food quality ,food plant sanitation, food laws and regulations, food engineering and packaging in food industry.

Graduate Attributes in B.Sc. (Hons) Food Technology

- **Disciplinary knowledge**

Students are able to demonstrate comprehensive knowledge and understanding of one or more disciplines such as chemistry, bio-chemistry, mathematics, statistics, microbiology, engineering, management; regulations with support of different allied subjects of Life Science; Physical Science.

- **Communication Skills**

Development of students' communication skills is planned through an AECC paper (English) which is compulsory. Besides that the students do various assignments that enable them to

develop skills in public speaking writing and effective's interpersonal skills. Presentations in each paper enhances their confidence, ability to express themselves; presentation skills.

- **Research-related skills**

Students develop a scientific temper and a sense of enquiry through various food technology papers. Students are capable of using appropriate research methodology in Food Technology and reporting the results in different formats.

- **Cooperation/Team work**

Students are capable of effective working in diverse contexts and teams in class rooms laboratories, student societies, industry and the community. They have basic management skills for independently organizing events, resource mobilization and leading community based projects, initiatives; cultural shows.

- **Self-directed learning**

Students are capable of working independently and are able to apply the concepts of Food Technology in an original; creative manner to solve and manage real life issues for the customers and industry. Students develop customized products as per the requirements of customers eg. Sugar free jams; desserts for diabetics, gluten free products for celiac etc.

- **Multicultural competence and traditional food systems of India**

Students are confident of working in diverse socio-cultural contexts. They are able to effectively engage with multicultural groups and teams. They have sensitivities of cross cultural and ethnic diversity which they can apply to different settings. College through a student and faculty exchange program with foreign university helps them to acquire multicultural competency. They are competent to seek higher education in foreign universities.

- **Moral and ethical awareness/reasoning**

Student has awareness of ethical conduct in different situations (academic and personal). They have skills in understanding and avoiding unethical behavior such as misrepresentation, plagiarism and environmental misuse and violence. They are formally taught ethics of research and human interventions.

- **Leadership readiness/qualities**

Students have leadership qualities in organizing teams and their mobilization for effective problem solving in different Food Technology aspects. Students apply creative leadership for realization of

various goals. As a leader, they are trained to have greater consumer sensitivity and connect. They can organize food courts and design business plans.

- **Lifelong learning**

Students acquire ability to gain knowledge and skills which are necessary in life for the holistic development for meeting their professional and personal needs in varying environment and changing contexts.

4. Structure of B.Sc. (Hons) Food Technology UGCF 2022

The B.Sc. (Hons) Food Technology will be of four-year duration with multiple exit options at the end of second, fourth, sixth and eighth semesters. Each year will be called an academic year and will be divided into two semesters, thus there will be a total of eight semesters. Each semester will consist of up to 15 weeks of study. The programme includes different kinds of courses such as Discipline Specific Core Courses (DSC), Discipline Specific Elective (DSE), Skill Enhancement Courses (SEC), Generic Elective (GE) in addition to Ability Enhancement and Value-added courses (VAC). While DSC, DSE and GE papers will have 4 credits each (to be divided between theory, practical/tutorial as per subject requirement), the SEC, VAC and AEC will be of two credits each. The curriculum will be delivered through various methods including chalk and talk, power-point presentation, audio, video tools, e-learning/e-content, field trips/industry visits, seminars, workshops, projects and class discussions.

The assessment will broadly comprise of internal assessment (25%) and End Semester examination (75%). The internal assessment will be through MCQs, tests, assignment, oral presentation, quizzes and worksheets. Each practical paper will be out of 50 marks, subject to University approval from time to time.

UGCF B.Sc. Hons Food Technology GRID Semester wise distribution of papers

Semester	Discipline Specific Core paper (3+1)	Discipline Specific Elective (DSE) (4 Credits)	Generic Elective (GE) (3+1=4 credits)	Ability enhancement course (AEC) (2)	Skill enhancement course (SEC)	Internship /apprenticeship/project (2)	Value addition course (VAC) (2)	Total Credits
I	DSC-1 Fundamentals of Food Technology DSC-2 Principles of Food Science DSC-3 Milk & Milk Products Technology		GE 1	AEC-1	SEC-1		VAC-1	22
II	DSC-4 Principles of Food Processing DSC-5 Technology of Food Preservation DSC -6 Fruits, Vegetables & Plantation Crops Processing Technology		GE 2	AEC-2	SEC-2		VAC-2	22
Students on exit shall be awarded Undergraduate Certificate (in the Field of Food Technology) after securing the requisite 44 credits in Semesters I and II								
III	DSC-7 Meat & Fish Processing Technology DSC-8 Nutrition Science DSC-9 Cereals, Pulses and Oilseeds Processing Technology	DSE - 1	GE 3	AEC-3	SEC -3	Internship/Project	VAC-3	22
IV	DSC-10 Food Quality Management DSC-11 Poultry & Egg Processing Technology DSC-12 Food Engineering- I	DSE-2	GE 4	AEC-4	SEC-4	Internship/Project	VAC-4	22
Students on exit shall be awarded Undergraduate Diploma (in the Field of Food Technology) after securing the requisite 88 credits on completion of Semester IV								

V	DSC-13 Food Microbiology DSC-14 Food Engineering II DSC 15 Food Chemistry I	DSE-3	GE 5		SEC-5	Internship/ Project		22
VI	DSC-16- Food Packaging DSC-17- Food Chemistry II DSC-18 Food Safety	DSE-4	GE 6		SEC-6	Internship/ Project		22
Students on exit shall be awarded Undergraduate Bachelor of Food Technology after securing the requisite 132 credits on completion of Semester VI								
VII	DSC-19 Sensory Science	DSE-5 DSE-6 DSE-7					Dissertation 6	22
VIII	DSC-20 Food Standards & Regulations	DSE-8 DSE-9 DSE-10					Dissertation 6	22
Students on exit shall be awarded Bachelor of Food Technology (Honours or Honours with Academic Project/Entrepreneurship) after securing the requisite 176 credits on completion of Semester VII								

Pool of DSE Papers (Even and Odd Semesters)

DSE - 1 Novel Food Processing Technology Theory + Practical 3+1

DSE-2 Bakery technology Theory + Practical 2+2

DSE-3 Food Fermentation Technology Theory + Practical 2+2

DSE-4 Research Methodology Theory + Practical 3+1

DSE-5 Nutraceuticals & Functional Foods Theory + Practical 2+2

DSE 6 Food Supply Chain Management Theory + Practical 2+2

DSE 7 Food Additives Theory + Practical 2+2

DSE 8 Food Rheology Theory + Practical 2+2

DSE 9 Food Plant Design & Sanitation Theory + Practical 2+2

DSE- 10 Food Toxicology Theory + Practical 2+2

Pool of SEC Papers (Even and Odd Semesters)

SEC-1 Processing of Milk & Milk products Theory + Practical 0+2

SEC-2 Processing of Fruits & Vegetable Products Theory + Practical 0+2

SEC -3 Confectionary technology Theory + Practical 0+2

SEC-4 Agribusiness Management Theory + Practical 1+1

SEC-5 Food Waste & By-product Utilization Theory + Practical 0+2

SEC-6 New Food Product Development Theory + Practical 0+2

SEC7—Traditional Indian Foods Theory + Practical 1+1

SEC8—Food Security & Sustainability Theory + Practical 1+1

SEC 9 Entrepreneurship Development Theory + Practical 1+1

SEC 10 Minimal Processing of food Theory + Practical 1+1

GE offered by Department of Food Technology

GE-1 Food Processing & Preservation-Theory + Practical

GE-2 Chemistry of Food Theory + Practical

GE-3 Sensory Evaluation of Food Theory + Practical

GE-4 Food microbiology & Food safety-Theory + Practical

GE-5 Food Engineering & Packaging –Theory + Practical

GE-6 Technology of Plants and Animal Foods -Theory+ Practical

GE 7 Food & Health Management Theory+ Practical

Suggestive GE offered to Food Technology Students

GE-1: Department of Chemistry

GE-2: Department of Biochemistry

GE-3: Department of Business Management Studies/ Department of Statistics

GE -4: Department of Mathematics

GE-5: Department of English (Project & Technical Writing)

GE-6: Department of Instrumentation

GE-7: Department of Computer Science

GE- 8: Department of Management

GE-9 : Department of Microbiology

GE-10: Department of Home Science

Matrix of 4 years Food Tech Program

**DSC----Discipline Core, DSE—Discipline Electives, GE—Generic Elective, AEC-Ability
Enhancement courses, SEC—Skill Enhancement courses**

Semester-wise Distribution of Discipline Specific Core (DSC) Courses and Discipline Specific Elective Courses (DSE), Skill Enhancement Elective Courses (SEC) and Generic Elective Courses B.Sc. (Hons.) Food Technology

DISCIPLINE SPECIFIC CORE courses			
Semester	Course Code	Course Name	CREDITS T=Theory Credits P=Practical Credits
I	DSC FT01	Fundamentals of Food Technology	(3T+1P)
	DSC FT02	Principles of Food Science	(3T+1P)
	DSC FT03	Milk & Milk Products Technology	(3T+1P)
II	DSC FT04	Technology of Food Preservation	(3T+1P)
	DSC FT05	Principles of Food Processing	(3T+1P)
	DSC FT06	Fruits, Vegetables & Plantation Crops Processing Technology	(3T+1P)
III	DSC FT07	Meat & Fish Processing Technology	(3T+1P)
	DSC FT08	Nutrition Science	(3T+1P)
	DSC FT09	Cereals, Pulses and Oilseeds Processing Technology	(3T+1P)
IV	DSC FT10	Food Quality Management	(3T+1P)
	DSC FT11	Poultry & Egg Processing Technology	(3T+1P)
	DSC FT12	Food Engineering-I	(3T+1P)
V	DSC FT13	Food Microbiology	(3T+1P)
	DSC FT14	Food Engineering II	(3T+1P)
	DSC FT15	Food Chemistry-I	(3T+1P)
VI	DSC FT16	Food Packaging	(3T+1P)
	DSC FT17	Food Chemistry II	(3T+1P)
	DSC FT18	Food Safety	(3T+1P)
VII	DSC FT19	Sensory Science	(3T+1P)
VIII	DSC FT20	Food Standards & Regulations	(3T+1P)

DISCIPLINE SPECIFIC ELECTIVE COURSES			
Semester	Course Code	Course Name	CREDITS T=Theory Credits P=Practical Credits
III IV V VI VII VIII	DSE FT 01	Novel Food Processing Technology	(3T+1P)
	DSE FT 02	Bakery technology	(2T+2P)
	DSE FT 03	Food Fermentation Technology	(2T+2P)
	DSE FT 04	Research Methodology	(3T+1P)
	DSE FT 05	Nutraceuticals & Functional Foods	(2T+2P)
	DSE FT 06	Food Supply Chain Management	(2T+2P)
	DSE FT 07	Food Additives	(2T+2P)
	DSE FT 08	Food Rheology	(2T+2P)
	DSE FT 09	Food Plant Design & Sanitation	(2T+2P)
	DSE FT 10	Food Toxicology	(2T+2P)

SKILL ENHANCEMENT ELECTIVE COURSES			
Semester	Course Code	Course Name	CREDITS T=Theory Credits P=Practical Credits
I II III IV V VI	SEC FT 01	Processing of Milk & Milk products	(0T+2P)
	SEC FT 02	Processing of Fruits & Vegetable Products	(0T+2P)
	SEC FT 03	Confectionary technology	(0T+2P)
	SEC FT 04	Agribusiness Management	(1T+1P)
	SEC FT 05	Food Waste & By-product Utilization	(0T+2P)
	SEC FT 06	New Food Product Development	(0T+2P)
	SEC FT 07	Traditional Indian Foods	(1T+1P)
	SEC FT 08	Food Security & Sustainability	(1T+1P)
	SEC FT 09	Entrepreneurship Development	(1T+1P)
	SEC FT 10	Minimal Processing of food	(1T+1P)

GENERIC ELECTIVE COURSES			
Semester	Course Code	Course Name	CREDITS
			T=Theory Credits P=Practical Credits
I II III IV V VI	GE FT 01	Food Processing and Preservation	(3T+1P)
	GE FT 02	Chemistry of Food	
	GE FT 03	Sensory Evaluation of Food	
	GE FT 04	Food Microbiology and Food Safety	
	GE FT 05	Food Engineering and Packaging	
	GE FT 06	Technology of Plant and Animal Foods	
	GE FT 07	Food & Health Management	

Details of Ability Enhancement Courses (AECs)

A student has to study one AEC course each of 2 credit in first four semesters of the programme. The AEC courses include environmental studies, sustainability and language courses. The pool of courses is offered by the University.

Details of Value Addition Courses (VACs)

A pool of value-added courses will be provided by the University.

Teaching-Learning Process

The undergraduate programme in Food Technology is designed to provide students with a sound theoretical background, practical training in all aspects of Food Technology and research. It will help them develop an appreciation of the importance of Food Technology in different contexts. The programme includes foundational as well as in-depth courses that span the traditional sub-disciplines of Food Technology. Along with the DSCs there are DSEs, GEs, SECs and AECs which address the need of the hour.

These courses will be delivered through the conventional chalk and talk method, laboratory work, projects, case studies, field work, seminars, hands-on training/workshops in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and ICT enabled teaching-learning tools (PowerPoint presentations, audio visual resources, e-resources, models, software, simulations, virtual labs, etc.).

Students will be required to carry out short term projects and participate in industrial and institutional visits and outreach programmes. They will be introduced to scientific reasoning and discovery, innovative problem-solving methodologies, online quizzes, surveys, critical analysis etc. to develop divergent thinking abilities.

The laboratory training complements the theoretical principles learned in the classroom and includes physico-chemical analysis and microbiological of food products, hands-on experience with modern instruments, computational data analysis, modelling and laboratory safety procedures.

Different pedagogies such as experiential learning, participative learning, project-based learning, inquiry-based learning and ICT pedagogy integration instruction (blended and flipped learning) will be adopted wherever possible. Students will be encouraged to work in groups to develop their interpersonal skills like communication and team work.

Students' active participation/ engagement in industrial visits/ internships/ Academic Projects/ Dissertations will lay a strong foundation for a successful career in Industry, academics, research, entrepreneurship and community outreach.

Assessment Methods

The primary objective of assessment will be to assess the learning outcomes of the course in tune with the broad outcomes of strengthening core theoretical knowledge base, practical laboratory skills, and research. Assessment will be based on continuous evaluation (class test, presentation, quiz, assignment etc.) and end of semester examination of University of Delhi.

- (i) Internal Assessment or Continuous Evaluation:** During a semester, students' learning outcomes as described in the syllabus will be assessed through class tests, assignments, group assignments, laboratory record files, project reports, presentations etc. Each theory paper will have 25% marks for internal assessment. The component of internal assessment for each practical paper will be 50 % marks. The critical analysis of internal assessment/ continuous evaluation outcomes will provide opportunities to improve the teaching-learning process by focusing on the areas that need conceptual strengthening, laboratory exposure or design of new experiments, and research. Attendance will be also be marked as part of Internal assessment.
- (ii) End of Semester University Examinations:** The end-semester university examinations will be conducted for both theory and practical courses. Besides internal assessment, each theory paper will have 75% marks and each practical paper will be of 50% marks for end of semester examination of the university.

DISCIPLINE SPECIFIC CORE (DSC)
(Credits 4: Theory 3; Practical 1)
DSC FT01 FUNDAMENTALS OF FOOD TECHNOLOGY
(Credits 3+1)

LEARNING OBJECTIVES:

1. To understand the basic principles of food science and technology.
2. To understand the structure, composition, nutritional value, changes during processing and storage of various plant and animal foods.

COURSE OUTCOMES:

1. Appreciate the principles of food science and technology.
2. Attain knowledge of the structure, composition, nutritional quality and post-harvest changes in various plant foods
3. Comprehend the structure and composition of various animal foods.
4. Understand the fundamentals of various plant and animal food processing.

Credit: 3+1

Total Lecture (Nos): **45 hours**

Course Coverage (in % of the total):

Theory: 3 hours/ week

Practical/ Field work/Hands-on-learning: 2 hours/week

Unit I: Introduction to Food Science and Technology	(No. of lectures) 4
Unit II: Structure, Nutritional Composition and Technological aspects of Plant foods	(No. of lectures)
Unit Description: Cereals, Millets and Pulses	12
<i>Subtopics:</i>	
Introduction to cereals, nutri-cereals (millets), pseudo cereals.	
<ul style="list-style-type: none"> ● Wheat- Structure and composition, types of wheat, Diagrammatic representation of longitudinal structure of wheat grain. ● Malting, dextrinization, gelatinization, types of browning-Maillard & caramelization. ● Rice- types of rice, parboiling of rice- advantages and disadvantages. ● Pulses- Introduction to pulses and legumes. ● Naturally occurring toxic constituents in pulses, types of processing- soaking, germination, 	

decortication, cooking and fermentation.	
Unit III: Structure, Nutritional Composition and Technological aspects of Plant foods Unit Description: Edible Oils, Fruits and Vegetables	(No. of lectures) 13
<i>Subtopics:</i> Fats & Oils- Classification of lipids, saturated fatty acids, unsaturated fatty acids, essential fatty acids, trans fatty acids. <ul style="list-style-type: none"> ● Refining of oils-different methods, hydrogenation ● Rancidity –Types- hydrolytic and oxidative rancidity and its prevention. Fruits & Vegetables- Classification of fruits and vegetables, composition, pigments, types of fibre. <ul style="list-style-type: none"> ● Enzymatic browning and its prevention, ● Post-harvest changes in fruits and vegetables – Climacteric and non-climacteric, ripening, physicochemical changes-physiological and horticultural maturity, pathological changes, during the storage of fruits and vegetables. 	
Unit IV: Nutritional Compositional and Technological aspects of Animal foods Unit Description: Flesh Foods - Meat, Fish, Poultry and Milk and Milk products	(No. of lectures) 16
<i>Subtopics:</i> <ul style="list-style-type: none"> ● Meat – Definition of carcass, composition of meat, post-mortem changes in meat- rigor mortis, tenderization of meat, curing and ageing of meat. ● Fish - Classification and composition of fish, aquaculture, characteristics of fresh fish, Types of spoilage in fish- microbiological, physiological, biochemical. ● Poultry - Structure and composition of egg, egg proteins, characteristics of fresh egg, deterioration of egg quality. difference between broiler and layers. ● Milk & Milk Products- Definition of milk, composition of milk and types of market of milk, milk processing- homogenization, pasteurization. 	

PRACTICAL

DURATION: 30 HRS (CREDIT 1)

1. To study enzymatic browning in fruits & vegetables.
2. To study different types of non-enzymatic browning.
3. To study gelatinization behavior of various starches.
4. To study the concept of gluten formation of various flours.
5. To study germination.
6. To study dextrinization in foods.
7. To perform quality inspection of egg.

COMPULSORY READINGS

1. Bawa. A.S., Chauhan, O.P, Raju. P.S. (2013) ed. *Food Science*. New India Publishing Agency
2. Potter, N. N., & Hotchkiss, J. H. (2012). *Food science*. Springer Science & Business Media.
3. Srilakshmi, B. (2018). *Food science*. New Age Publishers. 7th edition.

SUGGESTED READINGS:

1. De, Sukumar. (2007). *Outlines of Dairy Technology*. Oxford University Press
2. Kent, N.L.(2018). *Kent's Technology of Cereals: An introduction for students of food science and agriculture*. Elsevier. 5th edition.
3. Meyer. (2006). *Food Chemistry*. CBS publishers and distributors.
4. Stewart, G.F., & Amerine, M.A.(2012). *Introduction to Food Science and Technology*. Elsevier, 2nd Edition.
5. Rao, E.S. (2019) *Fundamentals of Food Technology and Preservation*, Variety Books, New Delhi

TEACHING LEARNING PROCESS

- Lecture method
- Power point presentation
- Projects
- Practical's

ASSESSMENT METHODS

- As per University of Delhi norms
- Continuous evaluation of practical's
- Assessment methods - quiz, identification tests, assignments
- End semester exams for theory and practical
- Feedback given to students for improving

KEYWORDS

Food Technology, nutri- cereals, millets, pulses, edible oils, meat, fish, poultry, milk.

DSC FT02 PRINCIPLES OF FOOD SCIENCE
(Credit 3+1)

LEARNING OBJECTIVES:

1. To impart basic concepts of food science, food chemistry and food sanitation.
2. To introduce the concept of food microbiology, sensory science and food packaging.

COURSE OUTCOMES:

Understand the basic concepts of

1. Structure and composition, food science and food sanitation.
2. Food microbiology, sensory science and food packaging

Credit: 3+1

Total Lecture (Nos): **45 hours**

Course Coverage (in % of the total):

Theory: 3 hours/week

Practical/ Field work/Hands-on-learning: 2 hours/week

Unit 1: Surface Chemistry and Structural properties of foods Unit Description: Surface Chemistry and Structural properties of foods	(No. of lectures-12)
<i>Subtopics:</i> <ul style="list-style-type: none"> ● Introduction to engineering properties of food and biomaterials, structure and chemical composition of foods, physical properties and surface chemistry (colloids, emulsions, foam, sols, gels, pectin gels) and application 	
Unit II: Sensory properties of foods Unit Description: Sensory properties of foods	(No. of lectures-10)
<i>Subtopics:</i> <ul style="list-style-type: none"> ● Basic description of taste, flavour, odour, colour and texture. ● Theories of gustation, olfaction, colour and texture. ● Techniques of sensory evaluation (Descriptive and Discriminative tests) 	
Unit III: Basic Food Microbiology Unit Description: Basic food microbiology	(No. of lectures-8)

<p><i>Subtopics:</i></p> <p>Introduction to types of microorganisms, Food as a substrate for microorganism, bacterial growth curve, Factors affecting growth of microbes : Intrinsic and Extrinsic</p>	
<p>Unit IV: Waste management and sanitation Unit Description: Waste water treatment and sanitation</p>	(No. of lectures-9)
<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> ● Properties of Waste water, hardness of water, break point chlorination, physical and chemical nature of impurities, BOD, COD, waste water treatment, detergents and sanitizers used in food industry, CIP and COP system with reference to food industry. 	
<p>Unit V: Introduction to Food Packaging Unit Description: Food packaging</p>	(No. of lectures-6)
<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> ● Objectives of packaging, types of packaging materials (paper, glass, plastic, metal and wood, rigid and flexible packaging) and properties 	

PRACTICAL

DURATION: 30 HRS (CREDIT 1)

1. Preparation and standardization of reagents
2. Determination of moisture content of food samples
3. Demonstration of fat/ protein estimation
4. Preparation of degree brix solution
5. Application of colloidal chemistry to food preparation
6. To perform sensitivity / threshold tests for basic taste
7. Introduction to microscopy and study of morphology of bacteria, yeast and mold using permanent slides.
8. Determination of alkalinity/ hardness of water
9. Determination of BOD/COD and total dissolved solids of water samples
10. Identification and testing (Thickness, GSM) of different types of packaging materials

COMPULSORY READINGS

- Coles, R., McDowell, D., & Kirwan, M. J. (Eds.). (2003). *Food packaging technology* (Vol. 5). CRC press.

- De, S. (1996). Outlines of dairy technology. Oxford University Press.
- DeMan, J. M., Finley, J. W., Hurst, W. J., & Lee, C. Y. (2018). *Principles of food chemistry*, 4th ed. Springer.
- Frazier, W.C. and Westhoff, D.C.(2004). *Food Microbiology*.New Delhi. TMH Publication
- Shadaksharaswamy, M., & Manay, N. S. (2011). Food, facts and principles. 4th ed. *New Age international publisher. New Age International.*
- Meyer LH.(2006). *Food Chemistry*, CBS Publication, New Delhi.
- Potter N.N., Hotchkiss J.H. (2007). *Food Science*,5th ed. CBS Publication, New Delhi
- Ranganna, S. (2002). Handbook of Analysis of quality control for fruit and Vegetables products 2nd Ed. Tata Mcgraw Hill pub. *Co. Ltd. New Delhi.*

Additional Resources

- Jenkins, W.A. and Harrington, J.P. (1991). *Packaging Foods with Plastics*, Technomic Publishing Company Inc., USA.
- Norman, G. Marriott. and Robert, B. Gravani. (2018). Principles of Food Sanitation,6th ed. New York, Springer.

TEACHING LEARNING PROCESS

- Power point presentations
- Experiential learning through demonstrations

ASSESSMENT METHODS

- As per University of Delhi norms
- Continuous evaluation of practicals
- Assessment methods - quiz, identification tests, assignments
- End semester exams for theory and practical
- Feedback given to students for improving

KEYWORDS

- colloidal chemistry
- Food microbes
- Hurdle Technology
- Food Packaging
- Minimal processing

DSC FT03 MILK & MILK PRODUCTS TECHNOLOGY (CREDITS: 3+1)

LEARNING OBJECTIVES:

1. Processing of milk and milk products at industry level
2. To know the compositional and technological aspects of milk
3. To study processed milk products

COURSE OUTCOMES:

1. Understand the importance of Dairy industry
2. Understand the various properties and composition of milk.
3. Understand the technology of manufacturing of various products like Butter, ghee, Yoghurt, Dahi, Shrikhand, Ice-cream, Milk powder, channa, Paneer, Cheese (cheddar), Khoa
4. Understand market milk industry stages of milk processing and working of a few Dairy equipment's

Credit: 3+1

Total Lecture (Nos): 45 hours

Course Coverage (in % of the total):

Theory: 3 hours/week

Practical/ Field work/Hands-on-learning: 2 hours/week

<p>Unit I: Physical properties of milk Unit Description: Understanding of the physical properties of milk.</p>	<p>(No. of lectures 7)</p>
<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> • Color • Taste • pH and buffering capacity • Refractive index • Viscosity • Surface tension • Freezing & boiling point • Specific heat and electrical conductivity 	
<p>Unit II: Composition of milk Unit Description: Macro nutrients and micronutrients of milk; milk sugar, fat and protein.</p>	<p>(No. of lectures 16)</p>
<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> • Lactose (alpha and beta forms and their differences) • Significances of lactose in dairy industry • Composition and structure • Fat constants (Saponification value, Iodine value, RM value, Polenske value, peroxide value) • Difference between casein and serum protein • Different types of casein (acid and rennet) • Uses of casein 	
<p>Unit III: Market milk industry and milk products Unit Description: Processing of milk and milk products.</p>	<p>(No. of lectures 22)</p>

Subtopics:

- Systems of 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
- Principle of processing of following milk products -Butter, ghee,
yoghurt, dahi, shrikhand, ice-cream, milk powder, channa,
paneer, cheese (cheddar), khoa

PRACTICAL

DURATION: 30 HRS (CREDIT 1)

1. To determine specific gravity of milk
2. To determine acidity of milk
3. To perform COB test in milk
4. To estimate milk protein by Folin method
5. To estimate milk fat by Gerber method
6. To prepare casein and calculate its yield
7. To perform MBRT test in milk
8. Schematic diagram of pasteurization of milk in dairy industry
9. Study energy regeneration in dairy industry
10. Study and schematic diagram of CIP in dairy industry

COMPULSORY READINGS

- De, Sukumar. (2007). Outlines of dairy technology. Oxford University Press.
- Webb B.H.and Alford (2005). Fundamentals of dairy chemistry. CBS Publisher.

SUGGESTED READINGS:

- P.F. Fox, T. Uniacke-Lowe and J.A.O' Mahony (2005). Dairy Science and Technology. Taylor & Francis.
- P. Walstra, Jan T.M. Wouters and Tom J. Geurts (2015). Dairy chemistry and Biochemistry. Springer

TEACHING LEARNING PROCESS

- Power point presentations
- Experiential learning through demonstrations

ASSESSMENT METHODS

- As per University of Delhi norms
- Continuous evaluation of practicals

- Assessment methods - quiz, identification tests, assignments
- End semester exams for theory and practical
- Feedback given to students for improving

KEYWORDS

- Food technology
- Dairy technology
- Milk processing

**DSC FT04 PRINCIPLES OF FOOD PROCESSING
(CREDIT: 3+-1)**

LEARNING OBJECTIVES:

1. To understand freezer, dryer types and functioning
2. To understand the material handling, separation processes and thermal processing.

COURSE OUTCOMES:

1. Understand cold preservation, Freezer types and functioning
2. Understand Dehydration, Dryer types and functioning
3. Understand the material handling in food industry, conveyer types, separation processes by distillation, extraction, filtration
4. Understand thermal processing and fundamentals of thermal process calculations

Credit: 3+1

Total Lecture (Nos): **45 hours**

Course Coverage (in % of the total):

Theory: 3 hours/week

Practical/ Field work/Hands-on-learning: 2 hours/week

UNIT I Cold Preservation and Freezers Unit Description: Cold preservation and Freezers	No. of Lectures: 12
<i>Subtopics:</i> <ul style="list-style-type: none"> • Refrigeration and Freezing: requirements of refrigerated storage - controlled low temperature, air circulation and humidity, modified gas atmosphere. Changes in food during refrigerated and frozen storage, Refrigeration load, factors determining freezing rate: food composition and non-compositional. • Freezing methods -direct and indirect, still air sharp freezer, blast freezer, fluidized freezer, plate freezer, spiral freezer and cryogenic freezing. 	
UNIT II Dehydration Unit Description: This unit covers the dehydration technique	No. of Lectures: 12
<i>Subtopics:</i> <ul style="list-style-type: none"> • Changes in food during drying, drying methods and equipments 	

air convection dryer, tray dryer, tunnel dryer, continuous belt dryer , fluidized bed dryer, spray dryer, drum dryer, vacuum dryer ,freeze drying ,foam mat drying.	
UNIT III Thermal processing Unit Description: The unit describes various concepts in Thermal processing	No. of Lectures: 9
<i>Subtopics:</i> <ul style="list-style-type: none"> Principles of thermal processing, Thermal resistance of microorganisms, Thermal Death Time, Lethality concept, characterization of heat penetration data, Thermal process Calculations, Aseptic processing of food 	
UNIT IV Material handling and Separation processes Unit Description: The unit describes Material handling and Separation processes	No. of Lectures: 12
<i>Subtopics:</i> <ul style="list-style-type: none"> Elementary concept of material handling in food industry, equipment and functioning of belt conveyor, screw conveyor, bucket elevator and pneumatic conveyor. Distillation principles and methods: steam, batch, continuous distillation with rectification and stripping. Extraction : Hildebrandt, Bollman, SCF extraction Filtration : Plate and frame , pressure leaf, continuous rotary vacuum ,batch and continuous filtration 	

PRACTICAL

DURATION: 30 HRS (CREDIT 1)

1. Preservation of food by freezing
2. Drying of food using Tray dryer/other dryers
3. Preservation of food by canning (Fruit/Vegetable/meat)
4. Cut-out analysis of canned food
5. Osmotic dehydration
6. Minimal Processing
7. Perform distillation of any food sample/by product
8. Processing of ready to eat frozen products
9. Study of Thawing Characteristics of frozen food

COMPULSORY READING

- Potter,N.N.and Hotchkiss,J.H.(2007). Food Science 5th Ed. New York: Chapman & Hall
- Ramaswamy, H. and Marcott, M. (2006). *Food Processing Principles and Applications*. CRC Press.

- Rao, P.G. (2010). *Fundamentals of Food Engineering*. New Delhi: PHI Learning Pvt Ltd.

ADDITIONAL RESOURCES

- Desrosier, N.W. and Desrosier, J.N. (1998). *The Technology of Food Preservation*. New Delhi: CBS Publication.
- Toledo, Romeo T. (2007). *Fundamentals of Food Process Engineering*. Aspen Publishers.

TEACHING LEARNING PROCESS:

- Lectured based teaching
- Power point presentations
- Experimental learning through practicals
- Along with pedagogy of flipped classroom students are encouraged to participate actively in the classroom through regular presentations on curriculum based topics, peer assessment

ASSESSMENT METHODS:

- As per University of Delhi norms
- Theory assessment methods – classroom assignment, test, quiz, presentation
- Continuous evaluation of practicals
- End semester exams for theory and practical
- Feedback given to students for improving

KEYWORDS:

Food Processing, Drying, Freezing, Canning, Minimal processing, material handling, conveyer belt system.

DSC FT05 TECHNOLOGY OF FOOD PRESERVATION (Credit: 3+1)

LEARNING OBJECTIVES:

1. To learn science behind various preservation/processing technologies.
2. Technological application of concepts on conventional Indian foods.

COURSE OUTCOMES:

1. Understanding of the concept of different processing and preservation technologies
2. Appreciate significance of various preservation methods used in food industries.

Credit: 3+1

Total Lecture (Nos): 45 hours

Course Coverage (in % of the total):

Theory: 3 hours/week

Practical/ Field work/Hands-on-learning: 2 hours/week

Unit I: Introduction to Technology of Food Preservation	(No. of lectures) 6
<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> • Introduction to historical evolution to food preservation techniques- Conventional to recent technologies • Classification of foods based on pH, concept of shelf life, perishable foods, semi perishable foods, shelf stable foods. 	
Unit II: Food Preservation by Low temperature Unit Description: Refrigeration, Chilling & Freezing	(No. of lectures) 14
<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> • Introduction to refrigeration, chilling, freezing as a means of preservation, cold storage • Principle of freezing, freezing curve, changes occurring during freezing, types of freezing i.e. slow freezing, quick freezing, • Introduction to thawing, changes during thawing and its effect on food 	
Unit III: Food Preservation by Thermal Processing and Irradiation Unit Description: Thermal processing and Food Irradiation	(No. of lectures) 10
<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> • Introduction to Thermal Processing- Blanching, pasteurization, sterilization, commercial sterilization. • Introduction, units of radiation, concept of cold sterilization, kinds of ionizing radiations, application in food industry. 	
Unit IV: Food Preservation by Moisture control Unit Description: Drying and Evaporation	(No. of lectures) 15
<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> • Introduction to Drying and Dehydration -Drying as a means of preservation, differences between sun drying and dehydration (i.e. mechanical drying), normal drying curve, heat and mass transfer, factors affecting rate of drying and its application in food industry. 	

- | | |
|---|--|
| <ul style="list-style-type: none"> • Introduction to Evaporation as a means of preservation – Definition, factors affecting evaporation, and its application in food industry. | |
|---|--|

PRACTICAL

DURATION: 30 HRS (CREDIT 1)

1. To study methods of sampling.
2. To study the concept of shelf life of different foods.
3. To perform blanching of plant foods.
4. To study the concept of sterilization
5. To perform pasteurization of fluids- juices/ milk/ squashes etc using different methods.
6. To determine the pH of different foods.
7. To evaluate the quality characteristics of foods preserved by solar drying/ dehydration/ freezing.

ESSENTIAL READINGS:

- Potter, N. N., & Hotchkiss, J. H. (2012). *Food Science*. Springer Science & BusinessMedia.
- Fellows, P. J. (2009). *Food Processing Technology: Principles and Practice*. Elsevier.
- Bawa. A.S., Chauhan, O.P, Raju. P.S. (2013) ed. *Food Science*. New India Publishing agency.
- Stewart, G.F., & Amerine, M.A. (2012). *Introduction to Food Science and Technology*. Elsevier, 2nd Edition.

SUGGESTED READINGS:

- Rao, E.S. (2019) *Fundamentals of Food Technology and Preservation*, Variety Books, New Delhi.
- Frazier, W.C. & West Hoff, D.C. 2004. *Food Microbiology*. TMH Publication, New Delhi,.
- Rao, D.G. 2010. *Fundamentals of Food Engineering*, PHI Learning Pvt Ltd, New Delhi,

TEACHING LEARNING PROCESS

- Lecture method
- Power point presentation
- Projects
- Practical's

ASSESSMENT METHODS

- As per University of Delhi norms
- Continuous evaluation of practicals
- Assessment methods - quiz, identification tests, assignments
- End semester exams for theory and practical

- Feedback given to students for improving

KEYWORDS

Food, Preservation, Technology, Micro-organism, Temperature, Evaporation, Freezing, Drying

DSC FT06 FRUITS, VEGETABLES & PLANTATION CROPS PROCESSING TECHNOLOGY (Credit: 3+1)

LEARNING OBJECTIVES:

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

COURSE OUTCOMES:

1. Understand the concept of quality of fruits and vegetables for developing good quality end products.
2. Understand the processing and preservation of fruits and vegetables using various techniques.
3. Understand processing of plantation crops.

Credit: 3+1

Total Lecture (Nos): **45 hours**

Course Coverage (in % of the total):

Theory: 3 hours/week

Practical/ Field work/Hands-on-learning: 2 hours/week

<p>Unit I: Introduction to Fruits and Vegetables Unit Description: Basic definition of fruits & vegetables, Why & How they should be preserved. Different modes of preservation.</p>	<p>(No. of lectures) 6</p>
<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> • Importance of Fruits & Vegetables • History & need of preservation • Reasons of spoilage, method of preservation (Short & Long Term) • Post harvest physiological & biochemical changes in fruits & vegetables 	
<p>Unit II: Canning & Dehydration Unit Description: Preservation of food by thermal processing & removal of moisture</p>	<p>(No. of lectures) 11</p>
<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> • Process of canning, factors affecting the process- time and temperature 	

<ul style="list-style-type: none"> ● Containers of packing, lacquering, syrups and brines for canning. ● Spoilage in canned foods. ● Sun drying & mechanical dehydration ● Process variation for fruits and vegetables ● packing and storage. Case hardening 	
Unit III: Fruits Beverages & Tomato Products Unit Description: Types, preparation & preservation of beverages	(No. of lectures) 13
<i>Subtopics:</i> <ul style="list-style-type: none"> ● Introduction & Processing of fruit juices (selection, juice extraction, deaeration, straining, filtration and clarification) ● Preservation of fruit juices (pasteurization, preservation with chemical, sugar & salt, freezing, drying, tetra-packing, carbonation) ● Processing of squashes, cordials, nectars, concentrates and powder Tomato Products : processing of tomato juice, tomato puree, paste, ketchup, sauce and soup	
Unit IV: Products preserved with class I & class II preservatives Unit Description: preservation by sugar, salt, vinegar & sodium benzoate & KMS	(No. of lectures) 7
<i>Subtopics:</i> <ul style="list-style-type: none"> ● Processing & Technology of Jam, Jelly, Marmalade & Pickles (Essential constituents, Role of pectin), Theory of jelly formation, defects in jelly, ● Marmalade - Types, defects. ● Pickles-- Processing , Types, Causes of spoilage in pickling 	
UNIT V : Technology of Plantation Crops Unit Description—Spices, Tea, Coffee & Cocoa	(No. of lectures) 8
Subtopics Spices <ul style="list-style-type: none"> ● Processing and properties of major and minor spices ● Essential oils & oleoresins, adulteration Tea, Coffee and Cocoa <ul style="list-style-type: none"> ● Processing, Variety and Products 	

PRACTICAL

DURATION: 30 HRS (CREDIT 1)

1. Estimation of total soluble solids (TSS), pH, acidity of various products.
2. Estimation of brix: acidity ratio of various products.

3. Estimation of ascorbic acid and effect of heat treatment on it.
4. To study the steps of can making process.
5. Preparation & evaluation of pectin based product. (Jam)
6. Preparation & evaluation of tomato puree.
7. Dehydration of fruits and vegetables
8. Rehydration of fruits and vegetables
9. Extraction & estimation of polyphenols from fruit & Vegetable wastes.

ESSENTIAL READINGS

- Girdharilal., Siddappaa, G.S and Tandon, G.L.(2009). Preservation of fruits & vegetables. ICAR, New Delhi.
- Thompson, A.K., (2003). Fruits and vegetables; Harvesting, handling and storage. Blackwell Publishing.
- Verma L.R. & Joshi VK. 2000. Post Harvest Technology of Fruits & Vegetables. Indus Publication.

SUGGESTED READINGS:

- Crusess, W.B. (2004). Commercial Unit and Vegetable Products. W.V. Special Indian Edition. Agrobios India.
- Manay, S. and Shadaksharaswami, M. (2004). Foods: Facts and Principles. New Age Publishers.
- Ranganna S.(2007). Handbook of analysis and quality control for fruits and vegetable products. Tata Mc Graw-Hill publishing company limited, Second edition.
- Srivastava, R.P. and Kumar, S. (2006). Fruits and Vegetables Preservation- Principles and Practices. 3rd Ed. International Book Distributing Co.
- Somogyi, L.P., Ramaswamy, H.S. and Hui, Y.H. (1996). Biology, Principles and Applications. Volume 1. Technomic Publishing Company, Inc.

Teaching Learning Process :

- Interactive classes
- Power point presentations
- Demonstration of industrial process using videos
- Presentation by students on recent topics related to syllabus
- Projects on market survey to make students familiar with products launched by different companies

Assessment Methods

- Presentation/assignment by students
- Class Test at Periodic Intervals
- Written Assignment
- Continuous evaluation in practicals
- End Semester University Theory and Practical Exams

Key Words: Fruits, Vegetables, Canning, Beverages, Dehydration, Preservation, Tea, Coffee, Cocoa, Pickles, TSS, Lacquering, KMS, Sodium benzoate, Chemical preservatives

SEC FT01: PROCESSING OF MILK & MILK PRODUCTS

Credits—2 P, 60 Hrs

LEARNING OBJECTIVES:

1. To study processed milk products

COURSE OUTCOMES:

1. To provide hands-on training to students for the processing of different milk products
2. To impart skills to students for understanding the processing of milk and milk products for starting their own setup.

Credit: 0+2

Total Lecture (Nos): 60 hours

Course Coverage (in % of the total):

Practical/ Field work/Hands-on-learning: 4 hours/week

PRACTICALS

1. Processing of Flavoured milk
2. Preparation of Dahi
3. Preparation of Ghee
4. Preparation of milk based traditional Indian sweet
5. Preparation of Ice cream
6. Preparation of milk based instant mix
7. Preparation of whey based drink
8. Milk based new product development
9. How to plan a startup, budgeting , marketing / case study/ entrepreneur (anyone of the above)
10. Regulations, Licensing and registration of a startup

COMPULSORY READINGS

- De, Sukumar. (2007). Outlines of dairy technology. Oxford University Press.
- Webb B.H. & Alford (2005). Fundamentals of dairy chemistry. CBS Publisher.

SUGGESTED READINGS:

- P.F. Fox, T. Uniacke-Lowe and J.A.O' Mahony (2005). Dairy Science and

Technology. Taylor & Francis.

- P. Walstra, Jan T.M. Wouters and Tom J. Geurts (2015). Dairy chemistry and Biochemistry. Springer

TEACHING LEARNING PROCESS

- Practicals
- Projects

ASSESSMENT METHODS

- As per University of Delhi norms
- Continuous evaluation of practicals
- Assessment methods - quiz, identification tests, assignments
- End semester exams for practical
- Feedback given to students for improving

KEYWORDS

- Department of food technology
- Milk processing

SEC FT02 PROCESSING OF FRUITS & VEGETABLES

Credits—2 P, 60 Hrs

LEARNING OBJECTIVES:

1. To provide hands-on training to students for the preparation of variety of fruits & vegetable products.
2. To impart skills of processing fruits & vegetable products & by products for setting their own enterprise.

COURSE OUTCOMES:

1. This will impart training & creativity to students for developing various products of choice & need.

2. Enable the students to have skills of processing fruits & vegetable products & by products for setting their own enterprise

Credit: 0+2

Total Lecture (Nos): 60 hours

Course Coverage (in % of the total):

Practical/ Field work/Hands-on-learning: 4 hours/week

PRACTICALS

<p>Unit I; Practicals based on different processing/ preservation techniques.</p>	<p>(No. of lectures) 15x4=60 hrs</p>
<p><i>Subtopics:</i></p> <ol style="list-style-type: none"> 1. Preparation of canned fruits /vegetables 2. Preparation of chips from potato/bittergourd/apples etc. 3. In bottle pasteurization of fruit juices, nectars, purees etc. 4. Preparation of fruit squashes 5. Preparation of fruit cordials 6. Preparation of fruit jams/jellies 7. Preparation of fruit nectars 8. Preparation of mango/chilli/ lime pickle 9. Preparation of Tomato puree & product 10. How to plan a startup, budgeting , marketing / case study/ entrepreneur (anyone of the above) 11. To study the Regulation, Licensing & registration of particular product. 	

ESSENTIAL READINGS

- Girdharilal., Siddappaa, G.S and Tandon, G.L.(2009). Preservation of fruits & vegetables. ICAR, New Delhi.
- Thompson, A.K., (2003). Fruits and vegetables; Harvesting, handling and storage. Blackwell Publishing.

SUGGESTED READINGS:

- Crusess, W.B. (2004). Commercial Unit and Vegetable Products. W.V. Special Indian Edition. Agrobios India.

- Manay, S. and Shadaksharaswami, M. (2004). Foods: Facts and Principles. New Age Publishers.
- Ranganna S.(2007). Handbook of analysis and quality control for fruits and vegetable products. Tata Mc Graw-Hill publishing company limited, Second edition.
- Srivastava, R.P. and Kumar, S. (2006). Fruits and Vegetables Preservation- Principles and Practices. 3rd Ed. International Book Distributing Co.
- Somogyi, L.P., Ramaswamy, H.S. and Hui, Y.H. (1996). Biology, Principles and Applications. Volume 1. Technomic Publishing Company, Inc.

Teaching Learning Process:

- Interactive Classes
- Experiential Learning
- Hands on training
- Standardization of product formulaion
- Promote critical thinking to create new products
- Presentation of product report

Assessment Methods:

- Continuous evaluation of laboratory work and record file.
- Viva-voce, tests & graded assignments
- Presentation (Power point by students)
- Semester end University examination.

Key Words: Standardization, Dehydration, Pasteurization, TSS, Tomato puree, fruit jam, jelly, Nectars, Squash, Cordial, Homogenization, Packaging, Shelf-life, acceptability.

GENERIC ELECTIVE (GE)
(Credits 4: Theory 3; Practical 1)
GE FT01 FOOD PROCESSING AND PRESERVATION
(Credits 3+1)

LEARNING OBJECTIVES:

1. To impart basic concept of Food colloids, Freezing, Dehydration processes and equipment used during the processing
2. To understand the Principles of thermal processing, Minimal Processing and hurdle technology
3. To understand the concepts of water disposal and sanitation.

COURSE OUTCOMES:

1. Understand the basic concepts of Food colloids, Freezing, Dehydration processes and equipment used during the processing
2. Understand the Principles of thermal processing, Minimal Processing and hurdle technology
3. Understand the concepts of water disposal and sanitation.

Credit: 3 +1

Total Lecture (Nos): 45 hours

Course Coverage (in % of the total): 100

Theory: 3 hours/ week

Practical/ Field work/Hands-on-learning: 2 hours/week

UNIT I Food Processing Operations Unit Description: Food Processing operations	(No. of lectures) 20
<p><i>Subtopics</i></p> <ul style="list-style-type: none"> • Refrigeration and Freezing Requirements of refrigerated storage - controlled low temperature, air circulation and humidity, changes in food during refrigerated storage, progressive freezing, changes during freezing Freezing methods -direct and indirect, still air sharp freezer, blast freezer, fluidized freezer, plate freezer, spiral freezer and cryogenic freezing. • Dehydration Normal drying curve , effect of food properties on dehydration, change in food during drying, drying methods and equipments: air convection dryer, tray dryer, tunnel dryer ,continuous belt dryer , fluidized bed dryer, dryer, drum dryer, vacuum dryer , freeze drying, foam mat drying. • Thermal Processing of Foods Classification of thermal processes, Principles of thermal processing, commercial canning operations, Aseptic Processing, UHT Irradiation and microwave heating. Principles, Dosage, Applications of Irradiation, Mechanism of microwave heating and applications. 	
UNIT II Technology of Colloids in Food Unit Description: Technology of Colloids in Food	(No. of lectures) 10

<i>Subtopics:</i> Surface chemistry (colloids, emulsions, foam, sols, gels, pectin gels)	
Unit III: Water Disposal and Sanitation Unit Description: Water Disposal and Sanitation	(No. of lectures) 10
<i>Subtopics:</i> 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	
Unit IV: Minimal processing and hurdle technology Unit Description: Minimal processing and hurdle technology	(No. of lectures) 5

PRACTICAL

DURATION: 30 HRS (CREDIT 1)

- Study of canning equipment (Forming, Flanging, Seaming, Exhausting and Retort)
- Canning of foods
- Preservation of food by the process of freezing
- Drying of food using Tray dryer/other dryers
- Study of thawing characteristics of frozen foods
- Preparation of brix solution and checking by hand refractometer
- Analysis of water
- Minimal Processing of food
- Application of colloidal chemistry in food preparation

ESSENTIAL READINGS:

1. Deman, J.M. (2007).Principles of Food Chemistry, 3rd Ed. Springer.
2. Potter, N. and Hotchkiss H. (2007).Food Science. New Delhi: CBS Publication.
3. Ramaswamy, H. and Marcotte, M. (2009).Food Processing Principles and Applications. CRC Press.

SUGGESTED READINGS:

1. Fellows' Food Processing Technology Principles and Practice 5th Edition (2022) Elsevier Publishing

TEACHING LEARNING PROCESS

- Lectured based teaching
- Power point presentations
- Experimental learning through practicals
- Along with pedagogy of flipped classroom students are encouraged to participate actively in the classroom through regular presentations on curriculum based topics, peer assessment

ASSESSMENT METHODS

- As per University of Delhi norms
- Assessment methods - quiz, identification tests, assignments
- End semester exams for theory and practical
- Feedback given to students for improving
- Continuous evaluation of practicals

KEYWORDS

Food Preservation, Food Processing, Colloidal chemistry, BOD, COD, Sanitation, Effluent system.

GE FT 02: CHEMISTRY OF FOOD (Credits 3+1)

LEARNING OBJECTIVES

- To understand the chemistry of foods - composition of food, role of each component
- To understand the different macromolecules and micromolecules in food
- To understand how food components contribute to overall quality of foods

COURSE OUTCOMES

- To understand the chemistry of foods - composition of food
- To understand the role of each component, their properties and reactions in food
- To comprehend how dietary components influence total food quality

Credit: 3 +1

Total Lecture (Nos): 45 hours

Course Coverage (in % of the total): 100

Theory: 3 hours/ week

Practical/ Field work/Hands-on-learning: 2 hours/week

UNIT I	Introduction to chemistry of Food	No of Lectures
	Subtopics: <ul style="list-style-type: none">• Introduction to Food Chemistry• Brief composition of food (Carbohydrates, fats, proteins, vitamins, minerals and pigments)	5
UNIT 2	Chemistry of Macromolecules	No of Lectures
	Subtopics: <ul style="list-style-type: none">• Water Definition of water in food, Structure of water and ice, Types of water, Role of water activity in shelf life and packaging• Carbohydrates Introduction, Classification, and Chemical reactions of carbohydrates• Protein Introduction, classification and structure, types of food protein (meat, egg, milk and wheat)• Lipids Introduction, classification and structure of triglycerides, types of fatty acid, deterioration of fats and oils. (Autooxidation and lipolysis)	20
UNIT 3	Chemistry of Micromolecules	No of Lectures
		10

	Subtopics: <ul style="list-style-type: none"> • Vitamins Introduction, types (water soluble and fat soluble vitamins) • Minerals Introduction, major and minor minerals, Toxic minerals in food 	
UNIT 4	Flavors and Pigments	No of Lectures 10
	Subtopics: <ul style="list-style-type: none"> • Definition and basic tastes • Description of some common food flavors • Introduction and classification of pigments 	

PRACTICAL CONTENT

DURATION: 30 HRS (CREDITS

1)

1. Preparation of primary and secondary solutions
2. Estimation of moisture content
3. Determination of gelatinization temperature range (GTR) of different starches
4. Determination of effect of additives on GTR of starches
5. Estimation of total nitrogen content by Kjeldahl method
6. Estimation of fat
7. Estimation of total ash and acid insoluble ash
8. Estimation of reducing sugar

COMPULSORY READINGS

- DeMan, John M. (1995). Principles of Food Chemistry. 3rd Ed., Springer.
- Fennema, Owen R. (2008). Fennema's Food Chemistry-CRC Press (2008) - 4th Edition.

ADDITIONAL RESOURCES

- Potter, N.N. and Hotchkiss, J.H. (2007). Food Science 5th Ed. New York: Chapman & Hall.
- Richard Owusu-Apenten. (2002) Introduction to Food Chemistry. CRC press
- Hans-Dieter Belitz, Werner Grosch, Peter Schieberle. (2009) Food Chemistry. Springer link

ASSESSMENT METHODS

- As per University of Delhi norms
- Assessment methods - quiz, identification tests, assignments
- End semester exams for theory and practical
- Feedback given to students for improving
- Continuous evaluation of practicals

KEYWORDS

- Department of Food Technology
- Food Chemistry
- Macromolecules

GE FT 03: SENSORY EVALUATION OF FOOD (CREDITS: 3+1)

LEARNING OBJECTIVES:

1. To understand sensory organs and their role in sensory evaluation
2. To obtain a basic knowledge of objective and subjective evaluation of food
3. To know the importance of sensory panels and testing methods.
4. Understanding the application of sensory evaluation in food industry.

COURSE OUTCOMES:

1. Learners will have an insight of basic tastes and derived tastes in food.
2. Basic understanding of flavours, colours and texture in foods.
3. Concept of sensory panels and various instruments used in assessing the quality parameters of food.

Credit: 3 +1**Total Lecture (Nos): 45 hours****Course Coverage (in % of the total): 100**

Theory: 3 hours/ week

Practical/ Field work/Hands-on-learning: 2 hours/week

Unit I: Taste	(No. of lectures)
Unit Description: Chemistry of five basic taste and their perception through tongue	11
<i>Subtopics:</i> <ul style="list-style-type: none"> • Introduction and importance of taste • 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 • Factors affecting taste quality, reaction time, taste modification, absolute and recognition Threshold • Taste measurement-Electronic Tongue. • Taste abnormalities 	
Unit II: Odour	(No. of lectures)
Unit Description: Identification of various types of odour's their perception and measurement.	11
<i>Subtopics:</i> <ul style="list-style-type: none"> • Introduction, definition and importance of odour and flavour • Anatomy of nose, physiology of odour perception • Mechanism of odour perception • Odour classification. • Odour measurement-GC-MS, Electronic Nose, • Olfactory abnormalities 	
Unit III: Colour	(No. of lectures)
Unit Description: Various attributes of colour and their objective measurement in foods.	11
<i>Subtopics:</i> <ul style="list-style-type: none"> • Introduction and importance of colour 	

<ul style="list-style-type: none"> • Dimensions and attributes of colour, appearance factors, gloss etc. • Perception of colour • Colour abnormalities • Measurement of colour; Munsell colour system, Tintometer, CIE colour system, Hunter colour system. 	
Unit IV: Texture Unit Description: Concept of texture and its objective assessment. Rheology of all food groups and instruments used.	(No. of lectures) 12
<i>Subtopics:</i> <ul style="list-style-type: none"> • Introduction, definition and importance of texture • Phases of oral processing • Texture perception, receptors involved in texture perception • Texture classification • Texture measurement – basic rheological models, forces involved in texture measurement • Some objective methods of texture evaluation of foods- TPA, mixograph, Extensiograph, amylograph, spreadimeter, compressimeter etc. 	

PRACTICAL CONTENT

DURATION: 30 HRS (CREDITS 1)

1. Training of sensory panel.
2. To perform recognition and sensitivity tests for four basic tastes.
3. To perform analytical tests of sensory evaluation.
4. Recognition tests for various food flavours.
5. Flavour defects in milk.
6. Sensory evaluation of dairy products-milk/cheese/butter/ice cream.
7. Extraction of pigments from various fruits and vegetables and study the effect of temperature and pH.
8. Texture Profile Analysis of any food product- cookies/ biscuits/chips/fruits.
9. Measurement of colour by using Tintometer/ Hunter Colour Lab etc.

ESSENTIAL READINGS

- Rao, E. S. (2013). Food Quality Evaluation, Variety Books, New Delhi
- DeMan, J. (2007). Principles of Food Chemistry, 3rd ed., Springer.
- Meilgard. (1999). Sensory Evaluation Techniques, 3rd ed. CRC Press LLC.

SUGGESTED READINGS:

- Amerine, Pangborn, & Roessler. (1965). *Principles of Sensory Evaluation of food*. London: Academic Press.
- Harry, T., Lawless, Barbara. & Klien, P. (1991). *Sensory Science Theory and Applications in Food*. Marcel Dekker Network.
- Rao, E.S. (2014). *Food Quality Testing and Evaluation- Sensory Test Instrumental Techniques*. New Delhi: Variety Book Publishers Distributors

TEACHING LEARNING PROCESS

- Conventional white board method
- Power Point Presentation
- Videos
- Assignment

ASSESSMENT METHODS

- As per University of Delhi norms
- Assessment methods - quiz, identification tests, assignments
- End semester exams for theory and practical
- Feedback given to students for improving
- Continuous evaluation of practicals

KEYWORDS

- Department of Food Technology
- Sensory Evaluation
- Taste of Food
- Odour of Food
- Colour of Food
- Texture of Food

GE FT 04: FOOD MICROBIOLOGY AND FOOD SAFETY (Credit: 3+1)

LEARNING OBJECTIVES:

- To understand the important genera of microorganisms associated with food and their characteristics.
- To understand the role of microbes in fermentation, spoilage and food borne diseases.
- To understand the principles of food preservation.
- To understand food safety , types of hazards associated with food and current regulatory regime along with food safety management systems.

COURSE LEARNING OUTCOMES

- Acquaint the knowledge of the important genera of microorganisms associated with food and their characteristics.
- Able to explain the role of microbes in fermentation, spoilage and food borne diseases and their role in food preservation
- Understand food safety and types of hazards associated with food
- Introduction to current Food Regulatory regime and Food Safety Management Systems.

Credit: 3 +1

Course Coverage (in % of the total): 100

Total Lecture (Nos): 45 hours

Theory: 3 hours/ week

Practical/ Field work/Hands-on-learning: 2 hours/week

Unit I: Introduction to Food Microbiology Unit Description: Covers genera of microorganisms associated with food and their characteristic features , growth pattern and enumeration	(No. of lectures -10)
Subtopics: <ul style="list-style-type: none">• Definition and Scope of food microbiology• Types of Microorganisms in food (bacteria, fungi and viruses)• Bacterial growth curve, Factors affecting the growth of micro- organisms in food• Sources of Microorganisms in foods• Enumeration of microorganisms	
Unit II: Role of microorganisms in Food Unit Description: Role of microbes in fermentation, spoilage and food borne diseases is the focus of this unit	(No. of lectures -12)
Subtopics: <ul style="list-style-type: none">• Food Spoilage , Spoilage in different food types• Beneficial role of microorganisms microorganisms used in food fermentations, common fermented foods• Food borne diseases and types – food infections, food borne intoxications and toxin infections	
Unit III: Food Preservation Unit Description: To understand the principles of food preservation	(No. of lectures- 9)
Subtopics: <ul style="list-style-type: none">• Principles of preservation• Effect of preservation methods such as thermal processing, freezing and irradiation on microbes• Introduction to Non thermal Methods of Food Preservation- HHP, PEF, Ohmic heating, Microwave etc.• Hurdle Technology	

<p>Unit IV: Food Safety and regulations Unit Description: Covers food safety , types of hazards associated with food , current regulatory regime and food safety management systems</p>	<p>(No. of lectures - 14)</p>
<p>Subtopics:</p> <ul style="list-style-type: none"> ● Food safety: Definition, Types of hazards, biological, chemical, physical hazards ● Food Safety Management Tools: HACCP and ISO series ● National Regulatory Regime ● International Regulatory bodies 	

PRACTICAL CONTENT

DURATION: 30 HRS (CREDITS 1)

1. Introduction to the Basic Microbiology Laboratory Practices and asepsis
2. Equipment in a microbiology laboratory-autoclave , laminar air flow chamber, incubators, hot air oven ,colony counter
3. Cleaning and sterilization of glassware
4. Working and handling of a compound microscope
5. Simple staining
6. Gram’s staining
7. Preparation and sterilization of culture media
8. Standard Plate Count Method- Serial Dilution
9. Standard Plate Count Method- Plating and counting of microorganisms
10. Bacteriological Analysis of Water using MPN method
11. Assessment of hand hygiene by thumb imprint method

ESSENTIAL READINGS

- Stephen J. Forsythe (2020) *The Microbiology of Safe Food*, 3rd Edition, Wiley
- Frazier, William C. and Westhoff, Dennis C. (2004). *Food Microbiology*. New Delhi: TMH.
- Garbutt, John. (1997). *Essentials of Food Microbiology*. London: Arnold.
- Jay, James M. (2000). *Modern Food Microbiology*. New Delhi: CBS Publication.
- Mathur, P. (2018). *Food Safety and Quality Control*. Hyderabad: Orient Black Swan Pvt. Ltd.

SUGGESTED READINGS:

- De Vries. (1997). *Food Safety and Toxicity*. New York: CRC.
- Lawley, R., Curtis L. and Davis,J. (2004). *The Food Safety Hazard Guidebook*. RSC Publishing.
- Norman G. Marriott, M. Wes Schilling, Robert B. Gravani (2018) *Principles of Food Sanitation (Food Science Text Series)*
- Pelczar, M.J., Chan E.C.S and Krieg, Noel. R. (2021) *Microbiology*, New Delhi: TMH

GE FT 05: FOOD ENGINEERING AND PACKAGING
(Credit: 3+1)

LEARNING OBJECTIVES:

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 OUTCOMES:

1. Understand the principles of Unit operation
2. Acquaint with fundamentals of food engineering and its process
3. An understanding of different food packaging materials and packaging design and techniques used for various foods

Credit: 3 +1

Total Lecture (Nos): 45 hours

Course Coverage (in % of the total): 100

Theory: 3 hours/ week

Practical/ Field work/Hands-on-learning: 2 hours/week

Unit 1: Unit Operations and Processes	(No. of lectures-20)
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<p><i>Subtopics:</i> Basic concepts and related numericals</p> <ul style="list-style-type: none"> • Units and Dimensions, Dimensional analysis • Mass and Energy Balance • Modes of heat transfer- Laws of Conduction, convection, Radiation. • Mass transfer-Fick's law of Diffusion, , Membrane separation processes. • Steam: Thermodynamics of Phase change, Pressure enthalpy diagram, related equations. Boilers: classification and types • Evaporation : Types of evaporators. Design of Single effect evaporator. • Dehydration: Basic drying process, Heat and mass transfer. • Refrigeration and Freezing : Components of Refrigeration System, Pressure Enthalpy Charts, Mathematical expressions useful in analysis of VCR System. Freezing time prediction, Plank's Equation. • Psychrometrics: Psychrometric Chart: construction and uses • Fluid flow: Liquid Transport system, types of pumps, Properties of Fluids: Density and Viscosity, Classification of fluids: Newtonian and Non Newtonian. Flow rate and Reynolds number. 	
<p>Unit II: Separation and Size Reduction Processes</p>	<p>(No. of lectures-12)</p>

<p><i>Subtopics:</i></p> <p>Principles and equipment used in following:</p> <ul style="list-style-type: none"> • Filtration • Extraction • Sedimentation and Centrifugation • Sieving • Size reduction – Milling and Grinding • Mixing of Food 	
Unit III: Introduction to Food Packaging	(No. of lectures-7)
<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> • Food Packaging Concept, Functions and its Significance • Manufacturing Process and Application of Rigid, Semi Rigid and Flexible Food Packaging Material 	
Unit IV: Food Packaging Techniques	(No. of lectures-6)
<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> • Packaging Techniques for Fresh Agricultural Produce • Packaging Techniques for Processed Foods 	

PRACTICAL CONTENT

DURATION: 30 HRS (CREDITS 1)

1. Study the mass balance equation.
2. Study the dehydration process of foods.
3. Study the freezing characteristics of foods.
4. Study the evaporation process.
5. Study and use of psychrometric chart.
6. To design layout of a food plant.
7. Determination of viscosity of foods using viscometer.
8. Identification of packaging materials.
9. Physical and mechanical testing of packaging materials.
10. Demonstration of vacuum/gas packaging of foods.

ESSENTIAL READINGS

- Singh, R.P. and Heldman, D.R.(2013).Introduction to food engineering, 5thEd. Academic Press
- Rao, D.G.(2010).Fundamentals of food engineering. PHI learning private Ltd.
- Robertson, (2012) Food Packaging: Principles and Practices , CRC Press

- Saha, N.C., Ghosh, A.K., Garg, M., Sadhu, S.D (2022) Food Packaging :Materials, Techniques and Environmental Issues, publisher springer

SUGGESTED READINGS:

- Fellows, P. (2000).Food processing technology. Woodhead publication, 2nd edition,
- Potter NH.(1998). *Food Science*, CBS Publication, New Delhi.
- Toledo Romeo T.(1999). *Fundamentals of Food Process Engineering*. Aspen Publishers
- Paine, F.A. and Paine, H.Y. (1992).*Handbook of Food Packaging*. New Delhi: Thomson Press India Pvt Ltd,
- Meenakshi Garg, Saumya Chaturvedi, Sushmita D Sadhu, Manjeet Barwa, BalaRam Pani. “Practical Handbook of Food Engineering” publisher ARYUSH EDUCATION, ISBN NO. 978-81-930437-5-2.; 2020
- Meenakshi Garg, Premlata Meena, Sushmita D Sadhu, Tanveer Alam. “Food Packaging: A Practical Guide” The Computype Media (Publishing Division), ISBN No.614027934-9; 2020.

Teaching Learning Process:

- Student centered teaching Learning process.
- Blend of conventional blackboard teaching and modern teaching learning tools
- Focus on real life applications of concepts
- Problem solving and quizzes
- Engaging students in collaborative learning.

Assessment Methods:

- Class Tests at Periodic Intervals.
- Written assignment(s)
- Oral assessment, quizzes.
- Semester end University examination.

Keywords: Food engineering, packaging, unit operation, techniques, design

GE FT06 TECHNOLOGY OF PLANT & ANIMAL FOODS

(Credit: 3+1)

LEARNING OBJECTIVES:

1. To understand the compositional and technological aspects of meat, egg, milk and fish
2. To understand processing of fruits, vegetables, cereals, pulses and oilseeds
3. To understand processing of various spices, tea, coffee and cocoa

COURSE OUTCOMES:

1. Understand the importance of meat, egg, dairy and poultry industry
2. Understand the compositional and technological aspects of meat, egg, milk and fish.
3. Understand different methods of fruits and vegetable processing
4. Understand technical knowhow of cereals, pulses and oilseeds processing
5. Understand processing of various spices, tea, coffee and cocoa

Credit: 3 +1

Total Lecture (Nos): 45 hours

Course Coverage (in % of the total): 100

Theory: 3 hours/ week

Practical/ Field work/Hands-on-learning: 2 hours/week

Unit I	(No. of lectures)
Technology of Fruits, Vegetables, Spices And Plantation Products	14
Unit Description: The unit aims at giving students understanding of the processing of fruits, vegetables, spices and plantation products	
<i>Subtopics:</i> <ul style="list-style-type: none">• Introduction and importance of fruit and vegetable preservation• Canning and bottling of fruits and vegetables: Selection of fruits and vegetables, process of canning, containers of packing• process and preservation of fruit juices, jams, jellies and marmalades• Processing and properties of important spices• Tea and Coffee: Processing	
Unit II: Technology Of Cereals, Legumes And Oilseeds	7
Unit Description: This unit briefly covers the processing of cereals, legumes and oilseeds.	
<i>Subtopics:</i> <ul style="list-style-type: none">• Types of wheat and its milling• Variety of rice and its milling• Milling of pulses• Oilseeds- Extraction of oil and refining.	
Unit III: Dairy and Fish Technology	11
Unit Description: Understand the compositional and technological aspects of milk and fish.	
<i>Subtopics:</i> <ul style="list-style-type: none">• Types of Market Milk• Physico-chemical properties of milk	

<ul style="list-style-type: none"> • Processing of Milk; concept of filtration, clarification, homogenization and pasteurization • Introduction to various milk products • Classification and composition of fish • Characteristics of fresh fish • Spoilage of fish • Preservation of fish 	
<p>Unit IV: Technology Of Meat, Poultry And Egg</p> <p>Unit Description: The unit gives introduction on meat technology. It also covers the processing aspect of poultry and egg technology.</p>	13
<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> • Definition of carcass • Composition of meat • post-mortem changes in meat- rigor mortis • Concept of an abattoir • Process of slaughtering in an abattoir • Structure and composition of hen's egg • Characteristics of fresh egg • Deterioration of egg quality • Preservation of eggs 	

PRACTICAL CONTENT

DURATION: 30 HRS (CREDITS 1)

1. Physical characteristics of wheat
2. Estimation of gluten content of flour
3. Estimation of degree Brix : Acid ratio
4. Estimation of percent Ascorbic acid
5. Platform tests in milk.(Acidity, COB, specific gravity)
6. Evaluation of eggs for quality parameters (market eggs, branded eggs)
7. Cut out examination of canned fish/meat.
8. To prepare casein and calculate its yield
9. To perform MBRT test in milk

ESSENTIAL READINGS

1. Girdharilal, Siddappaa, G.S and Tandon, G.L., 2009, Preservation of fruits & Vegetables, ICAR, New Delhi.
2. Kent, N.L., 2009, Technology of Cereals. Woodhead Publishing Ltd., England.
3. Lawrie R A, 2006, Lawrie's Meat Science, 7th Ed, Woodhead Publisher, England.
4. Shai Barbut, 2005.,Poultry Products Processing, CRC Press 2005.

5. Stadelman WJ, Owen J Cotterill, 2002, Egg Science and Technology, 4th Ed. CBS Publication New Delhi.
6. Hall GM, 1997, Fish Processing Technology, Blackie Academic & Professional., NY, 1997.

SUGGESTED READINGS:

1. Chakraverty, A., 2011. Postharvest Technology of Cereals, Pulses & Oilseeds, Oxford & IBH Publishing Co. Pvt. Ltd., ND.
2. Marshall, 1994, Rice Science and Technology, Wadsworth Ed., Marcel Dekker, New York, 1994.
3. H. Faride, 1997, The Science of Cookie and Cracker Production, CBS Publication, New Delhi.
4. W B Crusess.2007, Commercial Unit and Vegetable Products, W.V. Special Indian Edition, Pub: Agrobios India.
5. Potter NH, Food Science, CBS Publication, New Delhi, 1998
6. Kerry, Kerry, Ledward, 2012, Meat Processing: Improving Quality, Woodhead Publishing Ltd.
7. Fellows, P.J., 2009, Food Processing Technology : Principles & Practices, CRC Press,
8. Barrett, Somogyi, Ramaswamy, 2010, Processing Fruits: Science & Technology, 2nd Edition, Woodhead Publishing Ltd.
9. Cheng, 2002, Food Machinery: For the production of Cereal Foods, Snack Foods & Confectionery, Woodhead Publishing Ltd.

TEACHING LEARNING PROCESS

Lecture based teaching, power point presentations, experimental learning through practicals.

ASSESSMENT METHODS

- As per University of Delhi norms
- Assessment methods - quiz, identification tests, assignments
- End semester exams for theory and practical
- Feedback given to students for improvement
- Continuous evaluation of practicals

KEYWORDS

Department of Food Technology, Plant foods, Animal foods

GE FT07 FOOD AND HEALTH MANAGEMENT (Credits 3+1)

LEARNING OBJECTIVES:

1. To understand the relationship between food, nutrition and health.
2. To understand functions and food sources of various nutrients.
3. To appreciate the concept of balanced and healthy diets.
4. To be able to plan nutritious snacks
5. To be able to assess nutritional status of adults.
6. To know about various eating and nutritional disorders

COURSE OUTCOMES:

1. Appreciate the relationship between food, nutrition and health.

2. Explain functions and food sources of various nutrients.
3. Understand the concept of balanced diets
4. Plan and prepare nutritious snacks.
5. Assess nutritional status of adults.
6. Understand various eating and nutritional disorders

Credit: 3 +1

Total Lecture (Nos): 45 hours

Course Coverage (in % of the total): 100

Theory: 3 hours/ week

Practical/ Field work/Hands-on-learning: 2 hours/week

<p>UNIT I</p> <p>Food and Nutrition, balanced diets and nutritional labelling</p> <p>Unit Description: Basic concepts in food and nutrition and food groups, introduction to balanced diets and nutritional labeling</p>	<p>(No. of lectures)</p> <p>12</p>
<p><i>Subtopics</i></p> <ul style="list-style-type: none"> • Basic terms used in study of food and nutrition- Food, Nutrients, Nutritional status, Malnutrition, RDA. • Methods of assessment of nutritional status-BMI and Waist to Hip ratio, waist circumference • Functions of food-physiological, psychological and social • Understanding relationship between food, nutrition and health • Food Groups- based on functions and ICMR classification • Concept of Balanced Diets- Food Pyramid and MyPlate, fad diets • Introduction to Nutritional labelling- understanding a nutrition label on a food pack • Preventing nutrient losses during cooking 	
<p>UNIT II</p> <p>Macro and micronutrients</p> <p>Unit Description: Description of macro and micronutrients, their sources and disorders</p>	<p>(No. of lectures)</p> <p>12</p>

<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> • Classification, sources, functions and disorders associated with Energy, Carbohydrates, lipids, protein, vitamins and minerals (vitamin a, d,e, b group and c, calcium, iron, iodine and zinc) 	
<p>UNIT III</p> <p>Nutritional Disorders</p> <p>Unit Description-Clinical features and preventive strategies of nutritional and eating disorders</p>	<p>(No. of lectures)</p> <p>12</p>
<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> • Aetiology, prevalence, clinical features and preventive strategies of Undernutrition, Overnutrition, Nutritional anaemias, Vitamin A deficiency, Iodine deficiency disorder • Eating disorders-sign , causes and preventive strategies of Anorexia nervosa, Bulimia nervosa, Pica, Rumination disorder, Avoidant/restrictive food intake disorder 	
<p>UNIT IV</p> <p>Functional foods and dietary supplements</p> <p>Unit description- Functional foods and dietary supplements and their possible application in disease prevention/management.</p>	<p>(No. of lectures)</p> <p>9</p>
<p><i>Subtopics:</i></p> <ul style="list-style-type: none"> • Functional foods: definition, history, types, classification, food sources, potential health benefits and role of functional foods in management of cancer, cardiovascular diseases, hypertension and diabetes. • Dietary supplements: definition, types, uses and their role in disease prevention/management. • Regulatory aspects and health claims of functional foods and dietary supplements. 	

PRACTICAL CONTENT

DURATION: 30 HRS (CREDITS 1)

1. Identification of food sources for various nutrients using food composition tables.
2. Studying weight and measures using standard spoon and cups.
3. Introduction to meal planning, concept of food exchange system.
4. Planning of nutritious snacks for young/adolescent males and females.

5. Self dietary assessment using 24 dietary recall.
6. Critical analysis of nutritional labelling of food products.
7. Measurement and interpretation of Weight, Height and Waist circumference of young adults.
8. To identify clinical symptoms of anaemia in young adults.
9. To conduct a market survey of functional foods and dietary supplements.

ESSENTIAL READINGS:

- Byrd-Bredbenner, C., Moe, G., Beshgetoor, D. & Berning, J. (2013). *Wardlaw's Perspectives in Nutrition*, International Edition, 9th edition, New York: McGraw- Hill
- Chadha, R. and Mathur, P. eds. (2015). *Nutrition: A Lifecycle Approach*. Hyderabad: Orient Blackswan.
- Longvah, T., Ananthan, R., Bhaskarachary, K. and Venkaiah, K. (2017). *Indian Food Composition Tables*. Hyderabad: National Institute of Nutrition, Indian Council of Medical Research, Department of Health Research, Ministry of Health and Family Welfare, Government of India.

SUGGESTED READINGS:

- Bamji, M.S., Krishnaswamy, K. & Brahman, G.N.V. (2016). *Textbook of Human Nutrition*, 4th edition. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.
- *Codex Guidelines on Nutrition and Health Claims (CAC/GL 23-1997)*.
- FSSAI. *Food Safety and Standards Packaging, Labelling and Display Regulations*.
- ICMR. (2020). *Nutrient Requirements and Recommended Dietary Allowances for Indians*. Hyderabad: NIN, ICMR.

Teaching Learning Process:

- The teaching learning process will involve the traditional chalk and black board method along with ICT based tools such as power point presentations, videos and demonstrations.
- Students will be encouraged to participate actively in the classroom through regular presentations on curriculum based topics, peer assessment etc
- Practicals are planned in such a way so as to reinforce the topics covered in theory and to give a hands-on experience to make learning easy.

Assessment Methods:

Assessment methods will be as per the university norms and include graded assignments, conventional class tests, class seminars by students on course topics and end semester university examination for theory and practical.

Keywords:

Food and health, balanced diet, food groups, nutrition labelling, macro and micro nutrients, nutritional disorders, functional foods, dietary supplements.

VAC—FT01: Human Values & Professional Ethics

Credits—2 Th, 30 Hrs

LEARNING OBJECTIVES:

1. To give basic insights and inputs to the student to inculcate Human values to grow as responsible human beings with a proper personality.
2. Professional Ethics instils the student to maintain ethical conduct and discharge their professional duties.

COURSE OUTCOMES:

1. Understand the significance of value inputs in their life and profession.
2. Distinguish between values and skills, happiness and physical facilities.
3. Understand the role of a human being in ensuring harmony in society and nature.
4. Distinguish between ethical and unethical practices.

Credit: 2

Total Lecture (Nos): 30 hours

Course Coverage (in % of the total): 100

Theory: 50 %

Practical/ Field work/Hands-on-learning:50 %

Unit-I: Introduction to Value Education	(No. of lectures) 4
Subtopics: <ul style="list-style-type: none">• Value Education, Definition, Concept and Need for Value Education• The Content and Process of Value Education• Self-Exploration as a means of Value Education• Happiness and Prosperity as parts of Value Education	
Unit-II: Harmony in the Human Being	(No. of lectures) 4
Subtopics: <ul style="list-style-type: none">• Human Being is more than just the Body	

<ul style="list-style-type: none"> • Harmony of the Self with the Body • Understanding Myself as Co-existence of the Self and the Body • Understanding Needs of the Self and the Needs of the Body 	
Unit-III: Harmony in the Family, in Society and in the Nature	(No. of lectures) 8
<p>Subtopics:</p> <ul style="list-style-type: none"> • Family as a basic unit of Human Interaction and Values in Relationships • The Basics for respect and today's Crisis : Affection, Care, Guidance, Reverence, Glory, Gratitude and Love • Comprehensive Human Goal : The Five dimensions of Human Endeavour. 	
Unit IV: Social Ethics and Professional Ethics	(No. of lectures) 10
<p>Subtopics:</p> <ul style="list-style-type: none"> • The Basics for Ethical Human conduct • Defects in Ethical Human Conduct • Holistic Alternative and Universal order • Universal Human Order and Ethical Conduct • Value Based Life and Profession • Professional Ethics and Right Understanding Competence in Professional Ethics • Issues in Professional Ethics – The Current scenario Vision for Holistic Technologies, Production System and Management Models 	

Essential Reading:

1. Dr. N. Venkataiah, "Value Education", APH Publishing Corporation, 2007
2. M. Govindarajan, S. Natarajan, V. S. Senthil Kumar, "Professional Ethics & Human Values", PHI Learning Press, 2013.
3. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics

Suggested Reading:

1. S.S. Iyer (2002) Managing for Value, New Age International Publishers
2. Laura P Hartman, Abha Chatterjee (2007) Business Ethics, Tata McGraw Hill

3. S.K. Bhatia (2000) Business Ethics and Managerial Values, Deep & Deep Publications Pvt.Ltd.
4. A N Tripathy, 2003, Human Values, New Age International Publishers.
4. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
5. B L Bajpai, 2008, Indian Ethos and Modern Management, New Royal Book Co., Lucknow.

Teaching Learning Process :

- Interactive classes
- Power point presentations
- Video Demonstration
- Presentation by students on recent topics related to syllabus

Assessment Methods :

- Presentation/assignment by students
- Class Test at Periodic Intervals
- Written Assignment
- Continuous evaluation during presentation/Seminars
- End Semester University Theory Exams

Key Words :

Human Values, Professional Ethics, Value education, Harmony, Interaction, Relationships, Co-existence.

VAC—FT02: Communication & Soft Skill Development

Credits—2 Th, 30 Hrs

LEARNING OBJECTIVES:

- To understand the significance and essence of a wide range of soft skills.
- To learn how to apply soft skills in a wide range of routine social and professional settings.
- To learn how to employ soft skills to improve interpersonal relationships
- To learn how to employ soft skills to enhance employability and ensure workplace and career success.

COURSE OUTCOMES:

- Understand the significance and essence of a wide range of soft skills.
- Learn how to apply soft skills in a wide range of routine social and professional settings.
- Learn how to employ soft skills to improve interpersonal relationships
- Learn how to employ soft skills to enhance employability and ensure workplace and career success.

Credit: 2

Total Lecture (Nos): 30 hours

Course Coverage (in % of the total): 100

Theory: 50 %

Practical/ Field work/Hands-on-learning:50 %

<p>Unit I: Introduction to communication and soft skills</p> <p>Unit Description: Introduction to communication and soft skills</p>	<p>(No. of lectures)</p> <p>4</p>
<p>Subtopics:</p> <ul style="list-style-type: none"> • Soft Skills: An Introduction – Definition and Significance of Soft Skills; Process, Importance and Measurement of Soft Skill Development. • Self-Discovery: Discovering the Self; Setting Goals; Beliefs, Values, Attitude, Virtue. • Positivity and Motivation: Developing Positive Thinking and Attitude; Driving out Negativity; Meaning and Theories of Motivation; Enhancing Motivation Levels. 	
<p>Unit II: Verbal and nonverbal communication</p> <p>Unit Description:</p> <p>Unit covers Interpersonal Communication, Public Speaking, Group Discussion, Non-Verbal Communication, Teamwork and Leadership Skills:</p>	<p>(No. of lectures)</p> <p>8</p>
<p>Subtopics:</p> <ul style="list-style-type: none"> • Interpersonal Communication: Interpersonal relations; communication models, process and barriers; team communication; developing interpersonal relationships through effective communication; listening skills; essential formal writing skills; corporate communication styles – assertion, persuasion, negotiation. • Public Speaking: Skills, Methods, Strategies and Essential tips for effective public speaking. • Group Discussion: Importance, Planning, Elements, Skills assessed; Effectively disagreeing, Initiating, Summarizing and Attaining the Objective • Non-Verbal Communication: Importance and Elements; Body Language. • Teamwork and Leadership Skills: Concept of Teams; Building effective teams; Concept of Leadership and honing Leadership skills 	

<p>Unit III: Developing key traits</p> <p>Unit Description: Unit covers Interview Skills, Presentation Skills, Etiquette and Manners, Time Management , Personality Development</p>	<p>(No. of lectures)</p> <p>8</p>
<p>Subtopics:</p> <ul style="list-style-type: none"> • Interview Skills: Interviewer and Interviewee – in-depth perspectives. Before, During and After the Interview. Tips for Success. • Presentation Skills: Types, Content, Audience Analysis, Essential Tips – Before, During and After, Overcoming Nervousness. • Etiquette and Manners – Social and Business. • Time Management – Concept, Essentials, Tips. • Personality Development – Meaning, Nature, Features, Stages, Models; Learning Skills; Adaptability Skills. 	
<p>Unit IV: Essential and vocational skills: survival strategies</p> <p>Unit Description:</p> <p>Unit covers aspects of Decision-Making and Problem-Solving Skills, Conflict Management, Stress Management, Leadership and Assertiveness Skills, Emotional Intelligence:</p>	<p>(No. of lectures)</p> <p>10</p>
<p>Subtopics:</p> <ul style="list-style-type: none"> • Decision-Making and Problem-Solving Skills: Meaning, Types and Models, Group and Ethical Decision-Making, Problems and Dilemmas in application of these skills. • Conflict Management: Conflict - Definition, Nature, Types and Causes; Methods of Conflict Resoultion • Stress Management: Stress - Definition, Nature, Types, Symptoms and Causes; Stress Analysis Models and Impact of Stress; Measurement and Managemet of Stress • Leadership and Assertiveness Skills: A Good Leader; Leaders and Managers; Leadership Theories; Types of Leaders; Leadership Behaviour; Assertivness Skills. • Emotional Intelligence: Meaning, History, Features, Components, Intrapersonal and Management Excellence; Strategies to enhance Emotional Intelligence. 	

ESSENTIAL READINGS

- Managing Soft Skills for Personality Development – edited by B.N.Ghosh, McGraw Hill India, 2012.
- English and Soft Skills – S.P.Dhanavel, Orient Blackswan India, 2010.

Teaching Learning Process :

- Interactive classes
- Power point presentations
- Video Demonstration
- Presentation by students on recent topics related to syllabus

Assessment Methods :

- Presentation/assignment by students
- Class Test at Periodic Intervals
- Written Assignment
- Continuous evaluation during presentation/Seminars
- End Semester University Theory Exams

Key Words :

Human Values, Professional Ethics, Value education, Harmony, Interaction, Relationships, Co-existence.

BSc. (Hons.) Food Technology

DISCIPLINE SPECIFIC CORE COURSE DSC FT07: Meat and Fish Processing Technology
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CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/Practice		
Meat and Fish Processing Technology	4	3	0	1	XII Pass	DSC FT01, DSC FT02, DSC FT03, DSC FT04, DSC FT05, DSC FT06

Learning Objectives

1. To comprehend the meat quality and slaughter processes for meat animals.
2. To understand the concept and methods of processing and preservation of animal foods and by-product utilization.
3. To acquire the knowledge of fish preservation and value-added fish products.

Learning Outcomes

After completing this course, students will be able to:

1. Understand the need and importance of livestock industry.
2. Comprehend the structure, composition and nutritional quality of animal products.
3. Acquire the concept and methods of processing and preservation of animal foods.
4. Know the technology behind preparation of various animal food products and by-product utilization.
5. Apprehend the importance of fishery industry, the techniques that can be used for preservation of fish and manufacturing of various value-added fish products

SYLLABUS OF DSC FT07

THEORY

Credits 3 (45 Hrs.)

UNIT I: Introduction, meat quality, Slaughter process and By-products

Unit Description: The unit will provide information on the status and development of livestock industry, meat quality, ante-mortem and post-mortem examination, and by-products

Subtopics:

- Status of livestock industry in India, Development of meat industry in India and its need in nation's economy
- Effects of feed breed and stress on production of meat animals and their quality.
- Meat Quality-color, flavor, texture, Water-Holding Capacity (WHC), Emulsification capacity of meat.
- Layout of abattoir, Slaughter, Antemortem examination of meat animals, slaughter of buffalo, sheep/ goat.
- Post-mortem examination of meat, Grading, Post-mortem changes of meat.
- Importance of by-products utilization, classification and uses of by-products, Manufacture of Natural casings

UNIT II: Preservation of meat

Unit Description: The unit will provide knowledge of different meat preservation techniques.

Subtopics:

- Refrigeration and freezing, thermal processing- canning of meat, retort pouch, dehydration, irradiation, meat curing, Sausages-processing, types and defects, Packaging of meat

UNIT III: Introduction, Chilling and Freezing of fish

Unit Description: The unit will provide an understanding of the status of fishery industry in India. Fish chilling, storage, freezing will also be covered.

Subtopics:

- Status of fishery industry in India. Relationship between chilling and storage life, MAP, general aspects of freezing, freezing systems (air blast freezing, plate or contact freezing 36 spray or immersion freezing, freezing on board, onshore processing, changes in quality in chilled and frozen storage, thawing.

UNIT IV: Fish Curing, Smoking and Canning, By-products, fermented fish and concept of other seafoods

Unit Description: The unit will provide an knowledge of the different fish products processing and preservation techniques.

Subtopics:

- 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. 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).
- 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.
- Fish protein concentrates (FPC), fish protein extracts (FPE), fish protein hydrolysis (FPH) Flowchart of Indigenous products- Fish sauce and Paste
- Crabs, lobsters, prawns, shrimps.

PRACTICAL 1 Credits (30 Hrs)

- Estimation of moisture content of meat.

- Cut out analysis of canned meat/retort pouches (external parameters).
- Cut out analysis of canned meat/retort pouches (internal parameters).
- Analysis of frozen meat/meat emulsion product.
- Meat/fish product formulation (Ideation/development of product).
- Quality evaluation of fish/prawn.
- Subjective evaluation of Fresh Fish.
- Cut out analysis of canned fish (Sardine/Mackerel/Tuna) (external parameters).
- Cut out analysis of canned fish (Sardine/Mackerel/Tuna) (internal parameters).

Essential Readings

1. Lawrie, R. A. (2017). Lawrie's meat science. 8th ed. England: Woodhead Publishing Ltd.
2. Sen, D.P. (2005). Advances in Fish Processing Technology. Allied Publishers Pvt.Limited.
3. Hall, G.M. (1997). Fish Processing Technology. 2nd edition NY: VCH

Suggested Readings

1. Paul D. Warriss. (2010). Meat Science: An introductory text. 2nd Edition. CABI Publishers, Wallingford, UK (2010)
2. Borda D., Nicolau. A. I and Raspor P (2017). Trends in Fish Processing Technology (Contemporary Food Engineering). 1st edition CRC Press

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC CORE COURSE
DSC FT08 : Nutrition Science

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
		Theory	Tutorial	Practical/Practice		
Nutrition Science	4	3	0	1	XII Pass	DSC FT01, DSC FT02, DSC FT03, DSC FT04, DSC FT05, DSC FT06

Learning Objectives:

1. To understand the relationship between food, nutrition and health.
2. To learn the digestion, absorption, functions and food sources of various nutrients.
3. To comprehend the concept of balanced diet.
4. To know the different methods of cooking and ways to prevent nutrient losses.
5. To plan and prepare nutritious dishes for various age groups.
6. To assess nutritional status of adults.

Learning Outcomes:

After completing this course, students will be able to:

1. Students will be able to interpret and apply nutrition concepts to evaluate and improve nutritional health of individuals and communities
2. Comprehend the role of digestion, absorption, functions and food sources of various nutrients.
3. Understand the concept of balanced diet and exchange system.
4. Describe different methods of cooking and ways to prevent nutrient losses.
5. Plan and prepare nutritious dishes for various age groups.
6. Assess nutritional status of adults.

SYLLABUS OF DSC FT08

THEORY
Credits 3 (45 Hrs.)

UNIT 1: Introduction to Food and Nutrition

6 hrs

Unit Description: This unit will introduce the basic knowledge of food and nutrition, its functions. It will also help in understanding the inter-relationship between food, nutrition and health.

Subtopics:

- Basic terms used in study of food and nutrition
- Methods of assessment of nutritional status
- Functions of food-physiological, psychological and social
- Understanding relationship between food, nutrition and health

UNIT II: Nutrients

20 hrs

Unit Description: This unit will provide an understanding on functions, dietary sources and clinical manifestations of deficiency/excess of the following nutrients

Subtopics:

- Classification, digestion, absorption, functions, dietary sources, RDA, clinical manifestations of deficiency and excess of the following in brief:
- Energy
- Carbohydrates, lipids and proteins
- Fat soluble vitamins-A, D, E and K
- Water soluble vitamins – thiamine, riboflavin, niacin, folate, vitamin B12 and vitamin C
- Minerals – calcium, iron, iodine, fluorine, sodium, potassium, and zinc

Unit III: Planning Balanced Meals and Selection of Healthy Foods

6 hrs

Unit Description: This unit will help in understanding the concepts of food groups and balanced diet.

Subtopics:

- Food Groups
- Concept of Balanced Diets
- Understanding Nutrition labelling of foods

UNIT IV: Methods of Cooking and Nutrient Retention

13 hrs

Unit Description: This unit will help in developing know-how of different methods of cooking and ways to prevent nutrient losses

Subtopics:

- Dry, moist, frying and microwave cooking - Advantages, disadvantages
- Effect of various methods of cooking on foods and nutrients.
- Preventing nutrient losses

PRACTICAL 1 Credits (30 Hrs)

- Assessment of nutritional status using BMI and waist circumference.
- Identification of food sources for various nutrients using food composition tables.
- Introduction to meal planning, concept of food exchange system.
- Planning and preparation of nutritious snacks for adults using different methods of cooking.
- Planning and preparation of nutritious snacks for pregnant women.
- Planning and preparation of nutritious snacks for lactating women
- Planning and preparation of nutritious snacks for pre-schoolers.

- Planning and preparation of nutritious snacks for adolescents.
- Critical analysis of nutritional labelling of food products.

Essential Readings

1. Byrd-Bredbenner, C., Moe, G., Beshgetoor, D. & Berning, J. (2022). *Wardlaw's Perspectives in Nutrition, International Edition, 12th edition*, New York: McGraw- Hill 29
2. Chadha, R. and Mathur, P. eds. (2015). *Nutrition: A Lifecycle Approach*. Hyderabad: Orient Blackswan.
3. Longvah, T., Ananthan, R., Bhaskarachary, K. and Venkaiah, K. (2017). *Indian Food Composition Tables*. Hyderabad: National Institute of Nutrition, Indian Council of Medical Research, Department of Health Research, Ministry of Health and Family Welfare, Government of India.
4. Seth, V., Singh, K. & Mathur, P. (2018). *Diet Planning Through the Lifecycle Part I: Normal Nutrition- A Practical Manual*. 6th Edition. Delhi: Elite Publishing House.

Suggested Readings

1. Manay NS and Shadaksharaswamy M (2008). *Food-Facts and Principles*, Third Edition. New Age International (P) Ltd. Publishers, New Delhi.
2. Srilakshmi, B. (2021). *Nutrition Science*. 7th edition. New Age International.
3. Rekhi T and Yadav H (2014). *Fundamentals of Food and Nutrition*. New Delhi: Elite Publishing House Pvt Ltd.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC CORE COURSE
DSC FT09: Cereals, Pulses & Oilseed Processing Technology

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/Practice		
Cereals, Pulses & Oilseed Processing Technology	4	3	0	1	XII Pass	DSC FT01, DSC FT02, DSC FT03, DSC FT04, DSC FT05, DSC FT06

Learning Objectives

1. To impart knowledge of different methods of Cereal, Pulse & Oilseed processing.
2. To learn about processing of various products & by-products.

Learning Outcomes

After completing this course, students will be able to:

1. Understand the concept of quality (composition & types) of Cereals, Pulses & oilseeds for developing good quality end products.
2. Comprehend the processing and preservation of Cereals, Pulses & Oilseeds using various techniques.
3. Comprehend the processing of by-products.

SYLLABUS OF DSC FT09

THEORY
(Credits 3; Hours 45)

UNIT I: Introduction of Cereals

Subtopics:

Cereal Processing Technology

Introduction & chemical composition of cereals

- Wheat—Types, milling, flour grade, flour treatments (bleaching, maturing), flour for various purposes
- Rice: Types, Physicochemical properties, milling (mechanical & solvent extraction), parboiling, ageing of rice, utilization of by- products
- Corn: Milling (wet & dry), cornflakes, corn flakes, corn flour
- Barley: Milling (pearl barley, barley flakes)
- Oats: Milling (oatmeal, oatflour & oatflakes), By-products of oat processing
- Rye & Triticale: Milling (flour), uses

UNIT II: : Processing of Coarse Grains

Subtopics:

- Sorghum and Millets (Traditional & commercial milling)

UNIT III: Pulse Processing Technology

Subtopics:

- Introduction to pulses
- Milling of pulses
- Dry milling
- Wet milling
- Improved milling method

UNIT IV: Oilseed Processing Technology

Unit Description: The unit will provide an knowledge of the different fish products processing and preservation techniques.

Subtopics:

- Introduction
- Extraction of oil (Mechanical & Solvent Extraction Milling)
- Refining of oil
- Sources of protein (defatted flour, protein concentrates and isolates, properties and uses)
- Protein texturization, fibre spinning

PRACTICAL 1 Credits (30 Hrs)

- Physical characteristics of Wheat.
- Estimation of Gluten Content of flour.
- Estimation of Pelenske Value of flour.
- Fermenting power of yeast.
- Physical Characteristics of Rice and paddy.
- Cooking characteristics of rice.
- Determination of sedimentation power of flour
- Preparation of Dairy Analogue (Soy milk from Soybeans)

Essential 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.

Recommended readings:

1. Marshall, Rice Science and Technology. 1994. Wadsworth Ed., Marcel Dekker, New York.
2. Manay, S. and Sharaswamy, M. 1987. Food Facts and Principles. Wiley Eastern Limited.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC ELECTIVE
DSE FT01: Novel Food Processing Technologies

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/Practice		
Novel Food Processing Technologies	4	2	0	2	XII Pass	NIL

Learning Objectives

1. To enable students to learn the basics of novel processing techniques.
2. To impart knowledge about the mechanism of microbial inactivation by various processing techniques.
3. To acquire knowledge about the effects of various novel processing techniques on food quality.

Learning Outcomes

After completing this course, students will be able to:

1. Understand the principles and mechanism of microbial inactivation by various techniques in order to preserve food and provide safe food for consumption.
2. Comprehend the effects of various novel processing techniques on the food quality.

SYLLABUS OF DSE FT01

THEORY

Credits 2 (30 Hrs.)

Unit I: High pressure processing and Hurdle technology

(10 hrs)

Unit Description: The unit will provide an understanding of the High-pressure processing used in food industries. The unit will deal with its principle and effects on food quality. The unit will also provide knowledge of the hurdle technology and its use in food preservation.

Subtopics:

- **High Pressure Processing:** Definition, principles of high-pressure processing and effects of high pressure on food quality.
- **Hurdle Technology:** Concept and effect on preservation of food.

UNIT II: Pulsed electric fields processing

(8 hrs)

Unit Description: The unit will introduce fundamentals of pulsed electric field processing. It also deals with concept of e-beam.

Subtopics:

- **Pulsed electric fields processing:** Definition, PEF treatment systems, main processing parameters, mechanisms of microbial inactivation.
- **Concept of E-beam**

UNIT III: Ultrasound and radiofrequency processing

(6 hrs)

Unit Description: The unit will help in understanding the use of ultrasound and radiofrequency processing in food industry.

Subtopics:

- Ultrasound as a food preservation and processing aid, effects of ultrasound on food properties
- Radio-frequency processing.

UNIT IV:

(6 hrs)

Unit Description: The unit will provide and insight to various other novel processing techniques such as microwave heating, dielectric heating, ohmic heating, irradiation that aids in food preservation.

Subtopics:

- Microwave heating
- Dielectric heating
- Ohmic heating
- Irradiation
- UV-C radiation
- Ozone
- Plasma technology

PRACTICAL (2 Credits, 60 Hrs)

- Market survey of novel processed foods available
- Concept of hurdle technology
- Blanching using UV light
- Ultrasonication
- Setting up of Ohmic heater
- Applications of Microwave processing
- Layout of irradiation unit
- Ohmic heating process calculations
- Quality analysis of novel processed foods vs conventionally processed foods

Essential readings:

1. P J Fellows (2009). Food Processing Technology: Principles and Practice. Third edition. Wood Head Publishing in Food Science, Technology and Nutrition.
2. Howard Q. Zhang, Gustavo V. Barbosa-Cánovas, V. M. Bala Balasubramaniam, C. Patrick Dunne, Daniel F. Farkas, James T. C. Yuan (2011). Nonthermal Processing Technologies for Food. Wiley-Blackwell.
3. Ortega-Rivas, Enrique (2012). Non-thermal Food Engineering Operations. Springer.
4. Chauhan, O. P. (Ed.). (2019). *Non-thermal processing of foods*. CRC Press.
5. Potter NN and Hotchkiss H J (1996). Food Science, Fifth Edition. CBS Publication, New Delhi.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

COMMON POOL OF GENERIC ELECTIVES (GE) COURSES

GENERIC ELECTIVE (GE FT 03) : SENSORY EVALUATION OF FOOD

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course	Department offering the course
		Lecture	Tutorial	Practical/ Practice			
Sensory Evaluation of Food	4	3	0	1	Class XII	NIL	Home Science

Learning Objectives:

1. To understand sensory organs and their role in sensory evaluation
2. To obtain a basic knowledge of objective and subjective evaluation of food
3. To know the importance of sensory panels and testing methods.
4. Understanding the application of sensory evaluation in food industry.

Learning Outcomes:

Students will be able to:

1. Recognize basic tastes and derived tastes in food.
2. Describe flavours, colours and texture in foods.
3. Comprehend concept of sensory panels and various instruments used in assessing the quality parameters of food.

SYLLABUS OF GE FT01

THEORY

(Credits 3; Periods 45)

UNIT I: Taste

12 Hours

Unit Description: Chemistry of five basic taste and their perception through tongue

Subtopics:

- Introduction and importance of taste
- Structure and physiology of taste organs- tongue, papillae, tastebuds, salivary glands
- Mechanism of taste perception

- Chemical dimensions of basic tastes- sweet, salt, sour, bitter and umami
- Factors affecting taste quality, reaction time, taste modification, absolute and recognition threshold
- Taste measurement-Electronic Tongue.
- Taste abnormalities

UNIT II: Odour

11 Hours

Unit Description: Identification of various types of odour's their perception and measurement.

Subtopics:

- Introduction, definition and importance of odour and flavour
- Anatomy of nose, physiology of odour perception
- Mechanism of odour perception
- Odour classification.
- Odour measurement-GC-MS, Electronic Nose,
- Olfactory abnormalities

UNIT III: Colour

11 Hours

Unit Description: Various attributes of colour and their objective measurement in foods.

Subtopics:

- Introduction and importance of colour
- Dimensions and attributes of colour, appearance factors, gloss etc.
- Perception of colour
- Colour abnormalities
- Measurement of colour; Munsell colour system, Tintometer, CIE colour system, Hunter colour system.

UNIT IV: Texture

11 Hours

Unit Description: Concept of texture and its objective assessment. Rheology of all food groups and instruments used.

Subtopics:

- Introduction, definition and importance of texture
- Phases of oral processing
- Texture perception, receptors involved in texture perception
- Texture classification
- Texture measurement – basic rheological models, forces involved in texture measurement
- Some objective methods of texture evaluation of foods- TPA, mixograph, Extensiograph, amylograph, spreadimeter, compressimeter etc.

PRACTICAL
(Credit 1; Periods 30)

- Training of sensory panel.
- To perform recognition and sensitivity tests for four basic tastes.
- To perform analytical tests of sensory evaluation.
- Recognition tests for various food flavours.
- Flavour defects in milk.
- Sensory evaluation of dairy products-milk/cheese/butter/ice cream.
- Extraction of pigments from various fruits and vegetables and study the effect of temperature and pH.
- Texture Profile Analysis of any food product- cookies/ biscuits/chips/fruits.
- Measurement of colour by using Tintometer/ Hunter Colour Lab etc.

Essential readings:

1. Rao, E. S. (2013). Food Quality Evaluation, Variety Books, New Delhi
2. DeMan, J. (2007). Principles of Food Chemistry, 3rd ed., Springer.
3. Meilgard. (1999). Sensory Evaluation Techniques, 3rd ed. CRC Press LLC.

Suggested readings:

1. Amerine, Pangborn, & Roessler. (1965). *Principles of Sensory Evaluation of food*. London: Academic Press.
2. Harry, T., Lawless, Barbara. & Klien, P. (1991). *Sensory Science Theory and Applications in Food*. Marcel Dekker Network.
3. Rao, E.S. (2014). *Food Quality Testing and Evaluation- Sensory Test Instrumental Techniques*. New Delhi: Variety Book Publishers Distributors

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UNIVERSITY OF DELHI

CNC-II/093/1(28)/2023-24/21

Dated: 29.12.2023

NOTIFICATION

Sub: Amendment to Ordinance V

[E.C Resolution No. 14-1/-(14-1-6/-) dated 09.06.2023 and 27-1-1/ dated
25.08.2023]

Following addition be made to Appendix-II-A to the Ordinance V (2-A) of the Ordinances of the University;

Add the following:

Syllabi of Semester-IV, V and VI of the following courses of Department of Home Science under the Faculty of Science based on Under Graduate Curriculum Framework -2022 implemented from the Academic Year 2022-23 :

- (i) BSc. (Hons.) Home Science
- (ii) BSc. (Hons.) Food Technology
- (iii) BSc. (Prog.) Home Science
- (iv) BA (Prog.) Food Technology
- (v) BA (Prog.) Nutrition & Health Education (NHE)
- (vi) BA (Prog.) Human Development & Family Empowerment (HDFE)
- (vii) BA (Prog.) Apparel Design & Construction (ADC)

DEPARTMENT OF HOME SCIENCE

SEMESTER 4

B.Sc. Hons (Food Technology)

DISCIPLINE SPECIFIC CORE COURSE

DSC FT10: Food Quality Management

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/Practice		
FOOD QUALITY MANAGEMENT	4	3	0	1	XII Pass with PCM/PCB	NIL

Learning Objectives

- To appreciate the significance of food quality assurance in food processing.
- To comprehend approaches to Food Quality Management.
- To understand Food Quality Management during food production.

Learning Outcomes

After completing this course, students will be able to:

- Apply knowledge of food quality management in food value chain.
- Understand the dynamics and Techno- managerial approaches in the agri- food chain.
- Apply food recall and traceability protocols to assure food quality.
- Identify different contaminants formed during food production.

SYLLABUS OF DSC FT10

THEORY Credits: 3; Hours: 45

UNIT I: Introduction to Food Quality

15 Hours

Unit Description: This unit will provide concept of food quality management and assurance in the agri- food chain.

Subtopics:

- Definition of food quality: concepts, perception, attributes.
- Quality control and quality assurance.
- Food quality management functions.
- Food quality relationship and its management in the agri- food production chain.

UNIT II: Approaches to Food Quality Management.

15 Hours

Unit Description: This unit will provide insights on different approaches of quality management, food recall and traceability in the agri -food production chain.

Subtopics:

- Dynamics in the agri- food chain.
- Techno- managerial approach in Food Quality Management.
- Core developments in food quality management
- Food Recall
- Food Traceability

UNIT III: Food Quality Management during food production.

(15 Hours.)

Unit Description: This unit will provide information on contaminants formed during processing and packaging of foods. Major focus will be on emerging concerns with food contaminants.

Subtopics:

- Contaminants formed during processing & packaging – nitrosamines, acrylamide, aldehydes, benzene, dioxins, 3- mono chloro 1,2-propanediol (3-MCPD), furans, and methyl furans, VOCs.
- Persistent organic pollutants, PAH (Polycyclic Aromatic Hydrocarbons), Heterocyclic amines (HCAs), fumigants, autoxidation products.
- Emerging concerns in food- Microplastics, Bisphenol A, Endocrine Disruptors, hypersensitivities from food additives.

PRACTICAL
Credit : 1, Hours: 30

1. Determination of quality standards and inspection of various food grains- cereals and -nutri - cereals/milletts.
2. Determination of quality standards and inspection of pulses.
3. Determination of quality standards and inspection of spices and condiments.
4. Perform qualitative tests for fats and oils.
5. Determination of non-permitted colours in fruits and vegetables.
6. Estimation of ammonia nitrogen in water.
7. Prepare an effective HACCP plan for any food commodity or process in the food chain.

Essential Readings

- Pieterneel A, Luning. & Willem, J. Marcelis. (2009). *Food Quality Management Technological and Managerial principles and practices*. Wageningen.
- Lawley, R., Curtis, L., & Davis, J. (2012). *The food safety hazard guidebook*. Royal Society of Chemistry.
- DeMan. (2007). *Principles of Food Chemistry*. Springer, 3rd edition.

Suggested Readings

- Carol, E., Steinhart, M. and Ellin, D. (1995). *Food Safety*, Food Research Institute. New York: Marcel Dekker, Inc
- Shapton, D.A. and Shapton, N.F. (1998). *Principles and Practices for the safe processing of Foods*. CRC Press.

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DISCIPLINE SPECIFIC CORE COURSE

DSC FT11: Poultry & Egg Processing Technology

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/Practice		
Poultry & Egg Processing Technology	4	3	0	1	XII Pass with PCM/PCB	NIL

Learning Objectives

- To understand primary processing of poultry, chicken quality and by-product utilization.
- To understand HACCP models for poultry processing.
- To understand egg production practices, and egg preservation methods.
- To understand egg quality and development of value-added products.

Learning Outcomes

After completing this course, students will be able to:

- Understand the need and importance of egg and poultry industry.
- Comprehend egg production and poultry product processing.
- Acquire knowledge about application of HACCP model for poultry processing.
- Understand value-addition and by-product utilization

SYLLABUS OF DSC FT011

THEORY

Credits: 3; Hours: 45

Unit 1 Introduction

5 Hours

Unit Description: The unit will provide an understanding of the status and development of the Poultry industry, chicken quality, and processing of poultry and by-products.

Subtopics:

- Development of Poultry industry in India and its need in nation's economy,
- Chicken Quality - Color, Flavor, Texture, Water-Holding Capacity (WHC), Emulsification capacity.

Poultry products processing

15 Hours

- Primary processing of poultry,
- Inspection, Grading, Cut Up and Composition, ante-mortem and post-mortem inspection of poultry,
- A Generic HACCP model for poultry slaughter.
- Processing of enrobed poultry products, HACCP for a Cooked Product Model.
- Poultry by-products.

UNIT II: Egg Industry and Egg Production Practices

12 Hours

Unit Description: The unit will provide knowledge on the status and development of the Egg industry, and management of poultry farms.

Subtopics:

- The egg industry , Production of shell eggs
- Laying stock, Brooding period
- General management of Poultry farm.

UNIT III: Quality identification of shell eggs

5 Hours

Unit Description: The unit will provide an understanding of the factors that affect egg quality. Measures of egg quality will also be covered.

Subtopics:

- Grading of shell eggs
- Factors affecting egg quality
- Measures of Albumen and Yolk quality

UNIT IV: Preservation of eggs

8 Hours

Unit Description: The unit will provide information on the functional properties of eggs and different egg product processing and preservation techniques.

Subtopics:

- Refrigeration and freezing, egg powder manufacture, egg coatings.
- Functional properties of eggs and development of value-added products

PRACTICAL **Credit : 1, Hours: 30**

1. To study the shelf-life of eggs by different methods of preservation
2. Evaluation of eggs for quality parameters (market eggs, branded eggs)
3. To perform freezing of yolk/albumen
4. Egg product formulation.
5. Cut out analysis of canned chicken/retort pouches (external parameters).
6. Cut out analysis of canned chicken/retort pouches (internal parameters).
7. Planning generic HACCP model for poultry.
8. To prepare flow chart of enrobed chicken products/evaluate the quality of enrobed chicken products (chicken nuggets).

Essential Readings

- Shai, Barbut. (2016). *Poultry Products Processing. An Industry Guide*. CRC Press.
- Stadelman, W. J., Newkirk, D., & Newby, L. (2002). *Egg science and technology*. 4th ed. New Delhi: CBS Publication.
- Isabel Guerrero-Legarreta, Hui, Y.H .et.al.(2010)*Handbook of Poultry Science and Technology, Volume 2:Secondary Processing*. Wiley Publication

Suggested Readings

- Owens, C. M. (2010). *Poultry meat processing*. CRC Press.
- Richardson, R.I.,Mead,G.C(2005)*Poultry meat Science* New Delhi:CABI Publishing
- Parkhurst, C., &Mountney, G. J. (1997). *Poultry meat and egg production*. New Delhi: CBS Publishers

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DISCIPLINE SPECIFIC CORE COURSE

DSC FT12: Food Engineering- I

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/Practice		
Food Engineering- I	4	3	0	1	XII Pass with PCM/PCB	Nil

Learning Objectives

- To understand the concept of unit operation, units and dimensions.
- To comprehend the different Heat and mass transfer, refrigeration and Freezing operations.
- To understand the fundamentals of food engineering systems and its process.

Learning Outcomes

After completing this course, students will be able to:

- Understand the principle of unit operation.
- Apprehend the different methods of separation in the food industry.
- Acquire the basic knowledge of thermal properties, methods of heat transfer and mass transfer, principles of refrigeration and freezing.
- Apply these principles for solving numerical problems.

SYLLABUS OF DSC FT12

THEORY

Credits: 3; Hours: 45

UNIT I: Introduction

6 Hours

Unit Description: The unit will provide information on the concept of unit operation, mass balance and energy balance system.

Subtopics:

- Concept of Unit operation
- Units and dimensions, Unit conversions, dimensional analysis
- Mass and Energy Balance

UNIT II: Separation Processes

12 Hours

Unit Description: The unit will provide an insight into the principle and equipment design of various separation processes like distillation, extraction, centrifugation, filtration and sedimentation.

Subtopics:

- Distillation principles and methods: steam, batch, continuous distillation with rectification and stripping.
- Extraction : Hildebrandt, Bollman, SCF extraction
- Filtration : Plate and frame, pressure leaf, continuous rotary vacuum, batch and continuous filtration
- Centrifugation: Tubular, disc bowl and basket centrifuge
- Sedimentation : continuous thickener

UNIT III: Heat and Mass Transfer

15 Hours

Unit Description: The unit will provide knowledge of thermal properties of food, design and derivation of heat and mass transfer systems and applications.

Subtopics:

- Systems for heating and cooling food products
- Thermal Properties of Food
- Modes of heat transfer- Conduction, Convection and Radiation
- Applications 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
- Fick's Law of Diffusion
- Related basic numerical
- Membrane separation systems-Electrodialysis system , Reverse Osmosis, Ultra filtration, Microfiltration
- Membrane devices used for RO and UF: Plate and Frame, Tubular, Spiral wound and hollow fiber devices

UNIT IV: Refrigeration and Freezing

12 Hours

Unit Description: The unit will provide concept of refrigerants, VCR cycle, components of Refrigeration system and freezing time calculations

Subtopics:

- Concept, properties and selection of refrigerants
- Description of Vapor compression refrigeration (VCR) cycle
- Pressure Enthalpy charts and Tables
- Mathematical expressions useful in analysis of VCR cycle
- Numerical on VCR system using R -134a, R-717, R-12; Saturated cycle and deviations from the standard
- Freezing time calculation using Plank equation
- Frozen food storage

PRACTICAL
Credit : 1, Hours: 30

1. Mass and Energy Balance Calculations
2. Determination of alcohol insoluble solids using extraction process
3. Determination of the osmotic pressure of the given sample
4. Estimation of sedimentation rate
5. Determination of thermal properties of the given samples
6. Mathematical Design of Heat exchanger
7. Cooling refrigeration load calculations.
8. Determination of Convective heat transfer coefficient and freezing time
9. Determination of freezing point depression in given solution

Essential Readings

- Rao, D.G. (2010). *Fundamentals of food engineering*. PHI learning private ltd.
- Singh, R.P. and Heldman, D.R. (2009) *Introduction to food engineering* 2nd edition. 4th edition Academic press.
- Singh, R.P. and Heldman, D.R. (2014) *Introduction to food engineering* 5th edition. Academic press

Suggested Readings

- Earle, R.L. (1983). *Unit Operations in Food Processing*, 2nd edition. Pergamon press.
- Fellows, P. (2009). *Food processing technology*. Woodhead publication, 3rd edition
- Garg, M., Chaturvedi, S., Sadhu, S.D. and Barwa, M. and Pani. B ., (2020) *Practical Handbook of Food Engineering* Aryush Education, ISBN NO. 978-81-930437-5-2

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DISCIPLINE SPECIFIC ELECTIVE COURSE

DSE FT02 A: Bakery Technology

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/Practice		
Bakery Technology	4	2	0	2	XII Pass with PCM/PCB	Nil

Learning Objectives

- To understand the fundamentals of baking and technology of various bakery products.
- To understand basic knowledge, importance, quality and safety concerns in bakery industry.
- To understand technology used in modified bakery products for different health conditions.

Learning Outcomes

After completing this course, students will be able to:

- Understand the fundamentals of baking.
- Acquire the knowledge of technologies of bakery products.
- Understand trends in bakery industry.
- Get an overview of modified bakery products for different health conditions

SYLLABUS OF DSE FT03

THEORY

Credits: 2; Hours: 30

UNIT I: Introduction

5 Hours

- Bakery industry, current status and economic importance of bakery Industry in India.

- Nutritional quality and safety, pertinent standards & regulations, safety concerns

UNIT II: Bakery products

18 Hours

- Bread, Buns and Pizza base: Ingredients & processes for breads, buns, pizza base, changes taking place during baking, product quality characteristics, faults and corrective measures
- Cakes: Ingredients & processes for cakes, product quality characteristics, faults and corrective measures. Different types of icings.
- Pastry: Ingredients & processes for pastry, product quality characteristics, faults and corrective measures.
- Biscuits and Cookies: Ingredients & processes, product quality characteristics, faults and corrective measures.

UNIT III: Modified bakery products

7 Hours

- Modification of bakery products for people with special nutritional requirements e.g. high fibre, sugar free, low sugar, low fat, gluten free bakery products, use of fat and sugar replacers, enzymes, egg replacers and natural preservatives in bakery products.

PRACTICAL

Credit: 2, Hours: 60

1. Introduction of tools and equipment used in preparation of bakery products.
2. Quality assessment of wheat flour used in the preparation of baked products.
3. Preparation and acceptability of yeast leavened baked products (bread/ bun/ pizza base).
4. Preparation and acceptability of biscuits.
5. Preparation and acceptability of cookies.
6. Preparation of different types of cakes and their acceptability.
7. Preparation of different types of icings.
8. Development of any bakery product with special nutritional requirement.

Essential readings:

- Zhou, W., Hui, Y. H., Leyn, I. De., Pagani, M. A. , Rosell, C. M. , Selman, J. D., & Therdtai, N. . (2014). *Bakery Products Science and Technology* (Second ed.): John Wiley & Sons, Ltd.
- Dubey, S.C. (2007). *Basic Baking* 5th Ed. Chanakya Mudrak Pvt. Ltd.

Suggested readings:

- Khetarpaul, N. (2005). *Bakery Science and Cereal Technology*. India: Daya Publishing House.
- Edwards, W. P. (2015). *The Science of Bakery Products*. United Kingdom: Royal Society of Chemistry.
- Samuel, A. Matz (1999). *Bakery Technology and Engineering*. PAN-TECH International Incorporated
- Barndt, R. L. (1993). *Fat & Calorie – Modified Bakery Products*.US: Springer

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC ELECTIVE COURSE

DSE FT 02 B: Agribusiness Management

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/Practice		
Agribusiness Management	4	2	0	2	XII Pass with PCM/PCB	NIL

Learning Objectives

- To develop an insight of agribusiness management
- To develop an insight for different types of marketing management
- To gain knowledge and acquired skills for setting up an agribusiness and its management.

Learning Outcomes

After completing this course, students will be able to:

- Understand the basic knowledge of Agri-business management
- Develop insight for Agricultural Supply Chain Management
- Examine the role of various type of marketing management in agri-business
- Understand the different support system for agri-business
- Skill Development- After studying this paper, students will be able to identify entrepreneurial potential in agribusiness and explore the scope of sustainable agricultural produce, marketing and supply chain management. This paper would also improve the skill set of the students, enhance their agribusiness managerial skills and leadership quality which will entitle them to work in industries.

SYLLABUS OF DSE FT05

THEORY Credits 2 (30 Hours)

Unit 1 Concepts and application of agribusiness

15 Hours

Unit Description: The unit will provide an understanding of the Concepts and application of agribusiness.

Subtopics:

- Nature and Characteristics of Agribusiness

- Agro-based Industries in India
- Agricultural Supply Chain Management
- Strategic Management in Agribusiness
- Contract Farming
- ICT In Agribusiness

UNIT II: Marketing Management

15 Hours

Unit Description: The unit will provide knowledge on the concept of marketing management

Subtopics:

- Concepts of Marketing
- Marketing management: role of management in agri-business, attributes and responsibility of manager
- New product development and Product life cycle
- Product-mix, 4Ps of marketing

Practical Credit : 2, Hours: 60

1. Study of various business models in agri-business
2. Case study of Agri business and its aspects
3. Study of farm records & inventory
4. Study of system of book keeping & accountancy
5. Study of farm planning techniques & situations
6. Study of farm budgeting techniques & types
7. Study of balance sheet financial ratio analysis
8. Study of preparation of cash flow plan
9. Visit of Agri business enterprise

Essential Readings:

- Baker, G.A., Grunewald, O. Gorman, W.D. (2002) Introduction to food and agribusiness management: Prentice Hall of India, New Delhi.
- Kotler (1994). Marketing Management: Prentice Hall of India, New Delhi.
- S.S.Johl, T.R.Kapoor (2017) Fundamentals of farm business management: Kalyani Publishers, Ludhiana
- David, D. & Erickson, S. (1987) Principles of Agri Business Management. New Delhi: McGraw Hill Book Co.

Suggested Readings:

- Jakobsen, G. & Torp, J.E. (2001). Understanding Business systems in developing countries.
- Ahmad, S.M. (2000). Management Info Guide.
- Prasanna, C. (1996). Projects, Planning, Analysis, Selection, Implementation and Review. New Delhi: Tata McGraw-Hill Publishing Company Limited.
- K. Loknandhan, K. Mani, K. Mahendran (2015). Innovations in Agribusiness Management
- Tripathi (2012). Principles of Management: Tata McGraw-Hill Education

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DEPARTMENT OF HOME SCIENCE

SEMESTER 5

B.Sc. Hons (Food Technology)

DISCIPLINE SPECIFIC CORE COURSE

DSC FT13: Food Microbiology

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/Practice		
Food Microbiology	4	3	0	1	XII Pass with PCM/PCB	Nil

Learning Objectives

- To know the important genera of microorganisms associated with food and their characteristics.
- To understand the role of microbes in fermentation, spoilage and food borne diseases.

Learning Outcomes

Upon completion of this course, students are expected to:

- Recognize and describe the characteristics of important pathogens and spoilage microorganisms in foods.
- Understand the role and significance of intrinsic and extrinsic factors on growth and response of microorganisms in foods.
- Identify ways to control microorganisms in foods.
- Identify the conditions under which the important pathogens and spoilage microorganisms are commonly inactivated, killed or made harmless in foods.
- Describe the beneficial role of microorganisms in fermented foods and in food processing.
- 6. Utilize laboratory techniques to detect, quantify, and identify microorganisms in foods.

- Acquire, discover, and apply the theories and principles of food microbiology in practical, real-world situations and problems.
- Develop success skills in communication, critical thinking, interaction, information acquisition and interpretation and life-long-learning.

SYLLABUS OF DSC FT13

THEORY **Credits: 3; Hours: 45**

UNIT I: Microorganisms in food

15 Hours

Unit Description: The unit shall introduce students to the world of food microbiology. The structure and growth of bacteria, yeast, mold and virus in food as well as how the intrinsic and extrinsic factors affect the growth of microorganisms shall be taken up. The growth curve of bacteria will be covered to understand various phases of growth.

Subtopics:

- Introduction, history and scope of food microbiology.
- Morphological and physiological features of bacteria, yeast, mold. Introduction to bacterial endospores and capsules. Food borne viruses and their reproduction.
- Growth curve of bacteria.
- Factors affecting growth of microbes in foods.
- Role of microorganism in fermentation, spoilage and food borne diseases.

UNIT II: Cultivation of microorganism

10 Hours

Unit Description: Isolation and cultivation is the heart of microbiology. Therefore, the various techniques related to their cultivation and enumeration shall be taught. Although some are already taken in practicals but not all of them. A theoretical insight is needed.

Subtopics:

- Principles of cultivation of microorganism (purity, activity etc.).
- Pure culture technique.
- Methods of isolation and enumeration (including latest ones).
- Rapid methods of bacteria detection.

UNIT III: Microbial food spoilage

10 Hours

Unit Description: Food is the best substrate for the microorganism to grow, multiply and cause undesirable changes. The spoilage of raw as well as processed foods is very common. Therefore, as a food processor the understanding of food spoilage is very important for the students, in order to preserve the food.

Subtopics:

- Sources of microorganism in foods.
- Spoilage in milk, meat, cereals, fruits and vegetables (and few associated products).
- Spoilage in canned foods.

UNIT IV: Food preservation by novel technologies

10 Hours

Unit Description: There are many convention and new methods of food preservation. The novel methods cause minimum changes in sensory and nutritive properties of food. It is imperative to teach such methods and their application in food preservation.

Subtopics:

- Conventional methods of food preservation- an overview.
- Non-thermal methods such as pulse electric field preservation, high hydrostatic pressure, ohmic heating, irradiation, biopreservation etc. to be familiarized.
- Hurdle concept and minimal processing.

PRACTICAL
Credit: 1; Hours: 30

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

Essential Readings

- Frazier William C and Westhoff, Dennis C. Food Microbiology, TMH, New Delhi, 2004
- Jay, James M. Modern Food Microbiology, CBS Publication, New Delhi, 2000
- Garbutt, John. Essentials of Food Microbiology, Arnold, London, 1997
- Pelczar MJ, Chan E.C.S and Krieg, Noel R. Microbiology, 5th Ed., TMH, New Delhi, 1993
- W. M. Foster (2020) Food Microbiology. CBS Publishers & Distributors Pvt Ltd.

Suggested Readings

- Bibek Ray and Arun Bhunia. Fundamentals food microbiology, 5th Ed, CRC Press, 2014.
- K.R. Aneja. Experiments in microbiology, plant pathology, tissue culture and microbial biotechnology, New age international publishers, 2018.
- Roger Y. Stanier. General Microbiology, Macmillan, 1987.
- K.R. Aneja. Modern Food Microbiology, Medtech, 2018

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DISCIPLINE SPECIFIC CORE COURSE

DSC FT14: Food Engineering II

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/Practice		
Food Engineering II	4	3	0	1	XII Pass with PCM/PCB	Appeared in Food Engineering- I

Learning Objectives

- To understand the principle of size reduction and mixing unit operations
- To acquaint with fundamentals of fluid flow process and psychrometrics
- To understand the basics of designing of evaporator and dehydrator

Learning Outcomes

After completing this course, students will be able to:

- Apprehend the principles of size reduction and mixing unit operations.
- Comprehend the applications of fluid flow, steam and psychrometrics
- Understand basic design of evaporator and dehydrator used in food processing
- Apply these principles for solving numerical problems

SYLLABUS OF DSC FT14

THEORY

Credits: 3; Hours: 45

UNIT I: Introduction to Size Reduction and Mixing Operations

10 hours

Unit Description: The unit will provide information on the application of size reduction and mixing unit operations in food processing industry.

Subtopics:

- Introduction of size reduction and mixing operation
- Types of size reduction
- Size reduction equipment (crusher, grinding mill, pulveriser, roller mill, knife cutter)
- Application of size reduction

- Size separation, screening, screening equipment and applications
- Mixing equipment for solids and pastes (Planetary mixer, Kneader, Ribbon mixer, Double cone mixer)
- Applications of mixing in solids and fluids

UNIT II: Fluid Flow in food Processing

11 hours

Unit Description: The unit will provide knowledge of fluid characteristics, viscometers and pressure measuring devices

Subtopics:

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

UNIT III: Steam and Evaporation

12 hours

Unit Description: The unit will provide an understanding of generation of steam process, functioning and designing of evaporators

Subtopics:

- Generation of steam
- Construction and functions of fire tube and water tube boilers
- Thermodynamics of Phase change
- Steam tables
- Boiling point elevation
- Types of evaporators
- Design of single effect evaporators

UNIT IV: Psychrometrics and Dehydration

12 hours

Unit Description: The unit will provide knowledge of the psychrometrics, dehydration process and designing of dehydrator

Subtopics:

- Properties of dry air, water vapour, air vapour mixture
- Psychrometric Chart and its application
- Basic Drying Process
- Moisture content on wet basis and dry basis
- Dehydration systems
- Dehydration system Design

PRACTICAL

Credit: 1; Hours: 30

1. Screen analysis of food sample
2. Study the effect of temperature on viscosity of Newtonian / non-Newtonian fluids
3. Operation of pressure measuring instrument
4. Study properties of moist air using Psychrometer and psychrometric chart
5. Determination of evaporation rate of given food sample
6. Determine elevation in boiling point of given solution
7. Study steam table and its application

8. Operation of tray dryer and drying process calculations
9. Determination of drying characteristics of given food sample

Essential Readings

- Fellows, P. (2009). *Food processing technology*. Woodhead publication, 3rd edition
- Rao, D.G. (2010). *Fundamentals of food engineering*. PHI learning private ltd.
- Singh, R.P. and Heldman, D.R. (1993) *Introduction to food engineering* 2nd edition. Academic press
- Singh, R.P. and Heldman, D.R. (2014) *Introduction to food engineering* 5th edition. Academic press

Suggested Readings

- Earle, R.L. (1983). *Unit Operations in Food Processing*, 2nd edition. Pergamon press.
- Garg, M., Chaturvedi, S., Sadhu, S.D. and Barwa, M. and Pani. B ., (2020) *Practical Handbook of Food Engineering* Aryush Education, ISBN NO. 978-81-930437-5-2
- Jafari, Seid Mahdi, ed. (2021) *Engineering Principles of Unit Operations in Food Processing: Unit Operations and Processing Equipment in the Food Industry*. Woodhead Publishing.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC CORE COURSE

DSC FT 15: Food Chemistry I

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/Practice		
Food Chemistry I	4	3	0	1	XII Pass with PCM/PCB	Nil

Learning Objectives

- To understand the composition of food.
- To learn the structure, interaction, importance & stability of macro & micro components.
- To understand the functional aspects of food components and to study their role in food processing.

Learning Outcomes

After completing this course, students will be able to:

- Understand and describe the general chemical structures of the major & minor components of foods.
- Give a molecular rationalization for the observed physical properties and reactivity of the food components.
- Provide a theoretical explanation for observed extent and rates of reactions that are common to foods
- Predict how processing conditions are likely to change the reactivity of food components

THEORY

Credits: 3; Hours: 45

Unit I: Introduction to Food Chemistry

2 Hours

Unit II: Water

8 Hours

- Definition of water in food
- Structure of water and ice
- Types of water

- Sorption phenomenon
- Water activity and packaging
- Water activity and shelf-life

Unit III: Macronutrients

26 Hours

Lipids

- Classification of lipids
- Physical properties-melting point, softening point, specific gravity, refractive index, smoke, flash and fire point, turbidity point.
- Chemical properties-reichert meissl value, polenske value, iodine value, peroxide value, saponification value.
- Effect of frying on fats
- Changes in fats and oils- rancidity, lipolysis, flavor reversion
- Auto-oxidation and its prevention
- Technology of edible fats and oils- Refining, Hydrogenation and Interesterification, Fat Mimetics

Proteins

- Protein classification and structure
- Properties of proteins (electrophoresis, sedimentation, amphotericism and denaturation,)
- Functional properties of proteins eg. organoleptic, solubility, viscosity, binding gelation / texturization, emulsification, foaming.

Carbohydrates

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

Unit IV : Micronutrients

11 Hours

Vitamins

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

Minerals

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

PRACTICALS

Credit: 1; Hours: 30

1. Preparation of primary and secondary standard Solutions.
2. Estimation of moisture content.
3. Determination of gelatinization temperature range (GTR) of different starches and effect of additives on GTR.
4. Determination of refractive index and specific gravity of fats and oils.
5. Determination of smoke point and percent fat absorption for different fat and oils.
6. Determination of percent free fatty acids.
7. Estimation of saponification value.
8. Estimation of total ash content.

Essential Readings

- DeMan, J.M.(2018).Principles of Food Chemistry.NewYork: AVI.
- Fennema, Owen R. (2017).Food Chemistry. 3rd Ed..NewYork: Marcell Dekker
- Whitehurst and Law.(2002).Enzymes in Food Technology. Canada: CRC Press.

Suggested Readings

- Potter, N.N. and Hotchkiss, J.H. (1999). Food Science, 5th Ed., Chapman & Hall.
- Wong, Dominic WS. (2018). Food Enzymes. New York: Chapman and Hall.
- Meyer, L.H. (2004). Food Chemistry. CBS Publishers & Distributors Pvt Ltd, India.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC ELECTIVE COURSE**DSE FT03 A: Food Fermentation Technology****CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE**

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/ Practice		
Food Fermentation Technology	4	2	0	2	XII Pass with PCM/PCB	Nil

Learning Objectives

- To understand the concept and significance of fermentation
- To understand the principles of food fermentation technology
- To study the types of starters used in the food industry
- To study the production of various fermented foods

Learning Outcomes

- An understanding of the basic components of Food Fermentation Technology and their principles.
- An understanding of the concept of the different fermentation processes.
- Develop insight into common types of starters used in the Food Industry.
- Apply acquired skills in the production of various fermented foods.

SYLLABUS OF DSE FT 03**THEORY****Credits: 2; Hours: 30****UNIT I: Introduction to fermentation****10 Hours**

Unit description: This unit introduces the concept of fermentation as a process ,its basic requirements and types . It also covers the types of microbes required in the process resulting

in the formation of different products along with the emphasis on the significance of fermentation

Subtopics:

- Definition of Fermentation
- Types of fermentation process: submerged/solid state, Batch/continuous fermentation
- Requirements for the fermentation process
- Role of Starter cultures and their types commonly used in fermentation
- Importance of Fermentation

UNIT II: Fermentation Technology

10 Hours

Unit description: This unit covers Food Fermentation Technology with a focus on fermenters and their operations. Both the concept of upstream and downstream processing will be taught along with coproduct recovery

Subtopics:

- Fermenter: design and its operation
- Measurement and control of fermentation
- Upstream processing- screening and identification of microorganisms, media preparation, multiplication of microbes
- Downstream processing -Recovery of fermentation products and conversion into commercially viable products, Co-product recovery, and valorization

UNIT III: Fermented Products

10 Hours

Unit description: This unit describes the fermentation process of various products and their classification with an emphasis on the Indian traditional fermented products.

Subtopics:

- Types of fermented products and their classification
- Fermentation of milk, vegetables, cereals
- Industrial Production of selected products -Baker's yeast, Cider, Vinegar, and Cheese
- Traditional Indian Fermented products

PRACTICAL

Credit: 2, Hours: 60

1. To study the design and operation of a lab scale fermenter
2. To study the sugar utilization patterns by microorganisms
3. To determine β -galactosidase activity of microorganisms
4. To perform Solid State Fermentation using byproducts as a substrate at lab scale.
5. To produce Baker's Yeast
6. To prepare Sauerkraut
7. To prepare Curd /Yogurt
8. To develop a fermented food/drink utilizing plant products or their by- products
9. To develop a fermented food/drink utilizing animal products or their by-products

Essential Readings

- Brian, J. Wood. (1997).*Microbiology of Fermented Foods*. Volume II and I. Elsevier Applied Science Publication.

- Joshi, V.K. & Pandey. A. (2009). *Biotechnology: Food Fermentation Microbiology, Biochemistry and Technology*. Volume I and II. Asiatech Publishers Inc.
- Stanbury, P.F., Whitekar A. and Hall (2013). *Principles of Fermentation Technology*. Reed Elsevier India Pvt.Ltd.

Suggested Readings

- Adams, M. & Moss, M. (2008). *Food Microbiology*. 2nd Edition. RSC Publishing.
- John, Garbutt. (1997). *Essentials of Food Microbiology*. Arnold International Students Edition.
- Arnold L. Demain & Julian E. Davis. *Industrial Microbiology & Biotechnology*, ASM Press. (2004).

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC CORE COURSE**DSE FT 03 B: Traditional Indian Foods****CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE**

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/Practice		
TRADITIONAL INDIAN FOODS	4	2	0	2	XII Pass with PCM/PCB	NIL

Learning Objectives

- To understand the evolution, cultural, regional diversity and health benefits of traditional Indian foods.
- To understand the processing and preservation methods used for traditional Indian foods.

Learning Outcomes

After completing this course, students will be able to:

- Upon successful completion of this course students will gain knowledge of the diverse traditional Indian foods from the vedic times, states, regions, cultures and religion.
- The course aims to provide hands-on training to students in processing of different traditional Indian foods for setting enterprise, promotion of healthy forgotten traditional foods for research and development.

SYLLABUS OF DSE FT 06**THEORY****Credits 2 (30 Hours)****Unit 1 Introduction to Traditional Indian foods****15 Hours**

Unit Description: This unit will be covering the history and tradition of Indian foods from various cultures, regions and religions.

Subtopics:

- History of Indian Food Culture and Traditional Foods
- The journey of food from various Indian civilizations to Vedic period and modern era
- Categories of traditional foods of India: Traditional foods from different regions/states and different cultures and weaning foods in Indian tradition

- Concepts of Ayurvedic foods, classification of food based on Ayurveda: Grain based, fruits and vegetable based, milk-based traditional foods in Ayurvedic system.

UNIT II: Processing and preservation of traditional Indian foods

15 Hours

Unit Description: The unit will provide knowledge on the processing and preservation of traditional Indian foods

Subtopics:

- Ancient practices of food preservation: Dehydration, osmotic drying techniques
- Other Processing techniques used in preparation of traditional Indian foods

Practical Credit : 2, Hours: 60

Unit I: Practicals based on literature survey of the traditional Indian foods including the ingredients used, processing and health benefits.

1. Students will make presentations on vedic foods of India
2. Presentation on regional/state wise traditional Indian foods

Unit II: Practicals based on processing and preservation techniques used in Traditional Indian foods

1. Preparation of regional traditional foods: Regional cuisine preparation
2. Functional traditional foods: Fermented foods (grain based/drinks), adjuncts (papad/chutney/pickle).
3. Ayurvedic food preparations: Fruits and vegetable based/milk and milk product-based (ghee/buttermilk) processing of traditional foods
4. Processing of a traditional Indian foods by osmotic dehydration/drying

Essential Readings

- Achaya, K.T. (1994). Indian Food: A Historical Companion. Oxford University Press.
- Sarkar, P., Dh, L. K., Dhumal, C., Panigrahi, S. S., & Choudhary, R. (2015). Traditional and ayurvedic foods of Indian origin. Journal of Ethnic Foods, 2(3), 97-109.
- Raghunathsuri. (2012). Bhojanakutuhalam (Translated from original by Scholar of I-AIM, Institute of Ayurveda and Integrative Medicine, Bangalore).
- Suri, R. Balakrishna, A. (2013). Bhojanakutuhalam, first ed. Divya Prakashan, Haridwar, pp.1-373.

Suggested Readings

- Singh, A., & Singh, R. K. (2007). Cultural significance and diversities of ethnic foods of Northeast India.
- Subbulakshmi, G and Subhadra, M. (2020). Nutrition in Traditional Therapeutic Nutrition. Daya Publishing House Vol. 1 and 2

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DEPARTMENT OF HOME SCIENCE

SEMESTER 6

B.Sc. Hons (Food Technology)

DISCIPLINE SPECIFIC CORE COURSE

DSC FT16: Food Packaging

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/Practice		
Food Packaging	4	3	0	1	XII Pass with PCM/PCB	Nil

Learning Objectives

- To impart comprehensive overview of the scientific and technical aspects of food packaging.
- To instil knowledge on packaging machinery, systems, testing and regulations of food packaging
- To acquire knowledge of package designing for different food groups

Learning Outcomes

After completing this course, students will be able to:

- Comprehend the overview of scientific and technical aspects of food packaging
- Understand packaging machinery, systems and testing of material and package
- Acquire an insight into food packaging laws and regulations
- Apprehend the requirement of packaging material and package designing of food.

SYLLABUS OF DSC FT16

THEORY

Credits: 3; Hours:45

UNIT I: Introduction to Food Packaging

15 Hours

Unit Description: The unit will provide information on the status and concept of packaging, different packaging materials, their manufacturing process and applications

Subtopics:

- Status of Packaging industry, concept of food packaging
- Flexible packaging material (paper, plastic films, laminate and Aluminum foil)-manufacturing process and applications
- Semi rigid packaging material (paper board, corrugated board and composite carton)-manufacturing process and applications
- Rigid packaging material (metal, glass and plastic containers)-manufacturing process and applications
- Aseptic, active and intelligent packaging systems

UNIT II: Package Designing for Foods

15 Hours

Unit Description: The unit will provide knowledge of factors affecting shelf life of food, packaging system requirement and package designing

Subtopics:

- Fresh horticultural produce
- Animal foods
- Dry and moisture sensitive foods
- Frozen foods
- Fats and oils
- Thermally processed food

UNIT III: Testing of Food Packaging Material and Package

8 Hours

Unit Description: The unit will provide an understanding of the testing and quality evaluation of packaging material and package.

Subtopics:

- Testing procedures for packaging materials- thickness, tensile properties, puncture resistance, bursting strength, seal strength, water vapor permeability, gas transmission rate (CO₂ and O₂ permeability), grease resistance
- Compatibility and shelf-life studies
- Evaluation of transport worthiness of filled packages

UNIT IV: Regulatory Aspects of Food Packaging

7 Hours

Unit Description: The unit will provide knowledge of the food packaging and labelling regulations, environment issues and life cycle analysis (LCA)

Subtopics:

- Food Packaging and Labelling regulations (FSSAI)
- Sustainable and green packaging-environment issues
- LCA definition and methodology, carbon foot print and its significance in packaging material

PRACTICAL

Credit: 1, Hours: 30

1. Identification of plastic using floatation method.

2. Demonstration of the operation of Shrink wrapping/Vacuum packaging/Form Fill and Seal packaging machinery
3. Testing of packaging material and package: COBB / tensile strength /bursting strength / tear resistance/ drop/ leakage
4. Testing of thermal shock resistance of glass.
5. Study of water vapor transmission rate of packaging material.
6. Development of biodegradable film.
7. Design a package label
8. Study porosity of tinplate.
9. Examination of can double seam

Essential Readings

- Saha, N. C. (2022). *Food Packaging: Materials, Techniques and Environmental Issues*. Springer Nature.
- Robertson, G.L. (2012) *Food Packaging – Principles and Practice*. CRC Press Taylor and Francis Group
- Coles, R., McDowell, D.& Kirwan, MJ. (2003). *Food Packaging Technology*. Blackwell publication
- Paine, F.A. and Paine, H.Y. (1992). *A Handbook of Food Packaging*. Blackie Academic and Professional.

Suggested Readings

- Daniel, Lu. and Wong, D. (Eds). (2017). *Materials for Advanced Packaging*. Springer
- Garg, M., Meena, P.L., Sadhu, S.D. and Alam, T. (2020) *Food Packaging: A Practical Guide*, The Computype Media (Publishing Division), ISBN No.614027934-9

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC CORE COURSE

DSC FT 17: Food Chemistry II

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/Practice		
Food Chemistry II	4	3	0	1	XII Pass with PCM/PCB	Nil

Learning Objectives

- To understand the chemistry of food components and their interactions.
- To know about the role of enzymes and its application in food industry.
- To co-relate the quality changes during different processing methods of food.
- To understand the concept of new food product development.

Learning Outcomes

After completing this course, students will be able to:

- Determine approaches that may be used to control the reactivity of those food components that are likely to impact the overall quality of finished products.
- Interpret the reasoning of changes occurring in food during different processing treatments.
- Learn basic methods of food product development.

THEORY

Credits: 3; Hours:45

Unit I: Sensory Aspects (Colour & Flavour)

Natural Food Pigments

6 Hours

- Introduction and classification
- Food pigments (Sources, Structure, Stability and Interactions)

- Chlorophyll
- Carotenoids
- Anthocyanins and flavonoids
- Beet pigments
- Myoglobin

Flavour **5 Hours**

- Definition and basic tastes
- Chemical structure and taste
- Description of food flavours , Flavour enhancers

Unit II : Enzymes

- Introduction, classification
- General characteristics
- Enzymes in food processing
- Industrial Uses of Enzymes
- Immobilized enzymes

10 Hours

Unit III: Changes occurring during food processing treatments.

Physico-chemical and nutritional changes occurring during food processing treatments

9 Hours

- Drying and dehydration
- Irradiation
- Freezing
- Canning

Browning Reactions In Food

7 Hours

- Enzymatic browning
- Non – Enzymatic browning:
- Maillard reaction
- Caramelization
- Ascorbic acid oxidation

Unit IV: New Food product development

8 Hours

- Definition
- Importance
- Need of product development
- Stages of product development
- Product development tools
- Reasons for failure
- Product Life Cycle

PRACTICAL

Credit: 1; Hours: 30

1. Determination of thermal inactivation time of spoilage enzymes (Blanching time) in fruits and vegetables.
2. Estimation of minerals -demo
3. Estimation of iodine value
4. Estimation of peroxide value
5. Estimation of reducing and non-reducing sugars using potassium ferricyanide method.

6. Determination of carotenoids w.r.t flour pigments.
7. Extend of non-enzymatic browning by extraction methods.
8. Introduction of the concept of new product

Essential Readings

- DeMan, J.M.(2018).Principles of Food Chemistry.NewYork: AVI.
- Fellows, P. J. (2009). *Food processing technology: principles and practice*. Elsevier.
- Rahman, M. S. (2020). Handbook of Food Preservation. 3rd Edition. India: CRC Press.
- Fennema, Owen. R. (2017). Food Chemistry, 3rd Ed., New York: Marcell Dekker.
- Whitehurst and Law (2002).Enzymes in Food Technology. Canada: CRC Press.
- Graf, E & Saguy,I.S (2011). Food Product Development. Newyork, AVI pub.Co.

Suggested Readings

- Wong, Dominic W.S. (1996). Food Enzymes. New York: Chapman and Hall.
- Desrosier, Norman W. and Desrosier, James.N. (2018). The technology of food preservation, 4th Ed.Westport, Conn.: AVI Pub. Co.
- Hui, Y. H., & Evranuz, E. Ö. (Eds.). (2015). Handbook of vegetable preservation and processing. CRC press.
- Eskin, N. M., & Shahidi, F. (2012). Biochemistry of foods.
- Simpson, B. K., Nollet, L. M., Toldrá, F., Benjakul, S., Paliyath, G., & Hui, Y. H. (Eds.). (2012). Food biochemistry and food processing. John Wiley & Sons.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC CORE COURSE

DSC FT18: Food Safety

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITE OF THE COURSE

Course title & code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Theory	Tutorial	Practical/ Practice		
FOOD SAFETY	4	3	0	1	XII Pass with PCM/PCB	Nil

Learning Objectives

- To understand the concept of safe food and types of hazards associated with food.
- To control the potential threats to the safety of food.
- To familiarize with Good Hygienic Practices, Food Safety Management Systems and the Indian regulatory regime

Learning Outcomes

After completing this course, students will be able to:

- Understand the concept of food safety, types of hazards, and their control measures
- Identify and prevent potential sources of food contamination
- Comprehend the need for hygiene and sanitation for ensuring food safety
- Knowledge of Food Safety Management tools and introduction to the Indian regulatory regime
- Practical knowledge to detect and quantify microorganisms from various routes of contamination of food

SYLLABUS OF DSC FT18

THEORY

Credit: 3; Hours: 45

UNIT I Introduction to Food Safety

6 Hours

Unit Description: This unit introduces the concept of safe food. It focuses on the significance of food safety, common types of hazards associated with food, and factors that affect the safety of food, especially in a developing country like India.

Subtopics:

- Definition of safe food
- Types of hazards
- Factors affecting Food Safety
- Importance of Safe Foods

UNIT II Hazards associated with food

14 Hours

Unit Description: This unit begins with how various hazards gain entry into the food chain, then gradually delves into each hazard type, its example, and its impact. The unit also covers the chemical and biological hazards in depth keeping in view their public health significance. Topics like mycotoxins, indicator organisms, and allergens are also included for a better understanding of their relationship to food safety.

Subtopics:

- Mode of entry of hazards into food
- Physical hazards –common examples and control measures
- Chemical hazards (naturally occurring, environmental including radioactive components and intentionally added), packaging material as a threat
- Biological hazards (Foodborne pathogens: bacteria, viruses, and eukaryotes) , Seafood and Shellfish poisoning, Mycotoxins, Indicator Organisms
- Food Allergens

UNIT III Management of Hazards

16 Hours

Unit Description: This unit covers all the key factors which influence food safety in depth and provides hands-on information on managing hazards in the food industry. This unit helps the students not only to understand the significance of hygiene and sanitation but also the critical role of water and food handlers in maintaining food safety. The recent food safety management tools have also been included to emphasize the applied aspects of food safety.

Subtopics:

- Factors influencing food safety -Design of food plant, Temperature Danger Zone and Storage of Food, Food handler and personal hygiene, Quality of Water
- General Principles of Hygiene, Sanitation and methods of control using physical and

chemical agents, Waste Disposal, Pest and Rodent Control

- Food Safety Management Tools -Basic Concept, HACCP, ISO series, TQM - components of TQM, Risk Analysis

UNIT IV Trends in Food Safety

9 Hours

Unit Description: Food safety is a dynamic area of food science where new challenges recurrently appear and finding solutions to them is the key to safe food. This unit covers the current status of Food Safety Regulations in the country and all the emerging hazards in food. The new advances in food safety pertaining to the detection of hazards, food-borne pathogens, and preservation methods are also discussed.

Subtopics:

- Food Safety Regulations and their current status in India
- New and emerging pathogens and chemical hazards
- Genetically Modified Foods \ Transgenics, Organic foods
- Newer approaches to hazard and pathogen detection
- Recent technologies in food preservation and pathogen detection

PRACTICAL

Credit: 1, Hours: 30

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. Bacteriological Analysis of Water by MPN method
5. Assessment of surface sanitation by swab / rinse method
6. Assessment of Personal Hygiene
7. Preparation of a HACCP plan
8. Testing of foods for microbiological hazards

Essential Readings

- Forsythe, S.J. (2020). The Microbiology of Safe Food, 3rd edition. UK: Willey.
- Lawley, R., Curtis L. and Davis, J. (2015) The Food Safety Hazard Guidebook. London: RSC.
- Marriott, N G. and Gravani RB (2006). Principles of Food Sanitation. 5th edition New York: AVI
- Mathur, P. (2018). Food Safety and Quality Control. Hyderabad: Orient BlackSwan Pvt. Ltd.

Suggested Readings

- de Blackburn, C and Mc Clure P. (2009). Food borne pathogens. Hazards, risk analysis & control. 2nd edition. Washington, US: CRC Press.
- De Vries. (2014). Food Safety and Toxicity. New York: CRC.
- Mortimore S. and Wallace C. (2013). HACCP-A Practical Approach 3rd edition. London: Springer.

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DISCIPLINE SPECIFIC ELECTIVE
DSE HS 6-1: Research Methods in Home Science

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the Course (if any)
		Lecture	Tutorial	Practical/ Practice		
Research Methods in Home Science	4	3	0	1	NIL	NIL

Learning Objectives

- To provide students understandings about the basic concepts, approaches and methods in conducting Home Science research.
- To enable learners to appreciate and critique the nuances of designing a research study well.
- To sensitize students towards ethical concerns while conducting Home Science research.

Learning Outcomes

- Demonstrate knowledge of the scientific method, purpose and approaches to research in Home Science
- Compare and contrast quantitative and qualitative research approaches
- Explain different types of research design and their applicability in Home Science research
- Understand the key elements of a research process
- Explain ethical principles, issues and procedures

SYLLABUS DSE HS 6-1

THEORY
Credits: 3; Hours: 45

UNIT I: Research Purpose and Design

10 Hours

This unit will deal with meaning and importance of research in various areas of Home Science. Exposure to different types of research designs and measurement in Home Science research would also be given.

- Meaning, purpose and significance of research
- Research as a scientific method
- Types of research
- Quantitative, Qualitative and mixed method approaches

- Research Designs –Experimental and Non-Experimental; Descriptive and Observational; Participatory research
- Internal and external validity of research design
- Variables, concepts and measurement in research
- Levels of measurement
- Units of analysis

UNIT II: Sampling and Research tools & techniques

15 Hours

This unit will introduce the student to the concept of sampling and methods used to draw sample from population using examples from Home Science discipline. Students would also learn about types of data, its collection and reliability and validity concerns.

- Role of sampling in research
- Sampling techniques and their applicability, Sample size and sampling error
- Types of data: Primary and Secondary
- Tools of data collection; types, construction and administration- Interview, Questionnaire, Observation, Focus group discussion and other methods
- Validity and reliability of data collection tools

UNIT III: The Research Process

15 Hours

This unit will elaborate upon the various steps involved in conducting and reporting researches in Home Science.

- Defining the problem, research questions, objectives, hypotheses
- Review of related literature and originality in writing
- Systematic research: concept and methodology
- Planning the research
- Identifying variables and constructing hypothesis
- Selecting appropriate research methodology and tools
- Data analysis: coding and tabulation
- Writing a research report: styles and formats
- Citation formats: in medical sciences, social sciences

UNIT IV: Values, Social Responsibility and Ethics in Research

5 Hours

This unit will apprise the students about ethical concerns while conducting and reporting research.

- Ethical principles guiding research: from inception to completion and publication of research
- Plagiarism and Academic integrity in research: plagiarism tools and software
- Ethical issues relating to research participants and the researcher
 - Rights, dignity, privacy and safety of participants
 - Informed consent, confidentiality, anonymity of respondents, voluntary participation, harm avoidance

PRACTICAL (Credits 1; 30 Hours)

1. Data visualization
2. Levels of Measurement

3. Types of research designs
 - a. Experimental and non-experimental; Descriptive and observational
 - b. Qualitative, Quantitative and mixed method
4. Sampling techniques and sample size calculation
 - a. Probability sampling method
 - b. Non-Probability sampling methods
5. Tools of data collection- Interview schedule, questionnaire and FGD
 - Designing/ Construction
 - Preparation of tools for ethical review
 - Pilot testing/ validity and reliability of the tool\
6. Data collection and analysis process: conducting interviews, administering questionnaire
7. Coding and tabulation of data for analysis
8. Citation formats and Plagiarism
9. Reviewing a research paper from a specific area of specialization in Home Science

Essential Readings:

- Kerlinger F. N. and Lee, H.B. (2017). *Foundations of Behavioral Research* 4th Ed. Harcourt College Publishers.
- Kothari, C. R. (2019). *Research Methodology: Methods and Techniques*. New Age International Pvt Ltd, New Delhi.
- Kothari, C. R. (2022). *Shodh Padhati* 1st Ed. New Age International Pvt Ltd, New Delhi.
- Kumar, R. (2019) *Research Methodology: A Step-by-Step Guide for Beginners*. 5th Ed. Sage Publications, New Delhi.

Suggested Readings:

- Bernard, H. R. (2000). *Social research methods: Qualitative and quantitative approaches*. Thousand Oaks, CA.: Sage.
- Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches*. Thousand Oaks, CA: Sage Publications.
- Davis, A. M., Treadwell, D. (2019). *Introducing Communication Research: Paths of Inquiry*. United Kingdom: SAGE Publications.
- Flynn, J.Z., Foster, I.M. (2009). *Research Methods for the Fashion industry*. Fairchild books, Bloomsbury publishing.
- Indian National Science Academy (INSA) (2019). *Ethics in Science Education, Research and Governance*. ISBN:978-81-939482-1-7. <http://www.insaindia.res.in/pdf/EthicsBook.pdf>
- Jacobsen, K. H. (2020). *Introduction to health research methods: A practical guide*. Jones & Bartlett Publishers.
- UGC (2021) *Academic Integrity and Research Quality*. New Delhi: UGC, Retrieved from https://www.ugc.ac.in/e-book/Academic%20and%20Research%20Book_WEB.pdf

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.