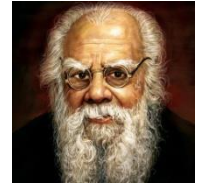




PERIYAR UNIVERSITY
Periyar Palkalai Nagar, Salem-636011
State University – NAAC Reaccredited A++ Grade – NIRF 63 – ARIIA 10



School of Professional Studies

DEPARTMENT OF FOOD SCIENCE AND NUTRITION

M.Sc.

FOOD SCIENCE, TECHNOLOGY AND NUTRITION

[Choice Based Credit System (CBCS) and Outcome Based Education (OBE)]



REGULATIONS AND SYLLABUS 8.0

[2005-06 (1.0); 2008-09 (2.0); 2012-13 (3.0); 2014-15 (4.0); 2016-17 (5.0); 2018-19 (6.0); 2022-23 (7.0)]

(Effective from the academic year 2023-2024 and thereafter)

IN 75 % COMPLIANCE WITH TANSCHÉ COMMON CURRICULUM STRUCTURE

M. Sc. FOOD SCIENCE TECHNOLOGY AND NUTRITION

OBE REGULATIONS AND SYLLABUS

(With effect from the academic year 2023-2024 onwards)

Preamble

The Department of Food Science and Nutrition was established in the year 2005 and fosters learning, imparts job specific skills, execute society oriented research and extension activities in the major thrust areas like Food Science and Chemistry, Food Processing and Technology, Public Health and Clinical Nutrition.

Vision

Inculcation of knowledge, productive learning, life and entrepreneurship skills and employability among the youth related to Food Science, Technology and Nutrition

Programme Objectives and Outcomes

To inculcate the importance in developing Food and Nutritional Science among the budding Food Scientists, Nutritionists and Food Processing Industrialists, the *M.Sc., Food Science Technology and Nutrition* programme is proposed with the following objectives and outcomes.

Programme Educational Objectives

- PEO1:** To engineer the students on theoretical and practical aspects of the entire food business and value chain management
- PEO2:** To promote interactions with food industries and other societal organizations/institutions for learning, problem analyzing/solving and innovation
- PEO3:** To gain insight into the national/global nutritional problems and its management
- PEO4:** To generate evidence based nutrition knowledge through research and disseminate to the agrarian and general community

Programme Specific Objectives

- PSO1:** To upskill the learners on technical knowledge, practical experience and field expertise for discipline specific career opportunities in institutions, organisations, industries, laboratories, corporates and government sectors
- PSO2:** To ascertain the learners on theories, models and approaches in innovative research for new product development, food safety management and quality assurance, nutrition intervention in the community and nutrition care process of the individual
- PSO3:** To enable the learners to equip themselves on food and nutripreneurship skills
- PSO4:** To update the learners on emerging trends in food science, technology and nutrition and equip themselves emotionally and intellectually stronger

Programme Outcomes

The learners can able to explore and attain the following theoretical (T), experiential (Practical) (E), professional (Transferable) (P) and attitudinal (A) skills

- PO(T):** Define and recognise the terms and concepts in food science and technology, food safety and quality control, public health nutrition and personalised nutrition
- PO(E):** Apply the principles and perform the food science and quality control tests, biochemical

tests, data analysis, food safety experiments, diet planning for healthy and diseased individual

PO(P):

1. Disseminate and fulfil the job requirements in teaching and learning institutions, food industries, food testing laboratories, nutrition intervention programmes, fitness centres, diet clinics and hospitals
2. Develop innovative food products, business plan, food quality assurance system, nutrition care process model for a community and individual cases.
3. Evaluate the food products in the market, hygiene, sanitation and quality control in food manufacturing and catering establishments, performance/implementation of government nutritional programmes/schemes and nutritional profile of the community and individual
4. Educate the population on nutritional conservation, food safety measures and initiatives, nutrition and health care, eat right initiatives and food as medicine
5. Operate and create an enterprise in the domain of food, nutrition and dietetics

PO(A): The learners can also able to acquire the graduate attributes of

- Leading the team
- Execution of work in team
- Globally competitive
- Emotionally intelligent to counsel the individuals
- Communicate effectively
- Digitally literate
- Sense of inquiry
- Job creator instead of only a job seeker
- Identify and innovate a solution to the problem
- Educate individual and community

Mapping of Programme Educational Objectives (PEOs) with Programme Outcomes (POs)

Programme Educational Objectives (PEOs)	Programme Outcomes (POs)							
	Theoretical	Experiential	Professional					Attitudinal
	PO(T)	PO(E)	PO(P1)	PO(P2)	PO(P3)	PO(P4)	PO(P5)	PO(A)
PEO1	X	X		X			X	X
PEO2		X	X	X	X	X		X
PEO3	X	X		X		X		X
PEO4		X	X	X	X	X	X	X

Mapping of Programme Specific Objectives (PSOs) with Programme Outcomes (POs)

Programme Specific Objectives (PSOs)	Programme Outcomes (POs)							
	Theoretical	Experiential	Professional					Attitudinal
	PO(T)	PO(E)	PO(P1)	PO(P2)	PO(P3)	PO(P4)	PO(P5)	PO(A)
PSO1	X	X	X		X	X		X
PSO2		X		X				X
PSO3		X		X	X		X	X
PSO4	X	X	X	X	X	X	X	X

Programme Pattern

This programme is offered under Choice Based Credit system (CBCS). Students can earn 94 credits with mandatory credit to MOOC/SWAYAM courses as supportive course. The programme is integrated with NSDC courses from FICSI Sector Skill Council under Core Courses. Elective courses as optional are framed in the two different field of specialization such as Food Technology and Nutrition and Health Care.

Candidate's Eligibility for Admission

B.Sc. Degree in Nutrition and Dietetics/Food Science and Nutrition/Food Technology, B.Tech./B.Sc. (H) in Food Technology, B.Voc. in Food Science and Nutrition related discipline and B.Sc./B.A. Home Science approved by the Association of Indian Universities are eligible to seek admission.

Duration of the Programme

Two years with four semesters.

Structure of the Programme and Scheme of Examinations

The programme structure comprises of two parts.

Course Component	No. of Courses	Marks	Credits
Part A (Credit Courses)			
Core Courses			
Theory and Practical Courses	17	1700	54
Project with Viva Voce	01	100	05
Elective Courses			
Generic Elective Courses	02	200	06
Discipline Specific Elective Courses (Optional)			
<i>Option 1: Food Technology</i>	04	400	12
<i>Option 2: Nutrition and Health Care</i>			
Non-Major Elective Courses (includes MOOC/SWAYAM Course)	02	200	04
Skill Enhancement Courses	04	400	07
Extension Activity	01	50	01
Internship / Industrial Activity	01	100	02
Self-Learning Courses (Human Rights)	01	50	01
Total	33	3200	92
Part B (Self-Learning Extra Credit Courses)			
Career oriented pre-job training courses	02	S/US	02
Total	02	S/US	02

Model Template for M.Sc. Programme (Food Science, Technology and Nutrition) 2023 – 2024											
This template complies the UGC guideline for Masters Programme and aligns with the State government - TANSICHE PG template											
Sem I	Credit	Hrs	Sem II	Credit	Hrs	Sem III	Credit	Hrs	Sem IV	Credit	Hrs
1.1. Core I (Theory) Food Science and Chemistry	5	5	2.1. Core IV (Theory) Food Microbiology and Preservation	4	4	3.1. Core VII (Theory) Nutritional Biochemistry	4	4	4.1. Core-XI (Theory) Clinical Nutrition I	4	4
1.2. Core II (Theory) Food Processing Technology	5	5	2.2. Core V (Theory) Food Safety and Quality Control	4	4	3.2. Core VIII Theory Nutrition in Life Cycle	4	4	4.2. Core-XII (Theory) Clinical Nutrition II	4	4
1.3. Core III (Practical) A. Food Science and Chemistry Practical	2	4	2.3. Core VI (Practical) A. Food Safety and Quality Control Practical	2	4	3.3. Core IX Practical A. Computer-Aided Diet Planning Practical	2	4	4.3. Core – XIII (Practical) A. Computer Aided Clinical Nutrition Practical	2	4
B. Data Management and Statistics Practical	2	4	B. Food Composition Analysis Practical	2	4	B. Biochemical Anaysis Practical	2	4	B. Food Innovation and Startup Practical	2	4
1.4. Elective (Discipline Centric) I Option A*: Technology of Non-Perishable Foods Option B*: Physiology of Nutrition	3	3	2.4. Elective (Discipline Centric) III Option A: Technology of Semi-Perishable and Perishable Foods Option B: Nutritional Medicine	3	3	3.4. Core X Industry Module** Holistic Newritrion	4	6	4.4. Project with Viva-Voce: Proof of Concept/Prototype/ Startup Plan for a nutrition related problem in multidisciplinary mode	5	6
1.5. Elective (Generic) II Research Methodology	3	3	2.5. Elective (Generic) IV Public Health Nutrition	3	3	3.5. Elective (Discipline Centric) V Option A: Food Testing and Certification Option B: Nutrition Care Process	3	3	4.5. Elective (Discipline Centric) – VI Option A: Foodpreneurship Option B: Nutripreneurship	3	3
1.6. Skill Enhancement Course SEC I Food Product Development and its Sensory	2	6	2.6. NME I: MOOC (SWAYAM/e-PG Pathshalla)	2	4	3.6. NME II: Food Safety Management/Nutrition for the Community Practical	2	3	4.6. Skill Enhancement Course - Professional Competency Skill SEC IV UGC NET/SET/TNPSC/UPSC Exam coaching	2	3

Quality Evaluation												
			2.7. Skill Enhancement Course SEC II : FSMS for a Food Product (NSDC and FSSAI Integration)	2	4							
			2.8 Human Rights (Self Learning)	1	-							
						3.7. Internship/ Industrial Activity 30 days internship in Food Establishments (Second semester holidays)	2	-			4.7. Extension Activity Nutrition/Diet Counselling to the individual/Food Safety Awareness	1 2
						3.8. Skill Enhancement Course – Term Paper and Seminar Presentation SEC III : Problem - Solution Fit: Systematic literature search and presentation of evidence based solution	1	2				
Total Credits / Semester	22	30		23	30		24	30			23	30

* Students can register for Option A courses or Option B courses in the Semester I and study all courses in that option during their programme of study. Option A courses are designed in the discipline of Food Technology and Option B courses are designed in the discipline of Nutrition Care

**Students can choose any one core industry based on their interest and teaching learning process is by Professor of Practice in that industry

Semester I

S.No.	Course Code	Course Title	TL Hours				C	Exam		
			Hrs/week	L	T	P		CIA	ESE	To
Core Courses (C)										
<i>Theory (T) and Practical (P) Courses</i>										
1.1	23FSTNCT01	Food Science and Chemistry	5	3	2	0	5	25	75	100
1.2	23FSTNCT02	Food Processing Technology	5	3	2	0	5	25	75	100
1.3 A	23FSTNCP01	Food Science and Chemistry Practical	4	-	1	3	2	40	60	100
1.3 B	23FSTNCP02	Data Management and Statistics Practical	4	-	1	3	2	40	60	100
Elective Courses (E) – Generic (GE) and Discipline Centric (DE)										
1.4 A	23FSTNDEA01	Technology of Non-perishable Foods	3	2	1	-	3	25	75	100
1.4 B	23FSTNDEB01	Physiology of Nutrition								
1.5	23FSTNGE01	Research Methodology	3	2	1	-	3	25	75	100
Skill Enhancement Courses (SEC I)										
1.6	23FSTNSEC01	Food Product Development and its Sensory Quality Evaluation	6	1 (L*)	1	4	2	40	60	100
		Total	30	11	09	10	22	220	480	700

Note:- L- Lecture, T-Tutorial/Demonstration, P- Practical, C- Credit; (L)* - Library, CIA – Continuous Internal Assessment, ESE – End Semester Examination, To – Total

Semester II

S.No.	Course Code	Course Title	TL Hours				C	Exam		
			Hrs/week	L	T	P		CIA	ESE	To

Core Courses (C)										
Theory (T) and Practical (P) Courses										
2.1	23FSTNCT03	Food Microbiology and Preservation	4	2	2	0	4	25	75	100
2.2	23FSTNCT04	Food Safety and Quality Control	4	2	2	0	4	25	75	100
2.3 A	23FSTNCP03	Food Safety and Quality Control Practical	4	-	1	3	2	40	60	100
2.3 B	23FSTNCP04	Food Composition Analysis Practical	4	-	1	3	2	40	60	100
Elective Courses (E) – Generic (GE), Discipline Centric (DE) and Non Major (NME)										
2.4 A	23FSTNDEA02	Technology of Semi-Perishable and Perishable Foods	3	2	1	-	3	25	75	100
2.4 B	23FSTNDEB02	Nutritional Medicine								
2.5	23FSTNGE02	Public Health Nutrition	3	2	1	-	3	25	75	100
2.6	23FSTNNME01	MOOC (SWAYAM/Food Tech Pathshala) / Pre-job Training	4	-	1	3	2	40	60	100
Skill Enhancement Courses (SEC II)										
2.7	23FSTNSEC02	FSMS for a Food Product (NSDC and FSSAI Integration)	4	-	1 (L*)	3	2	40	60	100
Value Education Course (VE)										
2.8	23FSTNVE01	Human Rights (Self Learning)	-	-	-	-	1	25	75	100
Total			30	08	10	12	23	285	615	900

Note:- L- Lecture, T-Tutorial/Demonstration, P- Practical, C- Credit; (L)* - Library, CIA – Continuous Internal Assessment, ESE – End Semester Examination, To – Total

Semester III

S.No.	Course Code	Course Title	TL Hours				C	Exam		
			Hrs/week	L	T	P		CIA	ESE	To
Core Courses (C)										
Theory (T), Practical (P) and Industry Module (I) Courses										
3.1	23FSTNCT05	Nutritional Biochemistry	4	2	2	0	4	25	75	100
3.2	23FSTNCT06	Nutrition in Life Cycle	4	2	2	0	4	25	75	100
3.3 A	23FSTNCP05	Computer Aided Diet Planning Practical	4	-	1	3	2	40	60	100
3.3 B	23FSTNCP06	Biochemical Analysis Practical	4	-	1	3	2	40	60	100
3.4	23FSTNCI01	Holistic Nutrition**	6	-	-	6	4	40	60	100
Elective Courses (E) – Discipline Centric (DE) and Non Major (NME)										
3.5 A	23FSTNDEA03	Food Testing and Certification	3	2	1	-	3	25	75	100
3.5 B	23FSTNDEB03	Nutrition Care Process								
3.6	23FSTNNME02	Food Safety Management/Nutrition for the Community Practical	4	-	1	3	2	40	60	100
Internship/Industrial Activity (IN)										
3.7	23FSTNIN01	30 days internship in food establishments (Second semester holidays)	-	-	-	-	2	40	60	100
Skill Enhancement Courses (SEC III)										
2.8	23FSTNSEC03	Term Paper and Seminar Presentation***	1	-	1 (L*)	-	1	20	30	50
Total			30	06	09	15	24	295	555	850

Note:- L- Lecture, T-Tutorial/Demonstration, P- Practical, C- Credit; (L)* - Library, CIA – Continuous Internal Assessment, ESE – End Semester Examination, To – Total, **Handled by Professor of Practice from Industries, *** Problem - Solution Fit: Systematic literature search and presentation of evidence based solution

Semester IV

S.No.	Course Code	Course Title	TL Hours				C	Exam		
			Hrs/week	L	T	P		CIA	ESE	To

Core Courses (C)										
Theory (T), Practical (P) and Industry Module (I) Courses										
4.1	23FSTNCT07	Clinical Nutrition I	4	2	2	0	4	25	75	100
4.2	23FSTNCT08	Clinical Nutrition II	4	2	2	0	4	25	75	100
4.3 A	23FSTNCP07	Computer Aided Clinical Nutrition Practical	4	-	1	3	2	40	60	100
4.3 B	23FSTNCP08	Food Innovation and Startup Practical	4	-	1	3	2	40	60	100
4.4	23FSTNCR01	Project with Viva Voce**	6	-	-	6	5	40	60	100
Elective Courses (E) – Discipline Centric (DE)										
4.5 A	23FSTNDEA03	Foodpreneurship	3	2	1	-	3	25	75	100
4.5 B	23FSTNDEB03	Nutripreneurship								
Skill Enhancement Courses (SEC IV)										
4.6	23FSTNSEC04	UGC NET/COMPETITIVE EXAM/SOFT SKILL coaching	3	1 (L*)	2	-	2	40	60	100
Extension Activity (EA)										
4.7	23FSTNEA03	Nutrition/Diet Counselling to the Individual/Food Safety Awareness***	2	-	-	2	1	20	30	50
Total			30	07	09	14	23	255	495	750

Note:- L- Lecture, T-Tutorial/Demonstration, P- Practical, C- Credit; (L)* - Library, CIA – Continuous Internal Assessment, ESE – End Semester Examination, To – Total, **Proof of Concept/Prototype/Startup Plan for a nutrition related problem in multidisciplinary mode, ***Inside the campus and in adopted village

Credit Calculation

Method of teaching	Hours	Credits
Lecture	1	1
Tutorial/Demonstration/Activities	1	1
Practical	2	1
Internship/Apprenticeship/ Field Visit/Extension Activity	3 - 6	1

Programme Guidelines

A. General

The students has to adopt the guidelines prescribed in the academic calendar of the University for the respective academic year and fulfil the minimum requisites to complete the programme.

B. Online Courses

The students are required to complete one mandatory course in the second semester by registering in the online education portal in the first semester itself (SWAYAM/e-skill/Foodtech Pathshala) as NME I. The completion certificate is recorded in the second semester marks statement. If they are not able to complete it in the first year, they are permitted to register for any other SWAYAM course/e-skill course in the third semester and can submit the completion certificate in the second year.

C. Internship/Industrial Activity Course (Self-Learning)

The students are required to undertake one internship course (second semester break) in a reputed food industry/establishment/hospital/health centre mandatorily for 30 days. On completion of the course, the students are required to submit the report. The departmental committee will assess the student's performance on the basis of attendance certificate from the

industry/establishment/hospital/health centre, training report and viva voce examination and will be awarded Satisfactory grade if the total score for internship is above 75%.

D. Add-on Courses (Extra Credit Courses)

The skill course taught in the first year is also assessed by the concerned Sector Skill Councils of NSDC or industrial partners by following the rules and regulations of NSDC and the separate certificate will be issued to the students certified by SSC of NSDC and the University as one Add-on Course and another Add-on course may be offered by Industries/Startups/Visiting Faculty Scheme based training.

E. Value Education Courses

The students are required to complete one mandatory course entitled 'Human Rights' in the second semester.

F. Co-Curricular Activities

a. Short –term Courses (e-Skill Courses)

The Department offers the following e-skill courses as value added course which can be learnt by the students and scholars from any discipline, industry personnel and common public through registration.

S.No.	Short term course Code	Title of the course	Duration (Hours)	L	T	P	C
1.	23FSTNST01	Food Safety Management System (ISO 22000)	42	6	12	24	1
2.	23FSTNST02	Menu Labelling	42	6	12	24	1
3.	23FSTNST03	Sports Nutrition	42	6	12	24	1

b. UGC – NET/TN - SET Coaching

The students have to undergo minimum 54 hours of learning in the semester IV to empower them to appear and succeed in the UGC – NET/TN - SET examination.

c. Bridge Course

The first year students are oriented on curriculum framework, SWOT analysis of the Department and him/herself, student welfare measures and the comprehensive contribution of the students for the growth and fame of the Department as bridge course on the starting three days of the programme.

G. Extra-Curricular Activities

a. Student Engagement Activities

The students are motivated to participate in the following activities of the University Departments or outside the University (minimum of 10 hours in a semester) and it is mandatory that the students have to submit two participation/winner certificate in any one of the activity every year to the Department.

- a. NSS/NCC/YRC camps and its competitions
- b. Inter-institutional/Inter-departmental competitions
- c. Personality Development programmes
- d. Student Seminar
- e. Placement training
- f. IAS coaching class
- g. Typewriting class
- h. Language coaching class
- i. Paper presentation in conferences/seminar/workshop etc.

All activities will be recorded as Food and Nutri Youth Club activities.

b. Remedial Coaching

In order to improve the knowledge, skills and linguistic proficiency of the students who need special attention, remedial coaching classes on

- a. Basic laboratory techniques
- b. Oral presentation skills
- c. Notes taking and exam preparation techniques

is conducted for one hour in a week. The hour will be mentioned in the time table to motivate the students to attend the remedial classes. The

c. Mentor-Mentee System

The students are facilitated by all faculty in the Department personally and professionally through peer mentor and mentee system under the umbrella of Food and Nutri Youth Club. All students will become the member of the Youth Club and can forecast the activities to build their graduate attributes. The cooperative learning groups are formed in compliance with UGC guidelines by electing peer mentor for each group comprising of 5 members will cooperatively learn on LSRW skills, computer skills, discipline specific software, learning platforms like foodtech pathshala, NPTEL, Coursera, e-Learning zone of FICSI etc. and e-magazines through google classroom.

d. Innovation/Incubation/Sponsored Projects/Consultancy

The students are motivated to participate in the following activities and it is mandatory that the students have to submit two participation/winner certificate in any one of the activity every year to the Department.

- a. Innovation contests
- b. Student projects
- c. Startup/Industry consultancy projects
- d. Pre-incubation/co-working activities at the incubation centre
- e. Innovation and Entrepreneurship courses
- f. Special trainings/internships on innovation and self-employment

H. Examinations

Examinations are conducted in semester pattern. The examination for the Semester I & III will be held in November/December and that for the Semester II and IV will be in the month of April/May. 75% attendance is mandatory to appear for the assessment of theoretical knowledge, practical experience, performing skills, field expertise and outreach activities.

Candidates failing in any subject (both theory, practical and skill) will be permitted to appear for such failed subjects in the same syllabus structure at subsequent examinations within next 5 years. Failing which, the candidate has to complete the course in the present existing syllabus structure.

I. Scheme for Evaluation and Attainment Rubrics

Evaluation will be done on a continuous basis and will be evaluated as per assessment matrices of OBE for Continuous Internal Assessment (CIA) and University End Semester Examination (ESE). CIA Evaluation may be by activities, assignments, seminars, e-learning material development, objective type questions, short answers, essays or a combination of these, and the end semester examination is by University norms with prescribed question paper pattern.

Attainment Criterion for Theory Courses (K1, K2, K3, K4, K5, K6)

CIA (Max. Marks - 25)

- Test documents in CO1, CO2, CO3, CO4 and CO5 - 10 Marks
- Presentation skill + e-material development (Student Seminar) – 05 Marks (Graduate attribute attainment assessment)
- Two activity/problem solving exercises (Assignment) (K3, K4, K5, K6) - 10 (Each 5 Marks)

ESE (Max. Marks - 75)

Question Paper Pattern (Theory) (Updated as per amendments by COE)

Section	Approaches	Mark Pattern	K Level	CO Coverage
A	One word (Answer all questions)	20X1 = 20 (Multiple Choice Questions)	K1, K2 (LO)	CO1 – 20%, CO2 – 20%, CO3 – 20%, CO4 – 20 % and CO5 – 20%
B	100 to 200 words (Answer any three out of five questions)	3X5 = 15 (Analytical type questions)	K4 (HO)	CO1 – 20%, CO2 – 20%, CO3 – 20%, CO4 – 20 % and CO5 – 20%
C	500 to 1000 words	5X8 = 40 (Essay type questions)	K3, K5, K6 (IO and HO)	CO1 – 20%, CO2 – 20%, CO3 – 20%, CO4 – 20 % and CO5 – 20%

Attainment Criterion for Practical Courses (K3, K4, K5, K6)

CIA (Max. Marks-40)

- Adopting Good Laboratory Practices - 05 Marks
- Standard Operating Procedure Creation - 10 Marks
- Performance evaluation of all mandatory experiments - 15 Marks
- Internal Tests (CO mapped) – 10 Marks

ESE (Max. Marks - 60)

External examination components are

- Knowledge on GLP and SOP – ten multiple choice questions (10 marks) (K1)
- Understanding on handling of chemicals, glasswares and equipments – ten multiple choice questions (10 marks) (K2)
- Conduct of experiment (10 marks) (K3)
- Precision of results (10 marks) (K4)
- Result analysis and interpretation (10 marks) (K5)

- Framing of SOP for experiment proposed for the candidate (10 marks) (K6)

Note: Student can perform one experiment for 3 hours of examination from the learned experiments.

Attainment Criterion for Skill Enhancement/ Innovative Learning Courses/ Research (HO-K4, K5 and K6)

CIA (Max. Marks - 40)

- First review - Problem Statement and Idea in Brief – 25% (10 marks)
- Second review - PoCs – 25% (10 marks)
- Third review - Prototype in Brief – 25 % (10 marks)
- Manuscript and Report on Idea/PoCs/Prototype Template of IIC – Yukti – 25 % (10 marks)

Research Review Committee Composition for CIA

1. Head of the Department
2. Research Colloquium Coordinator
3. Faculty Facilitators

ESE (Max. Marks – 60)

- Problem Statement - – 10 marks
- Idea in Brief – 10 marks
- PoCs/Prototype in Brief – 20 marks
- Value proposition of PoCs/Prototype – 10 marks
- Video content of PoCs/Prototypes – 10 marks

Evaluation Committee Composition for ESE

1. Start-up/Industry Representative – External Examiner
2. IIC Representative (Innovation Ambassador) – Internal Examiner

Attainment Criterion for Experiential Learning Courses/Field Visit and Internship (K4 and K5)

ESE (Max. Marks – 100) – graded as Satisfactory if secured 75%

Criterion	Weightage	Rubrics
Attendance (Internship Provider)	30%	Based on the total number of days allotted and total number of days present
Involvement in execution of proposed activity (Internship Provider)	30%	Based on the total number of activities proposed and executed
Submission of activity report on daily basis (Internship Provider)	20%	Based on quality of the daily report
Final evaluation through viva voce (Head of the Department and Internship Coordinator)	20%	Organogram – 5%, Governance – 5%, Workflow and Production Management – 5%, Case studies – 5%

J. Grading System

Evaluation of performance of students is based on ten-point scale grading system as given below.

Ten Point Scale			
Grade of Marks	Grade points	Letter Grade	Description

90-100	9.0-10.0	O	Outstanding
80-89	8.0-8.9	D+	Excellent
75-79	7.5-7.9	D	Distinction
70-74	7.0-7.4	A+	Very Good
60-69	6.0-6.9	A	Good
50-59	5.0-5.9	B	Average
00-49	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

K. Course Outcome and Programme Outcome Attainment Metrics for OBE at the Completion of the Programme

The impact of OBE is assessed by evaluating the satisfactory remark achieved by the learners with respect to Applied Knowledge and Skills, Interpersonal abilities and Personal Attributes. Course Outcome attainment is graphically presented for each semester based on CIA and ESE marks of each course along with knowledge level attainment.

S.No.	Criteria	Grades of Criteria		
		To great extent	To some extent	To a little extent
1.	Useful knowledge of facts			
2.	Good study habits			
3.	Cultural understanding			
4.	Tolerance			
5.	Job specific knowledge			
6.	Written communication skills			
7.	Oral communication skills			
8.	Analytical skills			
9.	Societal understanding			
10.	Numerical skills			
11.	Interpersonal skills			
12.	Innovation and Creativity			

The percentage of students reveal to each grade of criteria is summarized for assessing the impact of OBE.

Semester I Syllabus

Core I (Theory)

Course Name	1.1 Food Science and Chemistry	Programme Name	M.Sc. Food Science, Technology and Nutrition
Course Code	23FSTNCT01	Academic Year Introduced	2023 - 24
Type of Course	Theory	Semester	I

COURSE OUTCOMES

On completion of the course, the students will be able to	
CO1:	define the role of colloidal system in daily diet
CO2:	differentiate the role of cereals, millets, pulses in cookery and complementary food preparation
CO3:	identify and define the serving principles of sugar, fruits and vegetables in the daily diet
CO4:	differentiate the nature of protein in the egg, meat, poultry, fish and its changes during cooking
CO5:	appraise the types of milk, fats and oils, spices based products and non-alcoholic beverages in the market

Mapping of COs with POs, PSOs

COs / POs & PSOs	PO(T)	PO(E)	PO(P1)	PO(P2)	PO(P3)	PO(P4)	PO(P5)	PO(A)	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1	1	1	1	1	2	3	1	1	3
CO2	3	1	1	1	1	1	1	2	3	1	1	3
CO3	3	1	1	1	1	1	1	2	3	1	1	3
CO4	3	1	1	1	1	1	1	2	3	1	1	3
CO5	3	1	1	1	1	1	1	2	3	1	1	3

1 – Slight, 2 – Moderate, 3 – Substantial

COURSE OBJECTIVES AND HOURS OF INSTRUCTION

Unit/Module	Objectives	Hours of Instruction TL+Ac+As = T
Colloidal System	To provide learning on types and application of colloidal system	11+6+1=18
Cereals, Millets and Pulses	To impart knowledge on science and cooking principles of different cereals, millets and pulses and its complementary role	11+6+1=18
Sugars, Fruits and Vegetables	To illustrate the types, science in cooking of sugar, fruits and vegetables	11+6+1=18
Egg and Fleshy Foods	To elaborate the science and chemistry of fresh and cooked egg, meat, poultry and fish	11+6+1=18
Milk, Fats and Oils, Spices and Beverages	To inculcate the technical knowledge on the nature of milk protein, fats and oils, spices and non-alcoholic aromatic beverages	11+6+1=18
Total Hours of Instruction		90 (18x5)

TL-Teaching and Learning, Ac-Activities, As-Assessment, T-Total Hours

COURSE PLAN

Unit/Chapters	Intended Learning Chapters	CO(s) Mapped	Cognitive Level / KD	Psychomotor domain activities	Psychomotor domain level
UNIT 1: Colloidal System					
1.	Concept of food and nutrients, types of water in the food, structure and properties of water and ice	CO1	K1, F	List the 5 nutrient rich food for each nutrient	K4, S1
2.	Colloidal system in foods- Types & Properties	CO1	K1, F	Identify the type of colloidal system in our daily diet	K5, S1
3.	Sols - types and properties	CO1	K2, F	Demonstrate the nature of true solution with an example	K5, S1
4.	Gels-theory of gel formation and factors influencing gel formation	CO1	K2, F	Differentiate sol and gel	K5, S1
5.	Emulsion- types & nature, types of surface film & activity, common food emulsifiers, functions of emulsifying agents, emulsification capacity, factors affecting emulsion stability	CO1	K2, F	Identify the common emulsifying agents used in packed foods	K4, S1
6.	Foams- theory of foam formation, factors affecting foam formation, foaming capacity & stability	CO1	K2, F	List food foams available in the market	K5, S1
7.	Hydrocolloids	CO1	K2, C	Identify and list the thickeners & stabilizers in packed food	K5, S1
UNIT II: Cereals, Millets, Pulses, Nuts and Oil Seeds					
8.	Classification, nutritional composition,	CO2	K1, F	Prepare a scrap book of all the cereals, pulses,	K6, S3

Cognitive Process: K1 - Remembering K2 - Understanding K3 - Applying K4 - Analyzing K5 – Evaluating K6 - Creating
 Knowledge Dimension: F - Factual C - Conceptual P - Procedural MC - Meta Cognitive
 Psychomotor Domain: S1-Imitation S2-Manipulation S3-Precision S4-Articulation S5-Naturalization

	structure			nuts and oilseeds with nutritional information	
9.	Types of starch in cereals	CO2	K2, C	Tabulate the types of starch in cereals, pulses, millets, nuts and oilseeds	K3, S1
10.	Principles of starch cookery- gelatinization, gelation, retrogradation, syneresis & dextrinization	CO2	K2, P	Demonstrate the changes in rice flour on cooking and storage	K4, S2
11.	Starch uses in food systems	CO2	K1, C	List the food starches available in the market	K5, S4
12.	Toxic constituents in pulses	CO2	K2, F	Infograph the toxins present in the food	K5, S4
13.	Factors influencing cooking quality of pulses	CO2	K2, C	Identify the major factor affecting the cooking quality of any one pulse	K3, S1
14.	Complementary proteins	CO2	K2, C	Generate a list of food with complementary proteins	K6, S4
UNIT III: Sugars, Vegetable and Fruits					
15.	Sugars- sources, properties	CO3	K1, F	Tabulate the kinds of sugar as per its sources	K3, S3
16.	Stages of cookery, crystalline and non-crystalline candies	CO3	K2, C	Infer about the crystalline and non-crystalline candies in the market	K4, S3
17.	Sugar substitutes	CO3	K1, C	Interpret on each sugar substitute	K5, S4
18.	Vegetables and fruits- composition, classification	CO3	K1, C	Prepare a scrap book on fruits and vegetables in the local market	K6, S1
19.	Pigments, enzymes, tannins, pectin, acids & flavors	CO3	K2, C	Tabulate the presence of pigments, enzymes, tannins, pectin, acids and flavours in any one fruit and a vegetable	K3, S1
20.	Changes during the cooking, effect of cooking on pigments	CO3	K2, C	Demonstrate the effect of cooking on pigments any one fruit and a vegetable	K3, S1
21.	Enzymatic browning reaction in fruits and vegetables	CO3	K1, F	Catalogue the bioactive compounds responsible for enzymatic browning in any one fruit and a vegetable	K4, S1
22.	Ripening of fruits	CO3	K1, F	Criticize on different ripening agents used by a fruit industry	K4, S4
UNIT IV: Egg, Poultry, Meat and Fish					
23.	Egg - structure, composition	CO4	K1, F	Pictograph the different types of egg in the market	K3, S1
24.	Coagulation of egg protein, Factors effecting coagulation of egg protein, egg quality	CO4	K2, P	Experiment the fresh and coagulated egg quality using any one method	K4, S1
25.	Meat- structure, composition	CO4	K1, F	Tabulate the type of protein present in different meat	K3, S1
26.	Postmortem changes, tenderness of meat, changes during cooking	CO4	K2, P	Sketch on the tenderizers in meat preparation	K4, S1
27.	Poultry & fish- classification, composition, structure	CO4	K1, F	Picturize the poultry and fish varieties	K3, S1
UNIT V: Milk, Fat and Oils, Coffee, Tea and Cocoa beans					
28.	Milk- types, composition and physical and chemical properties	CO5	K1, F	Categorize different types of milk according to their nutritional content and source	K4, S2
29.	Effect of heat, acids & enzymes on milk component, non-enzymatic browning reaction	CO5	K2, C	Experiment on effect of various agents on milk component	K3, S1
30.	Milk substitutes	CO5	K2, C	Criticize on the commercial milk substitutes and its nutritional claims	K5, S3
31.	Fats and oils - sources, properties	CO5	K1, F	Differentiate fat and oil with examples	K3, S2
32.	Effects of heating on fat	CO5	K2, C	Flip chart the changes in fatty acids on continuous cooking of oil	K4, S4
33.	Rancidity & its prevention	CO5	K2, C	Collect the evidence based practice to prevent the rancidity of an oil	K5, S1
34.	Spices and condiments - types, uses & abuses	CO5	K1, F	Interpret the therapeutic role of any one spice or condiment	K5, S3
35.	Coffee, tea & cocoa beans- types and composition	CO5	K1, F	Compare the different brands of coffee, tea and cocoa beans in the market	K5, S2

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Cognitive Process: K1 - Remembering K2 - Understanding K3 - Applying K4 - Analyzing K5 – Evaluating K6 - Creating
Knowledge Dimension: F - Factual C - Conceptual P - Procedural MC - Meta Cognitive
Psychomotor Domain: S1-Imitation S2-Manipulation S3-Precision S4-Articulation S5-Naturalization

5	SunetraRoday (2012), Food Science and Nutrition, Second Edition, Oxford University Press, India.
JOURNALS AND DOCUMENTS	
1	Journal of Food Science and Technology, AFSTI Publication
2	Annals. Food Science and Technology, Valahia University Press
3	Food Science and Human Wellness, Beijing Academy of Food Sciences
4	Journal of Food, Agriculture and Environment, WFL Publisher Ltd.
5	Natural Products and Bioprospecting, Springer
6	Indian Journal of Dairy Science, Indian Dairy Association

Core II (Theory)

Course Name	1.2 Food Processing Technology	Programme Name	M.Sc. Food Science, Technology and Nutrition
Course Code	23FSTNCT02	Academic Year Introduced	2023 - 24
Type of Course	Theory	Semester	I

COURSE OUTCOMES

On completion of the course, the students will be able to	
CO1:	Adapt suitable techniques/methods for processing of cereals, millets and pulses/legumes and product development
CO2:	Infer the technical aspects of milk and egg processing and production of milk and egg products
CO3:	Select appropriate techniques for processing of fleshy foods and oil seeds and its product development
CO4:	Define suitable processing and preservation methods for fruits and vegetables and plantation products
CO5:	Define the appropriate technique for manufacturing of sugar, starch isolate, modified starch and spices

Mapping of COs with POs, PSOs

COs / POs & PSOs	PO(T)	PO(E)	PO(P1)	PO(P2)	PO(P3)	PO(P4)	PO(P5)	PO(A)	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	1	3	-	2	3	3	1	1	1
CO2	2	3	3	3	3	1	2	3	3	3	3	2
CO3	2	3	3	3	3	1	2	3	3	3	3	2
CO4	2	3	3	3	3	1	2	3	3	3	3	2
CO5	3	2	2	3	3	-	1	3	3	1	2	2

1 – Slight, 2 – Moderate, 3 – Substantial

COURSE OBJECTIVES AND HOURS OF INSTRUCTION

Unit/Module	Objectives	Hours of Instruction TL+Ac+As = T
Cereals, Millets and Pulses/legumes	To interpret the various steps and techniques involved in milling and processing of cereals, millets and pulses/legumes	11+6+1=18
Milk and Egg	To familiarize with different technologies applied in manufacturing of egg and dairy products	11+6+1=18
Fleshy Foods and Oilseeds	To illustrate the concepts involved in the processing of fleshy foods and oil seeds	11+6+1=18
Fruits, Vegetables and Plantation Products	To learn and adapt the various processing and preservation techniques of fruits and vegetables as well as processing of plantation products such as coffee, tea leaves and cocoa beans	11+6+1=18
Sugar, Starch and Spices	To impart the knowledge of raw sugar manufacturing, isolation and modification of starch and processing of spices	11+6+1=18
Total Hours of Instruction		90 (18x5)

TL-Teaching and Learning, Ac-Activities, As-Assessment, T-Total Hours

COURSE PLAN

Unit/Chapters	Intended Learning Chapters	CO(s) Mapped	Cognitive Level / KD	Psychomotor domain activities	Psychomotor domain level
UNIT I: Cereals, Millets and Pulses/legumes					
36.	Cereal Processing: Rice - preprocessing, parboiling, milling, by products of rice milling	CO1	K2, P	Visit to a modern and traditional rice milling unit, evaluate the process and report it	K5, S2
37.	Wheat- preprocessing, milling, by products of wheat milling; malting of cereals	CO1	K2, P	Picturize the byproducts of wheat milling in the local market	K3, S3
38.	Manufacture of breakfast cereals, extruded products, puffed and flaked cereals	CO1	K2, P	Video capture the manufacturing of puffed or flaked cereal	K3, S3
39.	Processing of millets - cleaning, decortication, milling and fractions	CO1	K2, P	Explore the different types of millets of Indian origin	K4, S5
40.	Pulse/legume processing- cleaning, decortication, splitting, grading, milling and germination	CO1	K2, P	Schematize the ways to enrich the nutrients in pulses/legumes and ways to reduce the anti-nutritional factors at home level and industrial level	K5, S2
UNIT -II: Milk and Egg					
41.	Milk Processing – preprocessing, separation, standardization, pasteurization, homogenization, sterilization, evaporation, drying, condensation, membrane fractionation	CO2	K2, P	Sketch the processing protocol in milk collection centre and milk processing industry	K4, S1
42.	Milk products-butter, ghee, cream, paneer, yoghurt and cheese	CO2	K2, P	Identify the most familiar brand of each milk product and compare with other brands	K5, S2

Cognitive Process: K1 - Remembering K2 - Understanding K3 - Applying K4 - Analyzing K5 – Evaluating K6 - Creating
Knowledge Dimension: F - Factual C - Conceptual P - Procedural MC - Meta Cognitive

Psychomotor Domain: S1-Imitation S2-Manipulation S3-Precision S4-Articulation S5-Naturalization

43.	Egg processing – preservation of egg by different methods, egg powder processing – spray drying and foam mat drying	CO2	K2, P	Extrapolate the GMP for the manufacture of egg powder	K3, S1
UNIT - III: Fleshy Foods and Oilseeds					
44.	Meat – preprocessing, canning, dehydro freezing, drying, processed meat products – hamburgers, sausages and meat balls	CO3	K2, P	Collect the photographs of the processed meat products in the market	K4, S1
45.	Poultry - chemical treatments, microwave heating, IR heating, freeze drying and irradiation	CO3	K2, P	Identify the best video lesson on processing of poultry	K4, S1
46.	Fish - chilling, freezing, canning, smoking, salting and fish oil extraction	CO3	K2, P	Identify the best video lesson on fish oil capsule preparation	K4, S1
47.	Fats and Oils - Oil Seeds Processing– preprocessing, milling, extraction of oil and it's processing, production of meal concentrates and isolates	CO3	K2, P	Display different types of oils and define its characteristics	K5, S1
48.	Specialty fats from non-traditional oilseeds, modification of fat, fat substitutes and replacers and fat mimetics	CO3	K1, C	Identify the fat mimetics, replacers and other non-conventional fat sources in the market	K4, S1
UNIT – IV: Fruits, Vegetables and Plantation Products					
49.	Fruits and vegetables processing– preprocessing, drying and dehydration, juice extraction, concentrate preparation, minimal processing and hurdle technology, meat analogues and textured vegetable protein	CO4	K2, P	Exhibit the processed products of fruits and vegetables	K3, S2
50.	Production of mushroom and its processed products	CO4	K2, P	Visit and report on mushroom production unit	K5, S4
51.	Plantation products processing- processing of coffee, tea leaves and cocoa beans	CO4	K2, P	Document on coffee, tea and cocoa based beverages with preparation	K6, S4
UNIT V: Sugar, Starch and Spices					
52.	Sugar – manufacturing of sugar from sugarcane and palm, sugar cubes and powdered sugar	CO5	K2, P	Prepare a scrapbook on natural sweeteners	K5, S4
53.	Starch – starch isolation, modification of starch	CO5	K2, C	Develop an SOP on isolation of starch	K6, S2
54.	Manufacturing of food Hydrocolloids – CMC and gaur gum	CO5	K1, C	Exemplify the industrial application of hydrocolloids	K5, S1
55.	Spices technology – decortication, splitting, extraction of essential oils and colors and masala products	CO5	K2, P	Design a pamphlet describing the health benefits of spices	K6, S3

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JOURNALS AND DOCUMENTS	
1	Annual review of Food science and technology, Annual review Inc.
2	Innovative Food Science and Emerging Technologies, Elsevier
3	Journal of Food Science and Technology, Springer Nature
4	Journal of Food Process Engineering, Blackwell Publishing Inc.

Cognitive Process: K1 - Remembering K2 - Understanding K3 - Applying K4 - Analyzing K5 – Evaluating K6 - Creating
Knowledge Dimension: F - Factual C - Conceptual P - Procedural MC - Meta Cognitive
Psychomotor Domain: S1-Imitation S2-Manipulation S3-Precision S4-Articulation S5-Naturalization

Core III (Practical)

Course Name	1.3 Food Science and Chemistry Practical	Programme Name	M.Sc. Food Science, Technology and Nutrition
Course Code	23FSTNCP01	Academic Year Introduced	2023 - 24
Type of Course	Practical	Semester	I

COURSE OUTCOMES

On completion of the course, the students will be able to												
CO1	Determine the colloidal nature of food items											
CO2	Justify the reason for changes in chemical and structural nature of carbohydrate, protein and fat rich food											
CO3	Define the chemical nature and justify the best conservation process for fruits and vegetables											
Mapping of COs with POs, PSOs												
COs / POs & PSOs	PO(T)	PO(E)	PO(P1)	PO(P2)	PO(P3)	PO(P4)	PO(P5)	PO(A)	PSO1	PSO2	PSO3	PSO4
CO1	1	3	3	2	3	1	3	3	3	2	3	3
CO2	1	3	3	3	3	1	3	3	3	2	3	3
CO3	1	3	3	3	3	1	3	3	3	2	3	3
1 – Slight, 2 – Moderate, 3 – Substantial												

COURSE OBJECTIVES AND HOURS OF INSTRUCTION

Unit/Module	Objectives	Hours of Instruction TL+Ac+As = T
Colloidal Properties	To understand colloidal nature of different food items	4+9+3 = 16
Carbohydrates	To gain knowledge on microscopic structure, gelatinization, retrogradation and pasting properties of flour/starches	2+6+8* = 16
Protein	To study the nature of protein in cereals, milk and meat; effect of tenderizers on meat protein	3+9+0 = 12
Fat	To apprehend the smoking point, iodine number and saponification number of various used and unused oils	3+6+3 = 12
Fiber	To perceive the content of soluble fiber (pectin) in different fruits	1+3+0 = 4
Food Pigments	To realize the effect of preprocessing and cooking on loss of pigments in fruits and vegetables and its conservation	1+3+0 = 4
Phytochemicals and Enzymes	To seize the enzymes responsible for browning of fruits and vegetables	2+3+3 = 8
Total Hours of Instruction		72 (18x4)

TL-Teaching and Learning, Ac-Activities, As-Assessment, T-Total Hours

COURSE PLAN

Module No.	Intended Learning Chapters	CO(s) Mapped	Cognitive Level / KD	Psychomotor domain activities	Psychomotor domain level
Module I: Colloidal Properties					
1.	Least gelation concentration of flour (*Workshop Certificate is mandatory)	CO1	K2, P	Compare the least gelation concentration of any two flour Demonstrate the viscosity of different gels using Brookfield Viscometer*	K5, S4
2.	Emulsification capacity of a natural emulsifier	CO1	K2, P	Define the concentration of a natural emulsifier to be added to food preparations	K4, S3
3.	Foaming capacity and foaming stability of egg white foam	CO1	K2, P	Measure the foaming capacity and stability of the different variant egg white	K4, S3
Module II: Carbohydrates					
4.	Microscopic examination of flour / starches	CO2	K2, P	Compare the microscopic structure of different starches	K5, S1
5.	Gelatinization and retrogradation properties of cereal / pulse flour (*Workshop Certificate is mandatory)	CO2	K2, P	Determine and compare the gelatinization and retrogradation properties of the cereal and pulse flour	K5, S1
				Demonstrate the gelatinization and retrogradation properties of the given sample using DSC*	K3, S1
6	Pasting properties of cereal / pulse flour (*Workshop Certificate is mandatory)	CO2	K2, P	Demonstrate and interpret the pasting properties of the flour using RVA*	K3, S1
Module III: Protein					
7.	Gluten content in wheat flour	CO2	K2, P	Examine the variation in wet and dry gluten content in the different wheat flour variant	K5, S3
8.	Relative density and casein content in milk	CO2	K2, P	Justify the variation in relative density and	K5, S3

Cognitive Process: K1 - Remembering K2 - Understanding K3 - Applying K4 - Analyzing K5 - Evaluating K6 - Creating
 Knowledge Dimension: F - Factual C - Conceptual P - Procedural MC - Meta Cognitive
 Psychomotor Domain: S1-Imitation S2-Manipulation S3-Precision S4-Articulation S5-Naturalization

				casein content of milk before and after cooking	
9.	Effect of tenderization of meat	CO2	K2, P	Identify the best tenderizer for meat	K5, S3
Module IV: Fat					
10.	Smoking point of oil	CO2	K2, P	Justify the reason for changes in smoking point of different oil and used oils	K5, S4
11.	Iodine number of oil	CO2	K2, P	Compare the iodine number of different oil and used oils	K5, S4
12.	Saponification number of oil	CO2	K2, P	Compare the saponification number of different oil and used oils	K5, S4
Module VI: Fiber					
13.	Pectin content in fruits	CO3	K2, P	Test and Identify the fruits rich in pectin content	K6, S3
Module VII: Food Pigments					
14.	Effect of preprocessing and cooking on pigments in fruits and vegetables	CO3	K2, P	Identify the best method of preprocessing and cooking to preserve pigments in fruits and vegetables	K6, S4
Module VIII: Phytochemicals and Enzymes					
15.	Enzymatic browning reaction in fruits and vegetables	CO3	K2, P	Identify the best method to prevent browning in selected fruits and vegetables	K6, S3

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JOURNALS AND DOCUMENTS	
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2	Food Chemistry, Function and Analysis, Royal Society of Chemistry
3	Food Analytical Methods, Springer Nature

Core III (Practical)

Course Name	1.3 Data Management and Statistics Practical	Programme Name	M.Sc. Food Science, Technology and Nutrition
Course Code	23FSTNCP02	Academic Year Introduced	2023 - 24
Type of Course	Practical	Semester	I

COURSE OUTCOMES

On completion of the course, the students will be able to												
CO1	Manage the processing of collected data											
CO2	Analyze the coded data statistically and interpret the results											
CO3	Define the statistical quality control measures to be followed in food industries											
Mapping of COs with POs, PSOs												
COs / POs & PSOs	PO(T)	PO(E)	PO(P1)	PO(P2)	PO(P3)	PO(P4)	PO(P5)	PO(A)	PSO1	PSO2	PSO3	PSO4
CO1	1	3	3	2	3	1	3	3	3	2	3	3
CO2	1	3	3	3	3	1	3	3	3	2	3	3
CO3	1	3	3	3	3	1	3	3	3	2	3	3
1 – Slight, 2 – Moderate, 3 – Substantial												

COURSE OBJECTIVES AND HOURS OF INSTRUCTION

Unit/Module	Objectives	Hours of Instruction TL+Ac+As = T
Processing of data	To understand and apply the guidelines to edit, code, tabulate and organize the collected data	5+12+3 = 20
Descriptive Statistics	To perceive and practice the application of descriptive statistics in analyzing the data	1+3+0 = 4
Sampling distribution	To study the nature of distribution of collected data and testing of hypothesis	5+15+0 = 20
Correlation and Regression	To apprehend the role of correlation and regression in predicting the nature of collected data	1+3+0 = 4
Statistical Quality Control	To realize the need for statistical quality control in food processing industries/food service operations	6+15+3 = 24
Total Hours of Instruction		72 (18x4)

TL-Teaching and Learning, Ac-Activities, As-Assessment, T-Total Hours

COURSE PLAN

Module /Experiment No.	Intended learning Chapters	CO(s) Mapped	Cognitive Level / KD	Psychomotor domain activities	Psychomotor domain level
Module I: Processing of Data					
1.	Types and kinds of data, manual calculations, use of formulas and function wizard in calculations	CO1	K2, P	Create the nutrition datasheet indicating different types and kinds of data	K6, S4
				Exhibit the application of manual calculation, formulas (Sum) and function wizard (If) in Microsoft Excel with suitable examples relevant to discipline	K3, S3
2.	Protecting the data, creating tables and charts	CO1	K2, P	Create different types of tables and charts using edited and coded data	K5, S3
3.	Creating pivot tables	CO1	K2, P	Create a pivot table for a nutrient database	K5, S3
4.	Use of commands like macro, database, goal seek	CO1	K2, P	Calculate nutrient content of a product using commands like macro, database and goal seek menu	K4, S3
Module II: Descriptive Statistics					
5.	Measures of Central Tendency	CO2	K2, P	Calculate and interpret the results on mean, median and mode using Excel/SPSS	K5, S1
6.	Measures of Dispersion	CO2	K2, P	Calculate and interpret the results on mean deviation and standard deviation using Excel/SPSS	K5, S1
Module III: Sampling Distribution					
7.	Standard Error	CO2	K2, P	Calculate the standard error for the given data and interpret the results based on framed hypothesis using Excel/SPSS	K5, S3
8.	't' distribution	CO2	K2, P	Exhibit the application of suitable t test to test the framed hypothesis using Excel/SPSS	K5, S3
9.	Chi-square distribution	CO2	K2, P	Apply chi-square test and interpret the results on tested hypothesis using Excel/SPSS	K5, S3
10.	F- distribution	CO2	K2, P	Exhibit the application of suitable ANOVA test to test the framed hypothesis using Excel/SPSS	K5, S3

Cognitive Process: K1 - Remembering K2 - Understanding K3 - Applying K4 - Analyzing K5 - Evaluating K6 - Creating
 Knowledge Dimension: F - Factual C - Conceptual P - Procedural MC - Meta Cognitive
 Psychomotor Domain: S1-Imitation S2-Manipulation S3-Precision S4-Articulation S5-Naturalization

Module IV: Correlation and Regression					
11.	Types of correlation and its application	CO2	K2, P	Define the nature of correlation exist in the given data using Excel/SPSS	K4, S4
12.	Types of regression and its application	CO2	K2, P	Predict the value using regression equation of X on Y or Y on X	K5, S4
Module V: Statistical Quality Control (3 Day Workshop by Inviting Experts Certificate is mandatory)					
13.	Forecasting models	CO3	K2, P	Demand/Sales forecasting of a product in a food industry and a restaurant	K6, S3
14.	Time series analysis	CO3	K2, P	Time series analysis for supply chain planning in Restaurants/Canteens	K4, S4
15.	Automation	CO3	K2, P	Visit a food industry/restaurant which is automated for production process and report on it	K4, S4
16.	Sampling plan	CO3	K2, P	Apply the suitable sampling plan to select the sample for testing the quality of raw material, intermittent products and finished products in a food industry/restaurant/canteen	K3, S3

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4	https://www.7shifts.com/blog/restaurant-forecasting-guide/
5	https://ieeexplore.ieee.org/document/9276872
JOURNALS AND DOCUMENTS	
1	Journal of Data, Information and Management, Springer
2	Statistics and Computing, Springer

Elective (Discipline Centric) I : Option A - Food Technology

COURSE 1 (23FSTNDEA01): Technology of Non Perishable Foods (Semester I)

COURSE 2 (23FSTNDEA02): Technology of Semi Perishable and Perishable Foods (Semester II)

COURSE 3 (23FSTNDEA03): Food Testing and Certification (Semester III)

COURSE 4 (23FSTNDEA04): Foodpreneurship (Semester IV)

Technology of Non Perishable Foods

Course Name	1.4 Technology of Non Perishable Foods	Programme Name	M.Sc. Food Science, Technology and Nutrition
Course Code	23FSTNDEA01	Academic Year Introduced	2023 - 2024
Type of Course	Theory	Semester	I

COURSE OUTCOMES

On completion of the course, the students will be able to												
CO1:	Define and determine the properties of non-perishable foods											
CO2:	Value add the non-perishable foods by applying the suitable primary processing techniques											
CO3:	Value add the non-perishable foods by applying the suitable secondary and tertiary processing techniques											
CO4:	Prescribe, design and develop packaging and labelling as per FSSAI and suggest suitable storage conditions											
CO5:	Provide consultancy on plant layout, production flow, instrumentation and process control and market strategy for a food product											
Mapping of COs with POs, PSOs												
COs / POs & PSOs	PO(T)	PO(E)	PO(P1)	PO(P2)	PO(P3)	PO(P4)	PO(P5)	PO(A)	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1	3	3	1	3	2	3	1	1	1
CO2	3	1	1	3	3	1	3	2	3	1	1	1
CO3	3	1	1	3	3	1	3	2	3	1	1	1
CO4	3	1	1	3	3	1	3	2	3	1	1	1
CO5	3	1	1	3	3	1	3	2	3	1	1	1
1 – Slight, 2 – Moderate, 3 – Substantial												

COURSE OBJECTIVES AND HOURS OF INSTRUCTION

Unit/Module	Objectives	Hours of Instruction TL + Ac + As = To
Properties of non-perishable foods	To understand the physical, chemical and functional properties of non-perishable foods	6+3+1=10
Primary processing of non-perishable foods	To familiarize with different types of primary processing techniques, instrumentation and process control of non-perishable foods	8+3+1=12
Secondary and tertiary processing of non-perishable foods	To learn the secondary and tertiary processing techniques, instrumentation and process control on production of value added non-perishable food products	8+3+1=12
Packaging, labelling and storage of non-perishable foods	To gain knowledge and skills to prescribe packaging, labelling and storage technique of processed non-perishable foods	6+3+1=10
Production and Market Plan	To acquire professional knowledge about plant layout, production unit, logistic mechanism, market feasibility, viability and desirability of a food product from non-perishable foods	6+3+1=10
Total Hours of Instruction		54 (18x3)

TL-Teaching Learning, Ac-Activities, As-Assessment, T-Total Hours

COURSE PLAN

Unit/Chapters	Intended Learning Chapters	CO(s) Mapped	Cognitive Level/KD	Psychomotor domain activities	Psychomotor domain level
UNIT I: Processing of					
56.	Introduction to non-perishable foods – cereals, millets, pulses, nuts, oilseeds, spices and condiments	CO1	K1, F	Exhibit the non-perishable foods	K3, S3
57.	List physical and structural properties for each food and specify the method of determination	CO1	K2, C	Infograph on physical and structural properties of any one non-perishable food	K3, S3
58.	List chemical properties for each food and specify the method of determination	CO1	K2, C	Tabulate the rich source of chemical component of any one non-perishable food	K4, S3
59.	List mechanical and thermal	CO1	K2, C	Pitch on any one mechanical or thermal property of	K5, S4

Cognitive Process : K1 - Remembering K2 - Understanding K3 - Applying K4 - Analyzing K5 – Evaluating K6 - Creating

Knowledge Dimension : F - Factual C - Conceptual P - Procedural MC - Meta Cognitive

Psychomotor Domain : S1-Imitation S2-Manipulation S3-Precision S4-Articulation S5-Naturalization

	properties for each food and specify the method of determination			a food	
60.	List rheological properties for each food and specify the method of determination	CO1	K2, C	Collect the video on determination of rheological properties of any one non-perishable food	K4, S1
UNIT II: Primary Processing of Non-Perishable Foods					
61.	Instrumentation and process flow on post-harvest handling, cleaning and grading of raw materials	CO2	K2, F	Document the post-harvest farm practices of any one non-perishable food	K3, S1
62.	Instrumentation and process flow for preconditioning, decortication/dehulling of raw materials	CO2	K2, F	Videograph the preconditioning and Dehulling process of any one non-perishable food	K6, S1
63.	Instrumentation and process flow for size reduction/grinding and milling/oil expulsion of raw materials	CO2	K2, F	Videograph the milling/oil expulsion process of any one non-perishable food	K6, S1
64.	By-products management on milling/oil expulsion	CO2	K2, C	Mind map the handling of by-products on milling/oil expulsion of any one non-perishable food	K4, S1
65.	Industrial waste management from primary processing	CO2	K2, C	Pictograph the waste management from any one primary processing industry	K6, S1
UNIT III: Secondary and Tertiary Processing of Non-Perishable Foods					
66.	Manufacturing process, instrumentation and process control of fermented, germinated, baked, puffed, flaked, canned, fried, hydrogenated and extruded products from non-perishable foods	CO3	K2, C	Videograph the manufacturing process of any one secondary products	K6, S1
67.	Manufacturing process, instrumentation and process control of fortified foods, protein concentrates and isolates, coated, colored and flavored products, composite and blended products, analogues and mimetics from non-perishable foods	CO3	K2, C	Videograph the manufacturing process of any one tertiary products	K6, S1
UNIT IV: Packaging, Labelling and Storage of Non-Perishable Foods					
68.	Packaging, labelling and storage of primary products from non-perishable foods	CO4	K1, F	Pictograph the storage mechanism of any one primary product	K4, S3
				Analyse and report the compliance of package and labelling of any one primary product	K4, S3
69.	Packaging, labelling and storage of secondary products from non-perishable foods	CO4	K1, F	Pictograph the storage mechanism of any one secondary product	K4, S3
				Analyse and report the compliance of package and labelling of any one secondary product	K4, S3
70.	Packaging, labelling and storage of tertiary products from non-perishable foods	CO4	K1, F	Pictograph the storage mechanism of any one tertiary product	K4, S3
				Analyse and report the compliance of package and labelling of any one tertiary product	K4, S3
UNIT V: Production and Market Plan					
71.	Model plant layout and production area for any one primary, secondary and tertiary products from non-perishable foods	CO5	K1, C	Infograph the plant layout and production area of any one product from non-perishable foods	K4, S1
72.	Logistic mechanism of primary, secondary and tertiary products from non-perishable foods	CO5	K1, C	Mind map the logistic mechanism followed to distribute products locally, national and international wide	K4, S1
73.	Market segments of primary, secondary and tertiary products from non-perishable foods	CO5	K2, C	Evaluate and report the primary, secondary and tertiary products available in domestic/retail/digital market	K5, S1

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2	Fellows P.J., (2009), Food processing Technology: Principles and Practice, 3 rd Edition, Woodhead Publishing Ltd., New Delhi.
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Cognitive Process : K1 - Remembering K2 - Understanding K3 - Applying K4 - Analyzing K5 - Evaluating K6 - Creating
Knowledge Dimension : F - Factual C - Conceptual P - Procedural MC - Meta Cognitive
Psychomotor Domain : S1-Imitation S2-Manipulation S3-Precision S4-Articulation S5-Naturalization

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1	Rao M.A., Syed S.H. Rizvi, Ashim K.Datta and Jasim Ahmed, (2014), Engineering Properties of Foods, 4 th Edition, CRC Press, New York.
2	Sahay K.M. and Singh K.K., (2012), Unit Operations of Agricultural Processing, 2 nd Edition, Vikas Publishing House Pvt. Ltd., New Delhi.
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6	Han J.H, (2014), Innovations in Food Packaging, Second Edition, Academic Press, UK.
7	Reading Material on Supply Chain Management in Agriculture, National Institute of Agricultural Extension Management, www.manage.gov.in.
JOURNALS AND DOCUMENTS	
1	Journal of Food Science and Technology, AFSTI Publication
2	Annals. Food Science and Technology, Valahia University Press
3	Food Science and Human Wellness, Beijing Academy of Food Sciences
4	Journal of Food, Agriculture and Environment, WFL Publisher Ltd.
5	Natural Products and Bioprospecting, Springer.

Elective (Discipline Centric) I : Option B - Nutrition and Health Care

COURSE 1 (23FSTNDEB01): Physiology of Nutrition (Semester I)

COURSE 2 (23FSTNDEB02): Nutritional Medicine (Semester II)

COURSE 3 (23FSTNDEB03): Nutrition Care Process (Semester III)

COURSE 4 (23FSTNDEB04): Nutripreneurship (Semester IV)

COURSE 1 (23FSTNEB01): Physiology of Nutrition

Course Name	1.4 Physiology of Nutrition	Programme Name	M.Sc. Food Science, Technology and Nutrition
Course Code	23FSTNDEB01	Academic Year Introduced	2023 - 2024
Type of Course	Theory	Semester	1

COURSE OUTCOMES

On completion of the course, the students will be able to												
CO1:	Integrate homeostasis of the body with nutrient assimilation and utilization											
CO2:	Inculcate the role of cells in nutrient metabolism and defense mechanism of the human body											
CO3:	Apply the knowledge on respiration, neuromuscular interaction and neurotransmitters on health and wellbeing of the individual											
CO4:	Manage the body fitness and disease conditions by applying the knowledge on cardiovascular, gastrointestinal and excretory system											
CO5:	Define the role of senses in food and nutrient intake, hormones in nutrient metabolism and puberty											
Mapping of COs with POs, PSOs												
COs / POs & PSOs	PO(T)	PO(E)	PO(P1)	PO(P2)	PO(P3)	PO(P4)	PO(P5)	PO(A)	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	1	1	2	3	1	1	1	3	3
CO2	2	1	1	1	1	2	3	1	1	1	3	3
CO3	2	1	1	1	1	2	3	1	1	1	3	3
CO4	2	1	1	1	1	2	3	1	1	1	3	3
CO5	2	1	1	1	2	2	3	1	1	1	3	3
1 – Slight, 2 – Moderate, 3 – Substantial												

COURSE OBJECTIVES AND HOURS OF INSTRUCTION

Unit/Module	Objectives	Hours of Instruction TL+Ac+As=To
Homeostasis and Blood	To understand the homeostasis throughout the body, thermoregulation, water, electrolyte and acid base balance	7+3+1=11
Cells, Integumentary and Immune System	To familiarize with cells, integumentary system, lymphatic system and immune mechanism of the body	7+3+1=11
Respiratory, Nervous and Muscular System	To visualize the parts, functions and interactions of respiratory, nervous and muscular system for effective signaling towards health and wellbeing	7+3+1=11
Cardiovascular, Gastrointestinal and Excretory System	To mind map the fitness of cardiovascular, gastrointestinal and excretory system for better assimilation and utilization of nutrients in the body	7+3+1=11
Senses, Endocrine and Reproductive System	To acquire physiological nature of senses, hormones secreted by endocrine glands and its integration with reproductive system, genetics and nutrition	6+3+1=10
Total Hours of Instruction		54 (18x3)

TL-Teaching Learning, Ac-Activities, As-Assessment, T-Total Hours

COURSE PLAN

Unit/Chapters	Intended Learning Chapters	CO(s) Mapped	Cognitive Level/KD	Psychomotor domain activities	Psychomotor domain level
UNIT I: Homeostasis and Blood					
74.	Structural organisation of the human body, functions of human life, requirements for human life	CO1	K1, F	Self-identify the structural organization of your body	K4, S3
75.	Introduction to homeostasis, pathways that alter the homeostasis and maintenance of homeostasis	CO1	K1, C	Schematize the mechanism of homeostasis	K5, S1
76.	Thermoregulation	CO1	K2, C	Test and document the changes in body temperature on hourly basis and justify on it	K4, S4
77.	Body composition	CO1	K1, F	Analyze your body composition	K4, S1
78.	Body fluid distribution	CO1	K1, F	Identify your body fluid distribution	K4, S2
79.	Blood composition	CO1	K1, F	Evaluate your blood composition	K5, S1
80.	Acid base balance	CO1	K1, C	Picturize the effect of acidosis and alkalosis	
UNIT II: Cells, Integumentary and Immune System					
81.	Cell structure, parts of the cell, cell	CO2	K2, F	Demonstrate the cell structure and its	K3, S1

Cognitive Process : K1 - Remembering K2 - Understanding K3 - Applying K4 - Analyzing K5 – Evaluating K6 - Creating

Knowledge Dimension : F - Factual C - Conceptual P - Procedural MC - Meta Cognitive

Psychomotor Domain : S1-Imitation S2-Manipulation S3-Precision S4-Articulation S5-Naturalization

	junctions and function			function using existing models	
82.	Cell building blocks, nutrient sensing, metabolism and cell growth control	CO2	K2, F	Pictorial presentation on any one nutrient sensing and cell growth control	K6, S1
83.	Skin layers and functions, types of hair, nail structure and parts of the fingernail	CO2	K1, F	Picturize the clinical symptoms of integumentary system and its linkage with nutrient deficiency	K6, S1
84.	Exocrine glands – sudoriferous (sweat glands), sebaceous, ceruminous and mammary glands	CO2	K1, F	Infograph the glands and its secretions	K6, S1
85.	Role of integumentary system in homeostasis	CO2	K2, C	Calculate sweat rate of a day	K4, S1
86.	Lymphatic system – lymph, lymphatic vessels and ducts, pathways and functions	CO2	K1, F	Exhibit the changes in the lymphatic system during infection with one example (Video mode)	K3, S3
87.	Organs, tissues and cells of the immune system	CO2	K1, F	Presentation on types of immunity	K6, S3
88.	Nutrition and immune system	CO2	K2, C	List the nutrients involved in immune system	K2, S1
UNIT III: Respiratory, Nervous and Muscular System					
89.	Structure and functions of the respiratory system	CO3	K1, C	Exhibit the parts of the lungs using a lung specimen	K3, S3
90.	Lung capacity, breathing and lung mechanics, stimulation of breathing and regulation of blood pH	CO3	K2, C	Determine your lung capacity	K4, S1
91.	Central, peripheral and autonomous nervous system	CO3	K1, F	Exhibit the parts of the nervous system using video	K3, S1
92.	Structure and functions of nervous tissues	CO3	K1, F	Demonstrate the reflex action of a nervous tissue using an animated video	K3, S1
93.	Structure and parts of the brain	CO3	K1, F	Exhibit the parts of the brain using a brain specimen	K3, S3
94.	Limbic system of the brain, memory and learning	CO3	K2, C	Conduct a memory test which describes your limbic system	K4, S4
95.	Muscular system and mechanics of muscle contraction	CO3	K2, C	Identify the body actions related to muscle contraction and relaxation	K6, S1
96.	Neuromuscular junction and neurotransmitters	CO3	K2, C	List the neurotransmitters related to hunger and appetite	K2, S1
UNIT IV: Cardiovascular, Gastrointestinal and Excretory System					
97.	Structure of the heart, circulatory system and cardiovascular pathways	CO4	K1, F	Animate the blood circulation throughout the body from and to the heart	K6, S5
98.	Cardiac cycle and ECG	CO4	K1, F	Determine your heartbeat before and after any one exercise	K5, S1
99.	Digestive system, layers of GI tract and accessory organs	CO4	K1, F	Pictograph on mechanism of digestion in the gastrointestinal tract	K3, S1
100.	Sites of absorption of nutrients in the gastrointestinal tract	CO4	K2, C	Poster presentation on nutrient absorption from a food in the gastrointestinal tract	K6, S1
101.	Hunger, appetite and satiety, circadian rhythm of salivary, gastric, pancreatic and glucocorticoid secretions	CO4	K3, F	Self-detect the factors influencing your sleep-wake cycle	K6, S1
102.	Organs and functions of urinary system	CO4	K1, F	Interpret the composition of urine	K5, S1
103.	Formation of urine and maintenance of water salt balance	CO4	K1, F	Experiment the water intake vs frequency of urination	K4, S3
UNIT V: Senses, Endocrine and Reproductive System					
104.	Sense of taste, smell, vision/sight, hearing, touch and space and its role in food intake	CO5	K1, C	Demonstrate on any one mindful eating exercise	K4, S5
105.	Endocrine glands and its hormones	CO5	K1, F	Differentiate exocrine and endocrine glands	K4, S1
106.	Interrelationship between nutrients and hormone signaling	CO5	K2, P	Schematize the relationship between a nutrient and a hormone	K3, S2
107.	Nutritional determinants of timing of puberty	CO5	K1, C	Food facts and myths on timing of puberty	K5, S5

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2.	H.S. Ravi Kumar Patil , H.K. Makari , H. Gurumurthy & S.V. Sowmya, (2009), Textbook of Human Physiology, I.K.International Pvt. Ltd.
3.	Nitin Ashok John (Editor) and Surrinder H Singh (Review Editor), (2018), CC Chaterjee’s Human Physiology, Volume 1 and 2, Twelfth Edition, CBS Publishers and Distributors Pvt. Ltd.
4.	John E. Hall, (2011), Guyton and Hall Text Book of Medical Physiology, Twelfth Edition, Saunders Elsevier Publication.
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Cognitive Process : K1 - Remembering K2 - Understanding K3 - Applying K4 - Analyzing K5 – Evaluating K6 - Creating
Knowledge Dimension : F - Factual C - Conceptual P - Procedural MC - Meta Cognitive
Psychomotor Domain : S1-Imitation S2-Manipulation S3-Precision S4-Articulation S5-Naturalization

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5.	https://www.cell.com/molecular-cell/pdf/S1097-2765(13)00053-1.pdf
6.	https://www.nature.com/scitable/topicpage/dynamic-adaptation-of-nutrient-utilization-in-humans-14232807/

Elective (Generic) II

Course Name	1.5 Research Methodology	Programme Name	M.Sc. Food Science, Technology and Nutrition
Course Code	23FSTNGE01	Academic Year Introduced	2023 - 24
Type of Course	Theory	Semester	I

COURSE OUTCOMES

On completion of the course, the students will be able to	
CO1:	Conceptualize the steps in research
CO2:	Identify a new research problem, define objectives and frame hypothesis
CO3:	Formulate a research framework for the food science and nutrition research
CO4:	Adapt and validate various tools and techniques in sampling and collection of data
CO5:	Plan and justify the method of presentation of collected data in a research report

Mapping of COs with POs, PSOs

COs / POs & PSOs	PO(T)	PO(E)	PO(P1)	PO(P2)	PO(P3)	PO(P4)	PO(P5)	PO(A)	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	3	3	2	3	3	-	3	1	2
CO2	2	-	-	3	1	-	-	3	2	2	2	3
CO3	3	-	-	2	2	-	-	3	3	3	3	3
CO4	-	3	-	3	3	-	2	3	3	3	2	2
CO5	3	-	2	2	2	3	1	3	1	2	1	3

1- Slight, 2- Moderate, 3-Substantial

COURSE OBJECTIVES

Unit/Module	Objectives	Hours of Instruction TL+Ac+As = T
Research Process	To illustrate the types of research and steps in research process	5+4+1=10
Conceptualizing the Research Problem	To define research problem from research ideas	6+4+1=11
Research Design	To categorize and discriminate research designs in food science and nutrition research	6+4+1=11
Research Methods and Data Collection	To learn and compare various methods of sampling, collection and valid measurement of data	6+4+1=11
Processing of Data and writing a research report	To infer and experiment the processing and representation of data in a research report	6+4+1=11
Total Hours of Instruction		54 (18x3)

TL-Teaching and Learning, Ac-Activities, As-Assessment, T-Total Hours

COURSE PLAN:

S. No.	Intended Learning Chapters	CO(s) Mapped	Cognitive Level/ KD	Psychomotor domain activities	Psychomotor domain level
UNIT I: Research Process					
1.	Meaning of research	CO1	K1, C	Collect the various definitions of research	K3, S1
2.	Purpose of research	CO1	K2, C	Differentiate research, invention and innovation	K4, S3
3.	Types of research – Application Research; Objective Research; Mode of Enquiry Perspective based Research	CO1	K1, C	Ideate research questions in the field of food science, technology and nutrition on each type of research	K6, S2
4.	Steps in research process	CO1	K1, C	Prepare a story board on eight steps of research	K4, S3
Unit II: Conceptualizing the Research Problem					
5.	Identification and formulation of research problem	CO2	K2, C	List the problems in the field of food science, technology and nutrition to be solved	K6, S3
6.	Reviewing the literature and research gap analysis	CO2	K2, F	Schematize the systematic literature review for a research title with the list of key words used for search	K6, S3
7.	Conceptualization of research – from ideas to action	CO2	K2, MC	Learn on design thinking model for idea generation	K2, S4
8.	Research objectives	CO2	K2, C	Frame an objective for a research problem	K6, S1
9.	Identifying variables and constructing the hypothesis	CO2	K2, C	Formulate a null hypothesis for a research objective	K6, S5
UNIT III: Research Design					
10.	Qualitative Research Designs – key features, uses and limitations	CO3	K1, C	Collect a research article for each qualitative research design	K5, S4
11.	Types of Qualitative Research Design – case studies, ethnographic research, narrative	CO3	K1, F	Appraise the type of research design suitable for a research problem	K4, S4

Cognitive Process: K1 - Remembering K2 - Understanding K3 - Applying K4 - Analyzing K5 - Evaluating K6 - Creating
 Knowledge Dimension : F - Factual C - Conceptual P - Procedural MC - Meta Cognitive
 Psychomotor Domain : S1-Imitation S2-Manipulation S3-Precision S4-Articulation S5-Naturalization

	research, action research				
12.	Quantitative Research Designs – key features, uses and limitations	CO3	K1, C	Collect a research article for each quantitative research design	K5, S4
13.	Types of Quantitative Research Design - Experimental and non-experimental research design	CO3	K1, C	Differentiate the experimental and non-experimental research	K4, S1
14.	Mixed research design – key features, uses and limitations	CO3	K2, C	Propose the research design for a given research problem using mixed research design	K6, S5
15.	Cross sectional and longitudinal studies	CO3	K1, F	Compare the features of cross sectional and longitudinal study	K4, S1
UNIT IV: Research Methods and Data Collection					
16.	Research methods - Methods of collecting the data in qualitative and quantitative research	CO4	K1, C	<ul style="list-style-type: none"> Frame a questionnaire for a nutrition survey using google form and validate it Exemplify the GCP in nutrition counselling centre 	K6, S3
17.	Primary and secondary data, measurement scales, construction of the research tools	CO4	K2, C	Conduct a pilot survey for pre-testing of questionnaire in the class room	K5, S5
18.	Reliability and validation of research tools, pilot testing	CO4	K2, C	Validate the pretested questionnaire using a discussion forum	K5, S3
19.	Sampling design – principles of sampling, sampling terminology	CO4	K2, C	Identify the sampling method for a research problem	K4, S2
20.	Types of sampling and calculating the sample size	CO4	K2, C	Calculate the sample size for a nutrition survey	K4, S3
21.	Ethical issues in data collection	CO4	K2, F	Frame the informed consent form and validate it	K6, S1
UNIT V: Processing of Data and Writing a Research Report					
22.	Editing and coding the data	CO5	K1, C	Code a Nutrition data of your choice	K4, S3
23.	Organization of data- types of classification	CO5	K1, C	Classify the given data using cross tabulation	K4, S1
24.	Tabulation – parts of a table, general rules of tabulation, types of tables	CO5	K1, C	Design a table for the given data	K6, S3
25.	Representation of data – types of diagrams and graphs	CO5	K1, C	Represent the a nutrition data using different forms of graphs	K6, S1
26.	Scientific writing – research article, review article, monographs, dissertation/thesis and reports	CO5	K2, C	Pictograph the model for each type of scientific writing	K6, S3
27.	Different referencing system and writing the bibliography	CO5	K2, C	Analyze the reference and bibliography in a research article using mendeley	K4, S3

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Text Books	
1.	Kothari, C.R., (2004), Research Methodology, Methods and Techniques, Second Revised Edition, New Age International Publishers, New Delhi.
2.	Ranjit Kumar, (2011), Research Methodology: a step-by-step Guide for Beginners, Third Edition, SAGE Publications, New Delhi.
3.	Beverly Moriarty, (2018), Research Skills for Teachers – From Research Question to Research Design, Allen & Unwin Publishers, Australia.
Reference Books	
1.	Rajendra Kumar, C. (2008), Research Methodology, APH Publishing Corporation, New Delhi
2.	Pagadala Suganda Devi (2017), Research Methodology: A Handbook for Beginners, Notion Press, Chennai
3.	Vijayalakshmi Ponnuraj and Sivaprakasam, C. (2008), Research Methods: Tips and Techniques, MJP Publishers
4.	Anantarayanan Raman and Jayashree Nimmagadda, (2006), A Handbook of Research Process, Macmillan Publishers.
5.	Gina Wisker, (2008), Post Graduate Research Handbook, Second Edition, Palgrave Macmillan, New York
Journals and Documents	
1.	International Journal of Social Research Methodology, Taylor and Francis
2.	International Journal of Science and Research Methodology, Human Journals
3.	Journal of Food, Agriculture and Environment, WFL Publisher Ltd.
4.	Journal of Innovation and Entrepreneurship, Springer
5.	The Journal of Global Entrepreneurship Research, Springer

Skill Enhancement Course SEC I

Course Name	1.6 Food Product Development and its Quality Evaluation	Programme Name	M.Sc. Food Science, Technology and Nutrition
Course Code	23FSTNSECO1	Academic Year Introduced	2023 - 24
Type of Course	Skill Training	Semester	I

COURSE OUTCOMES

On completion of the course, the students will be able to	
CO1	Develop a concept for new food product using design thinking process
CO2	Design a new food product with the application of systematic experimental research designs
CO3	Standardise and generate the process flow chart for a new food product
CO4	Evaluate the nutritional and sensory quality of a newly developed food product
CO5	Prepare the scientific report by justifying proper TRL, MRL and IRL

Mapping of COs with POs, PSOs

COs / POs & PSOs	PO(T)	PO(E)	PO(P1)	PO(P2)	PO(P3)	PO(P4)	PO(P5)	PO(A)	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	3	3	3	3	3	2	3	2	1
CO2	1	-	-	3	3	3	3	3	2	3	2	1
CO3	2	-	-	3	3	3	3	3	2	3	2	1
CO4	2	-	-	3	3	3	3	3	2	3	2	1
CO5	2	-	-	3	3	3	3	3	2	3	2	1

1 – Slight, 2 – Moderate, 3 – Substantial

COURSE OBJECTIVES AND HOURS OF INSTRUCTION

Unit/Module	Objectives	Hours of Learning and CIA F+I+PR = To
Concept Development	To learn the design thinking process to develop a concept for new food product	6+18+6 = 30
Design a New Food Product	To perceive the market need and design a new food product by applying systematic experimental design	3+15+0 = 18
Process Flow Determination	To standardize and mind map the process flow for the production of newly developed food product	2+10+6 = 18
Quality Evaluation	To evaluate the nutritional and sensory quality of the newly developed food product	3+15+6 = 24
Scientific Writing	To prepare the prototype report in the prescribed template	2+10+6 = 18
Total Hours of Instruction		108 (18x6)

F – Facilitation, I – Innovation, PR – Progress Review, To – Total, CIA – Continuous Internal Assessment

COURSE PLAN

Module /Experiment No.	Intended Learning Chapters	CO(s) Mapped	Cognitive Level / KD	Psychomotor domain activities	Psychomotor domain level
1.	Concept Development	CO1	K3, P	Identify the market need and develop the new product concept using design thinking process	K5, S4
2.	Design a New Food Product	CO2	K4, P	Design a new food product and define the formula to meet the market need using systematic experimental designs	K6, S3
3.	Process Flow Determination	CO3	K4, P	Create a flow chart for the processing of ingredients and production of newly developed product as per the defined formula	K6, S3
4.	Quality Evaluation	CO4	K3, P	Determine the nutritional quality of new food product with defined formula and level of ingredients (Nutrify India Now App – ICMR NIN)	K4, S3
				Determine the sensory quality of the new food product	K4, S1
6.	Scientific Writing	CO6	K3, P	Preparation of competent scientific report in the designed template for publication	K6, S1

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2	https://core.ac.uk/reader/6909038 , New Product Development using Experimental Design;

Cognitive Process: K1 - Remembering K2 - Understanding K3 - Applying K4 - Analyzing K5 – Evaluating K6 - Creating
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3	https://online.visual-paradigm.com/de/diagrams/templates/process-flow-diagram/food-manufacturing/ , process flow preparation templates preparation software, accessed on 23.07.2020
4	Nutrify India Now App (NIN ICMR) installation through google playstore, https://bit.ly/32H5OGK , accessed on 23.07.2020
5	PDST, Sensory Analysis Teacher's Manual, Dublin, 2017; https://www.pdst.ie/sites/default/files/A4%20Sensory%20Analysis%20Manual.pdf
6	https://www.scimagojr.com/journalrank.php?category=1106&area=1100&page=1&total_size=301 , accessed on 09.05.2020