

## ST. PHILOMENA'S COLLEGE(AUTONOMOUS)

Affiliated to University of Mysore  
Accredited by NAAC with 'B++' Grade  
Bannimantap, Mysore, Karnataka,  
India-570015



### PG DEPARTMENT OF FOOD SCIENCE AND NUTRITION

The Board of Studies in Food Science and Nutrition which met on 27/11/2024 has approved the syllabus and pattern of examination for Semesters I, II, III and IV for the Academic Year 2024-25 onwards

#### BOS COMMITTEE MEMBERS

Sl. No.	Name	Designation	BOS Members
1	Dr. Seema Siddiqi	Assistant Professor-HOD	Chairperson
2	Dr. Shekhara Naik	Professor	University Nominee
3	Dr. Anitha .C	Professor	College Nominee (Subject Expert)
4	Dr. Jyothi Lakshmi. A	Sr. Principal Scientist	College Nominee (Industrial Expert)
5	Dr. Syeda Farha. S	Assistant Professor	College Nominee (Subject Expert)
6	Dr. Sushma Appaiah	Nutrition Counsellor	College Nominee
7	Ms. Mary Irene	Assistant Professor	In house UG Faculty
8	Ms. Kaneez Haleema	Assistant Professor	Internal Member

## POSTGRADUATE PROGRAM

The Master's Degree Program will be conducted under the existing regulations governing two year-four semesters Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) with Learning Outcome Curriculum Framework under Autonomous Structure.

### Program Details

<b>Name of the Department</b>	: PG Department of Food Science and Nutrition. St. Philomena's College (Autonomous), Bannimantap, Mysuru
<b>Subject</b>	: Food Science and Nutrition.
<b>Faculty</b>	: Science.
<b>Name of the Course</b>	: Master of Science (M. Sc)
<b>Duration of the Course</b>	: 2 years- divided into 4 semesters

### 1. Preamble

Over the past decades the higher education system of our country has undergone substantial structural and functional changes resulting in both quantitative and qualitative development of the beneficiaries. Such changes have gained momentum with the introduction of the Choice Based Credit System (CBCS).

To compete with global Universities the need for learning outcome-based education is introduced giving more focus on the cognitive, affective and psychomotor behavior of the students. The learning outcome-based education provides very specific targets from which a teacher can achieve through the selected instructional process. This will definitely help the teachers to visualize the curriculum more specifically in terms of the learning outcome expected from the students at the end of each course.

The proposed curriculum is drafted based on guidelines suggested by the University Grants Commission. The concerns, needs and interests of students, teachers as well as societal expectations have been taken into consideration by introducing core and elective courses with special focus on technical, communication and subject-specific skills through practical, research and other innovative transactional modes to develop their employability skills. On completion of the program the student will acquire competency in communication and counselling skills, critical thinking, psychological skills, affective skills, problems solving, analytical, reasoning, research, teamwork, digital literacy, leadership, environmental, moral and ethical awareness and other cutting-edge issuers.

The curriculum of PG program is redesigned to meet all the requirement of the preamble based on the following criteria.

- i) **The Vision and Mission of the College**
- ii) **The Vision and Mission of the Department (shall be framed keeping in view the Vision and the mission of the College)**
- iii) **The content of the curriculum reflects the Vision and Mission of the college / the department and what a student should achieve on completion of the program**
- iv) **The redesigned PG Program curriculum is defined with –**
  - a) **Program Educational Objectives (PEOs)**
  - b) **Program Outcomes (POs)**
  - c) **Program Specific Outcomes (PSOs)**
  - d) **Cognitive Domain Levels (CDLs)**
- v) **The learning outcome-based curriculum offers the following courses:**
  - a. **Discipline Specific Course (DSC) - Hard Core**
  - b. **Discipline Specific Electives (DSE)- Soft Core**
    - **Discipline Specific (General)**
    - **Interdisciplinary**
    - **Ability Enhancement**
    - **Skill enhancement**
    - **Generic / Open Elective**
  - c. **Project Work/Internship/Fieldwork.**
  - d. **MOOC Online Courses (Extra Credit)**

**Based on criteria iv (a, b, c &d) the course content is framed with definite**

- **Course Outcomes (COs)**
- **Mapping of (CLOs) or (COs) with POs**

## **2. ELIGIBILITY CRITERIA FOR M.Sc. PROGRAMME IN FOOD SCIENCE AND NUTRITION**

### **➤ Eligibility for Admission**

**B.Sc., - Cognate subjects:** Home Science/any one of the following subjects as one option at BSc- Food Science and Nutrition/Human Nutrition and Dietetics/Clinical Nutrition and Dietetics/Food Science and Quality Control and from Medical and Para-medical courses (MBBS, BSc- Nursing, BSc- Yoga and Naturopathy) are eligible to apply.

Candidate from Non-cognate subjects viz., Biochemistry as major is also eligible to apply. Preference at every stage of seat allocation will be given to students who have studied **COGNATE** subjects. If seats fall vacant, applicants from non-cognate subjects shall be considered.

The qualification and the percentage of marks for admission shall be as per the guidelines issued by the University of Mysore from time to time.

### **3. Duration of the Programme**

The duration of programme shall extend over 4 semesters (two academic years) of 20 weeks each including instructions and semester-end examinations.

### **4. Maximum Period for Completion of the Programme**

The candidates shall complete the programme within 4 years from the date of admission. The term completion of the programme means passing all the prescribed examinations of the programme to become eligible for the degree.

No candidate shall be permitted to appear for the examinations after the prescribed period for completing the programme. Whenever a candidate opts for blank semesters/ dropped courses, he/she has to study the prevailing courses offered by the department when he /she continues his /her studies.

### **5. Medium of Instruction**

The medium of instruction shall be in English.

### **6. Hours of Instruction per Week**

There shall be 16-24 hours of instruction per week in subjects without practical /fieldwork and 20-26 hours of instruction per week in subjects with practical/fieldwork. These hours may be distributed per lectures, seminars, tutorials, practical, project work, and other modes of instruction which individual courses may demand.

### **7. Attendance**

Each course (theory/practical) shall be treated as an independent unit for attendance. A student shall attend a minimum of 75% of the total instruction hours in a course (theory/practical) including tutorials and seminars in each semester. There shall be no provision for condonation of shortage of attendance and a student who fails to secure a min of 75% attendance in a course shall be required to repeat that semester with the payment of the existing semester fees.

### **8. Guidelines to Implement CBCS & CAGP**

**Course:** Every course offered will have three components associated with the teaching learning process - **L**, **T** and **P**. Here, **L** - stands for Lecture session, **T**- stands for Tutorial session consisting of participatory discussion/self-study/deskwork/seminar presentations by students and such other novel methods that make a student to absorb and assimilate more effectively the contents delivered in the lecture classes and **P** stands for Practical session and it consists of Hands-on experience/laboratory experiments/field studies/case studies that equip students to acquire the much-required skill component.

In terms of credits, every one-hour session of L or T amounts to one credit per semester and a minimum of the two-hour session of Practical or Project Work/ Internship amounts to one credit per semester, over a period of one semester of 16 weeks of teaching–learning process. The total duration of a semester is 20 weeks inclusive of semester-end examination.

The course shall have either one or two or all three components. That means a course may have only a lecture component or only practical component or combination of any two or all the three components.

The total credits earned by a student in a course at the end of the semester, upon completing that course is equal to the algebraic sum of the credits earned separately under L, T and P.

## **9. Defining and Labelling of Different Courses of Study**

**a) Discipline-Specific Course (DSC)** - Compulsory course. A course that should compulsorily be studied by a candidate as a core requirement is termed as **DSC**.

### **b) Discipline-Specific Elective (DSE)**

Generally, a course which can be chosen from a pool of courses and which may be a very specific or specialized or advanced or supportive to the discipline / course of study or which provides an extended scope or which enables exposure to some other discipline/ course /domain or nurtures the candidate's proficiency/skill is called an Elective course. Elective courses may be offered by the main discipline course of study or by sister/ related disciplines.

**i) *The following elective courses may be considered as soft-core elective courses***

#### **General (DSE-G)**

If there is a choice or an option for the candidate to choose a paper from a pool of papers from the main discipline subject of study or a sister/ related discipline/subject which supports the main discipline/ subject is termed as **DSE-G**.

#### **ii) Interdisciplinary (DSE-ID).**

If there is a choice or an option for a candidate to choose a course from a pool of courses offered from a sister / related discipline of study which supports the main discipline is termed as **DSE-ID**.

#### **iii) Ability Enhancement (DSE-AE).**

An elective course is chosen from a pool of courses designed within the discipline to provide value-based knowledge to increase their employability is termed as **DSE-AE**.

#### **iv) Skill Enhancement (DSE-SE).**

These courses are chosen from a pool of courses designed to provide value-based and/or skill-based knowledge and should contain both theory and practical/ hands-on training/fieldwork. The disciplines should offer courses to the students under this category, based on their expertise, specialization, requirements, scope, and need to increase their employability.

#### **v) Generic Elective (DSE-GE)**

An elective course chosen from a pool of courses offered from an unrelated discipline to seek exposure beyond discipline/s of choice is termed as GE. The purpose of this category of courses is to offer the students the option to explore disciplines of interest beyond the choices they make in Core Discipline.

#### **vi) Project work / Internship.**

It is a special course involving the application of knowledge in solving /analysing / exploring a real-life situation / difficult problem. A project work /internship may be hard or soft-core as decided by the BOS. It may be of 02 to 12 credits. A project work of 2- 6 credits is called minor project work and 7 to 12 credits are called major project work.

## vii) SWAYAM MOOC online courses.

SWAYAM is a programme initiated by the Government of India and is designed to achieve the three cardinal principles of Education Policy viz., access, equity and quality. The objective of this effort is to take the best teaching-learning resources to all, including the most disadvantaged. SWAYAM seeks to bridge the digital divide for students who have either to remain untouched by the digital revolution and have not been able to join the main stream of the knowledge economy. All the students should compulsorily study at least one MOOC course of 4 credits before completion of the programme. The credits earned by the students will be treated as additional credits.

### 10. Scheme of Instruction

The effective teaching strategies to be adopted to develop competency in communication skills, critical thinking, effective skills, problem-solving, analytical, reasoning, research skills, teamwork, digital literacy, moral and ethical awareness, leadership readiness with other learner-centric modes which individual courses may demand. Some important and relevant teaching and learning processes are listed below:

- Flipped, hybrid /blended, and e-learning classes
- Seminars/ Presentations
- Group discussions and Workshops
- Framing Questions
- Peer teaching and learning
- Laboratory-based practical components and Technology enabled learning
- Extension activities to learn the moral & ethical awareness.
- Visit to Research Institutions/Industries/ Clinics, Hospitals, Wellness centres etc.
- Deputing students to participate and present research articles as poster / oral communications
- Encouraging students to do take part in National/ International Seminars/Workshops/Conferences.
- Publication of research articles in peer reviewed Journals.
- Project, Dissertation/Internship, Field based learning to enhance the knowledge beyond the discipline.

### 11. Award of Credits

- a. For the successful completion of any PG Program a candidate has to earn a minimum of **78** credits, as given in the following Table

Course Type	Credits
Discipline-Specific Core –DSC	A minimum of 52 but not exceeding 56
Discipline-Specific Elective-DSE	A minimum of 18
Interdisciplinary- DSE-ID	A minimum of 04
Ability Enhancement-DSE-AE	A minimum of 04
Skill Enhancement – DSE-SE	A minimum of 06
Generic Elective – DSE- GE	A minimum of 04
SWAYAM MOOC (Compulsory course)	Additional Credits

- b. A candidate can enroll for a minimum of 18 credits and a maximum of 22 credits per semester
- c. A candidate can also opt to earn more than 76 credits. In such cases wherein, a candidate opts to earn at least 4 extra credits in the same or different discipline/courses in addition to a minimum of 76 credits as said above, then a value-added *proficiency certification* will be issued to the candidate.

a) **Continuous Comprehensive Assessment (CCA)**

The evaluation and assessment of the performance of the candidate shall be based on continuous assessment. For reporting purposes, the continuous assessment and evaluation process is divided into 3 distinct components and is identified as C<sub>1</sub>, C<sub>2</sub>, and C<sub>3</sub>.

- b) i) The performance of a candidate in a course (theory or practical) will be evaluated and

Component	Syllabus in a course to be included	Weight age	Period of continuous Assessment
C <sub>1</sub>	First 50%	15%	During the 8 <sup>th</sup> week of the semester
C <sub>2</sub>	Remaining 50%	15%	During the 16 <sup>th</sup> week of the semester
C <sub>3</sub>	Semester-end examination (Content of all modules of the courses)	70%	To be completed during the 18 <sup>th</sup> – 20 <sup>th</sup> Week

- ii) The first component C<sub>1</sub> is for 15 marks and should be assessed periodically in the first half of the semester. The assessment will be based on the different rubrics such as Test, Assignment, Seminar, Quiz, and or any other modes as decided by the respective departments. It may be noted that the C<sub>1</sub> theory or practical test in any course be conducted only during the 8<sup>th</sup> week of the semester by completing the first half of the assigned syllabus. C<sub>1</sub> marks from all the components should be consolidated at the end of the 8<sup>th</sup> week of the semester. Beyond the 8<sup>th</sup> week, making any changes in C<sub>1</sub> marks is not permitted.

The second component C<sub>2</sub> is also for 15 marks and should be assessed (as in C<sub>1</sub>) only during the second half of the semester. It may be noted that the C<sub>2</sub> theory/practical test be conducted only during the 16<sup>th</sup> week of the semester by completing the second half of the assigned syllabus. C<sub>2</sub> marks should be consolidated at the end of the 16<sup>th</sup> week of the semester. The marks scored by the candidates in C<sub>1</sub> and C<sub>2</sub> shall be consolidated and displayed on the notice board during the 17<sup>th</sup> week of the semester. The grievances of the students (if any) are to be resolved by the HODs of the respective departments.

The outline for continuous assessment activities for Components (C<sub>1</sub> and C<sub>2</sub>) will be followed as per the UUCMs rubrics.

The students should be informed about the modalities of the assessments well in advance by notifying them on the departmental notice board.

The evaluated scripts/assignments during the C<sub>1</sub> and C<sub>2</sub> assessments are immediately returned to the candidates after obtaining acknowledgment in the register maintained by the concerned teacher for this purpose.

In the case of the courses involving only practical, the same assessment procedure for theory components (C<sub>1</sub> and C<sub>2</sub>) may be adopted as discussed and decided in the respective departmental staff meetings well in advance.

During the 18<sup>th</sup> – 20<sup>th</sup> week of the semester, a semester-end examination shall be conducted for each course. This forms the third/final component of assessment (C<sub>3</sub>) and the maximum marks for the final component in each course will be 70marks

- a) The setting of Question Papers and Evaluation of Answer Scripts**  
A blueprint of the question paper is to be prepared along with the curriculum and shall be placed before the BOS for approval. The questions in the question paper should be framed in such a way that an average student should be able to answer for at least 50% marks, good students for 80%, and intelligent students for 100%.
- b)** The setting of an effective question paper is very important for assessing the learner's outcome in terms of achievements concerning the objectives. Suitable assessments during the teaching-learning process stimulate and motivate learners and enhance learning. The summative evaluation of achievements and competencies developed in learners can be accessed through suitable question papers. The phrases used in framing the questions should convey the desired meaning to achieve maximum clarity and understanding for the students to express their learned knowledge and skills.
- c) List of phrases to be used during question paper setting**
- i) **Remembering (Recall and recognition):** Define, Identify, Label, Match, Name, Outline, Elect, State, List, Reorganize etc.
  - ii) **Understanding (Translate, Interpret, Extrapolate, Etc.):**  
Define in your own words, Convert, Distinguish, Compare, Estimate, explain in your own words, give examples, Infer, Predict, Manipulate, Verify, Discriminate, Classify, Construct, Represent, Record, Rearrange etc.
  - iii) **Application (Problem-solving)**  
Compute, Demonstrate, Modify, Change, Find, Calculate, Prepare, Produce, Solve, Use, Show, Establish, Apply etc.
  - iv) **Thinking, Analyze, Evaluate and Creative (Analysis, Produce, Synthesize, Judge, Evaluate, Solve, Etc.,)**  
Differentiate, Distinguish, Illustrate, Outline, find a relationship, Derive, Categorize, Design, Organize, Formulate, Reconstruct, write a theme, Criticize, Justify, Infer, Predict Etc.
  - v) **Skill- (Sketching, Drawing, Computing, Reading, and Table/Diagram Etc.):**  
Sketch, draw picture/graph, compare, find, calculate, read the chart, use chart/graph Etc.
- d)** The question papers (in 3 sets) shall be placed before the BoE.
- e)** The members of the Board of Examiners shall scrutinize and approve the question papers.
- f)** There shall be single valuation for all theory papers by internal and external examiners in the ratio of 60: 40 respectively. A scheme of valuation is to be prepared by the department and to be provided to the examiner along with the coded answer scripts.
- g)** The examination for Practical Work / Field Work / Project Work will be conducted jointly by an internal and external examiner. However, under special circumstances, the BOE at its discretion can also permit two internal examiners from the College.  
If a course is full of (L = 0): T: (P=0) types, then the examination for C<sub>3</sub> Component will be as decided by the BOS concerned.



- h) The details of the continuous assessment are summarized in the following table:

Component	Syllabus in a course to be included	Weightage	Period of continuous assessment
C <sub>1</sub>	First 50%	15%	During the first half of the
C <sub>2</sub>	Remaining 50%	15%	During second half of the semester
C <sub>3</sub>	Semester-end examination (Syllabus of all units of the course)	70%	To be completed during 18 <sup>th</sup> – 20 <sup>th</sup> Week

- i) A candidate's performance from all 3 components will be in terms of scores, and the sum of all three scores will be for a maximum of 100 marks (15+15+70).
- j) Finally, awarding the grades should be completed latest by the 24th week of the Semester

**Evaluation of Minor / Major Projects and Internships:**

Right from the initial stage of defining the problem, the candidate has to submit the progress reports periodically and also, present his / her progress in the form of seminars in addition to the regular discussion with the guide. Components of evaluation are as follows:

**C1 Component: Periodic progress and progress reports – 15 marks**

**C2 Component: Results of work and the draft reports – 15 marks**

**C3 Component: Final Viva Voce and Project Evaluation – 70 marks.**

- a) **Declaration of Results:**  
For a candidate to pass a course he/she should score a minimum of 40% from C<sub>1</sub>, C<sub>2</sub> and C<sub>3</sub> put together in that course provided he/she scores a minimum of 30% (09 marks) in C<sub>1</sub> and C<sub>2</sub> put together and 30% (21 marks) in C<sub>3</sub>.
- b) In case a candidate secures less than 30% (09 marks) in C<sub>1</sub> and C<sub>2</sub> put together in a course, the candidate is said to have **DROPPED** that course, and such a candidate is not allowed to appear for C<sub>3</sub> Component in that course.
- c) In case a candidate's class attendance in a course is less than 75% or as stipulated by the college, the candidate is said to have **DROPPED** that course, and such a candidate is not allowed to appear for C<sub>3</sub> in that course.
- d) Teachers offering the courses will place the above details in the PG Departmental Staff Meeting at the end of the 16<sup>th</sup> week of the semester or well before the commencement of the C<sub>3</sub> examination. Subsequently, a notification about the above will be brought out by the Principal of the college before the commencement of the C<sub>3</sub> examination. A copy of this notification shall also be sent to the office of the Controller of Examinations for information.
- e) In case a candidate secures less than 30% (21marks) in C<sub>3</sub> he/she may choose the DROP/MAKEUP option. A candidate exercising his/her option to MAKEUP examination shall be declared pass if he/she secures more than or equal to 40% in C<sub>1</sub>+C<sub>2</sub>+C<sub>3</sub> put together provided he/she fulfils the conditions mentioned in Para 15a to 15c. No separate MAKEUP examination shall be conducted for candidates who appeared and failed in the said examination. Such a candidate has to appear for the examination as and when the C<sub>3</sub> component examination is conducted for Odd and Even semesters of that academic year along with the regular candidates.

- f) A candidate has to re-register for the DROPPED course when the course is offered again by the department. If it is a DSC course the candidate may choose the same or an alternate core or elective in case the dropped course is a core/ elective course. A candidate who is said to have DROPPED project work has to re-register for the same within the stipulated period. The details of any dropped course will not appear on the grade card.
- g) The tentative/provisional grade card will be issued by the Controller of Examinations, at the end of every semester indicating the courses completed. This statement will not contain the list of DROPPED courses.

### The Grade (G) and the Grade Point (GP)

The Grade (G) and the Grade Point (GP) earned by the candidate in any course will be as given below:

Marks Obtained / Percentage in a course (M)	Grade (G)	Grade Point
90-100	9.0 - 10.0	GP = C x G
80-89	8.0 - 8.9	
70-79	7.0 - 7.9	
60-69	6.0 - 6.9	
50-59	5.0 - 5.9	
40-49	4.0 - 4.9	

Where 'C' is the credit value of the course and 'M' is the percentage of marks= [C1+C2+C3]

### a) The Semester Grade Point Average (SGPA)

The Semester Grade Point Average (SGPA) of a candidate after completing the required number of credits is given by

$$\text{SGPA} = \frac{\sum GP}{\text{Total number of credits}}$$

The Final Cumulative Grade Point (FCGP) of a candidate after successful completion of the required number of credits (76) is given by

$$\text{FCGP} = \frac{\sum GP \text{ of all the four Semesters}}{\sum \text{Credits of all the Semesters}}$$

### b)

Final Cumulative Grade Point (FCGP)	ALPHA- Sign Grade	
9.00 - 10.00	<i>O</i>	Outstanding
8.00 - 8.99	<i>A</i> <sup>+</sup>	Excellent
7.00 - 7.99	<i>A</i>	Very Good
6.00 - 6.99	<i>B</i> <sup>+</sup>	Good
5.00 - 5.99	<i>B</i>	Above Average
4.00 - 4.99	<i>C</i>	Average

A candidate can withdraw from any course within ten days from the date of notification of the final results of that semester. Whenever a candidate withdraws from a course, he/she has to register for the same course in case it is a hard-core course, the same course, or an alternate course if it is a soft-core/open elective.

The **DROPPED** course is automatically considered a course **withdrawn**.

### **Classification of Results and Overall Percentage**

The classification of final results is based on FCGP secured by the candidates.

The details are as given in the following Table:

FCGP	FCGP	
	Numerical Index	Qualitative Index
9.00 and	10	DISTINCTION
8.00 to 8.99	9	
7.00 to 7.99	8	FIRST CLASS
6.00 to 6.99	7	
5.00 to 5.99	6	SECOND CLASS
4.00 to 4.99	5	
<b>Overall percentage = 10 x FCGP</b>		

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**ST. PHILOMENA'S COLLEGE (AUTONOMOUS), MYSORE**  
(AFFILIATED TO UNIVERSITY OF MYSORE)  
REACCREDITED BY NAAC with B++ Grade  
**PROGRAMME: M. Sc Food Science and Nutrition**  
(For Candidates admitted during the Academic year 2024-25 onwards)

**PREAMBLE**

Post Graduate Department of Food Science and Nutrition is offering M.Sc. Degree in Food Science and Nutrition from the academic year 2024-25. Since the subject has grown tremendously post Covid-19 pandemic, there is a need to train students specifically for the job market. In view of this, it was found necessary to introduce a regular course of Food Science and Nutrition at St. Philomena's College. This program endeavors to provide students a broad-based training in Food Science and Nutrition with a solid background of basic concepts as well as exposing them to the exciting advancements in the field.

The syllabus is revised with slight modifications in par with University of Mysore syllabus as needed to keep abreast with latest knowledge in the field. The goal of the syllabus is to make Food Science and Nutrition popular, interesting and encouraging to the students for higher studies including research. It is also planned to give an opportunity to the students to opt for Dissertation /Project work /hospital based internship in the second year of M.Sc course for better job prospective and practical implementation of the subject.

The current syllabus focused on learner's centric and outcome-based curriculum as per the UGC guidelines. The frame work of learning outcome-based curriculum includes Vision and Mission statements of the Institute, Vision and Mission statements of the department, Programme Educational Objectives (PEOs), Programme Outcomes (POs), Programme Specific Outcomes (PSOs), Course Outcomes (COs), Evaluation and Result analysis, Teaching and learning process, technological tools, sharing of resources by industry partners with the institution and active feedback of the course outcome from the industry.

The learner centric curriculum provides and enables a continuous improvement of curriculum, teaching learning process, teaching resources, assessment methods, evaluation rubrics, validity and reliability of evaluation.

The curriculum is designed with compulsory Discipline core courses and Discipline Specific Electives to equip the students with required knowledge and skills by the employers, to build learner competencies and make themselves - learners.

The student can choose from a pool of electives that are offered below:

1. **Skill Enhancing Electives,**
2. **Interdisciplinary Electives,**
3. **Ability Enhancing Electives,**
4. **Generic Electives**
5. **Self-Study Electives**

The students will have flexibility, academic mobility and maximum utilization of human and material resources.

## **VISION AND MISSION OF THE COLLEGE**

### **VISION**

The college is guided by the visionary zeal of providing value- based education to everyone irrespective of religion, caste, creed or sex by which the character is formed, intellect is explained and one can stand on his /her feet.

### **MISSION**

To transform young men and women who come to learn not from books, but also from life and to share the experience of working and playing together, this inculcates life skills to become good citizens with integrity and discipline.

## **VISION AND MISSION OF THE DEPARTMENT**

### **Vision:**

- ✓ To achieve academic excellence in Food Science and Nutrition imparting in-depth knowledge to the students.
- ✓ Facilitating research activities and cater to the ever-changing industrial demand & societal needs.

### **Mission:**

1. To provide quality education and learning experience through application of innovative teaching methods in understanding the nutrition requirements which is the basis of life and emphasize on problem solving skills.
2. To cultivate a culture of scientific and critical thinking and apply same in novel research.
3. To promote basic and advanced practical and clinical skills in conducting and interpreting laboratory investigations.
4. To render comprehensive and quality clinical laboratory services for the betterment of community health.

PO No.	Programme Educational Objectives (PEOs)
PEO-1	<b>CORE PROFICIENCY</b> <ul style="list-style-type: none"> <li>To foster an interdisciplinary approach by integrating Food Science with other fields.</li> <li>Develop critical, analytical, problem solving and research skills.</li> </ul>
PEO-2	<b>PERSONAL DEVELOPMENTS</b> <ul style="list-style-type: none"> <li>To inspire and support research and development initiatives.</li> <li>To train students to critically analyse scientific data, draw objective conclusions and apply this knowledge for human welfare. Students should be able to demonstrate expertise and ethical perspective on areas related to Food Science and Nutrition.</li> </ul>
PEO-3	<b>LEARNING ENVIRONMENT</b> <ul style="list-style-type: none"> <li>✓ Pursue higher education and research in reputed institutes at national and international level</li> </ul>
PEO-4	<b>TECHNICAL ACCOMPLISHMENTS</b> <ul style="list-style-type: none"> <li>✓ To revisit and reinforce core concepts and principles by building a multidisciplinary approach.</li> </ul>

### Mapping of Mission of the Department with Programme Educational Objectives

Mission	Programme Educational Objectives (PEOs)			
	PEOs-1	PEOs-2	PEOs-3	PEOs-4
M1	✓		✓	
M2				
M3	✓		✓	✓
M4		✓		

### Program Outcomes (POs)

#### Upon completion of the Program the student will be able-

PO No.	Program Outcomes (POs)
PO-1	Attain extensive integrated approach and conceptual knowledge of Nutrition and Dietetics to achieve holistic health.
PO-2	Demonstrate and strengthen interdisciplinary knowledge and skills and keep abreast with the latest developments in the field of clinical nutrition and health sciences.
PO-3	Acquire critical thinking and counselling skills to identify and address problems related to health and disease condition
PO-4	Expertise in assessing the nutritional status and advocate appropriate nutrition intervention strategies and develop food formulations in health care system.
PO-5	Illustrate and deliver effective individual and team-based nutrition strategies to prevent, alleviate and treat nutritional problems associated with disease condition.
PO-6	Practice state-of-art ethical nutrition care in collaboration with other healthcare providers within the bounds of legal and professional standards.
PO-7	Enhance professional competencies in identifying and establishing research gap and achieve food and nutrition security.
PO-8	Plan and develop intervention strategies complying/influencing policies by the Government of India to improve nutrition, social and economic development
PO-9	Enhance the research competency and conduct need based multidisciplinary research for improving the health and disease condition
PO-10	Synergize a new generation with professional competence in nutrition & dietetics field to face the challenges of health sector
PO-11	To acquire skills to undertake systematic research in the area of food science and nutrition.
PO-12	To understand the applications of nutritional sciences in clinical interventions, communication for health promotion, food service management, food science and processing

**General Program Outcomes – the above PO’s are aligned to the following objectives :**

<b>PO1</b>	<b>Disciplinary Knowledge:</b> Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of Program of study.
<b>PO2</b>	<b>Communication Skills:</b> Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one’s views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information clearly and concisely to different groups.
<b>PO3</b>	<b>Critical thinking:</b> Capability to apply analytic thought to a body of knowledge; analyze and evaluate evidence, arguments, claims, and beliefs based on empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies, and theories by following a scientific approach to knowledge development.
<b>PO4</b>	<b>Problem-solving:</b> Capacity to extrapolate from what one has learned and applies competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one’s learning to real-life situations.
<b>PO5</b>	<b>Analytical reasoning:</b> Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and address opposing viewpoints.
<b>PO6</b>	<b>Research-related skills:</b> A sense of inquiry and capability for asking relevant/appropriate questions, problematizing, synthesizing, and articulating; Ability to recognize cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation.
<b>PO7</b>	<b>Cooperation/Teamwork:</b> Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.
<b>PO8</b>	<b>Scientific reasoning:</b> Ability to analyze, interpret, and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence, and experiences from an open-minded and reasoned perspective
<b>PO9</b>	<b>Self-directed learning:</b> Ability to work independently, identifies appropriate resources required for a project, and manages a project through to completion.
<b>PO10</b>	<b>Moral and ethical awareness/reasoning:</b> Ability to embrace moral/ethical values in conducting one’s life, formulates a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one’s work, avoid unethical behavior such as fabrication, falsification, or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.
<b>PO11</b>	<b>Leadership readiness/qualities:</b> Capability for mapping out the tasks of a team or an organization, setting direction, formulating an inspiring vision, building a team that can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, smoothly and efficiently.
<b>PO12</b>	<b>Lifelong learning:</b> Ability to acquire knowledge and skills, including, learning how to learn, that is necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social, and cultural objectives, and adapting to changing trades and demands of the workplace through knowledge/skill development/rescaling.

**Program Specific Outcome(s)**

<b>PSO No.</b>	<b>Program Specific Outcome(s) Upon completion of the Programme the student will acquire</b>
<b>PSO-1</b>	Global level research opportunities to pursue PhD programme targeted approach of CSIR-NET, UGC-NET, KSET examination
<b>PSO-2</b>	Enormous job opportunities at all level of Govt and Private sectors., viz., Food industries, Food business units, Research institutes, pharmaceutical, hospitals, wellness centres, self-employment, etc
<b>PSO-3</b>	Specific placements in R&D and quality control/quality assurance or food analysis division of nutraceutical, functional foods, pharmaceutical industries and allied divisions.

**Mapping of Programme Educational Objectives with Programme Specific outcomes**

<b>Programme Educational Objectives</b>	<b>PSO-1</b>	<b>PSO-2</b>	<b>PSO-3</b>
<b>PEO-1</b>	✓	✓	✓
<b>PEO-2</b>		✓	
<b>PEO-3</b>	✓	✓	✓
<b>PEO-4</b>		✓	✓

**Mapping of Programme Educational Objectives with Program Outcomes**

<b>Programme Educational Objectives</b>	<b>PO-1</b>	<b>PO-2</b>	<b>PO-3</b>	<b>PO-4</b>	<b>PO-5</b>	<b>PO-6</b>	<b>PO-7</b>	<b>PO-8</b>	<b>PO-9</b>	<b>PO-10</b>	<b>PO-11</b>	<b>PO-12</b>
<b>PEO-1</b>	✓			✓	✓	✓						
<b>PEO-2</b>			✓					✓		✓	✓	
<b>PEO-3</b>	✓	✓							✓			✓
<b>PEO-4</b>	✓					✓						

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**Choice-Based Credit System Syllabi of M. Sc in Food Science and Nutrition**

No	Paper Code	Title of course	Type	No. of credits				
				L	T	P	Total	
<b>FOOD SCIENCE AND NUTRITION</b>								
<b>I Semester</b>								
1.		Food Science and Food Processing- I	DSC [16 credits]	3	0	2	5	20
2.		Nutritional Biochemistry		2	1	2	5	
3.		Human Nutrition		2	1	0	3	
4.		Life cycle Nutrition		2	1	0	3	
5.		Food Microbiology	DSE - G	2	0	0	2	
6.		Public health nutrition	DSE (AE)	2	0	0	2	
7.		Assessment of Nutritional status	DSE (SE)	1	1	0	2	
<b>To choose any 2 DSE</b>								
<b>II Semester</b>								
1		Food Science and Food Processing- II	DSC [14 credits]	1	1	2	4	18
2		Vitamins in Nutrition		1	1	2	4	
3		Minerals in Nutrition		3	0	0	3	
4		Food laws and food safety		2	1	0	3	
5		Nutritional Epidemiology	DSE - G	2	0	0	2	
6		Nutraceuticals and Functional foods	DSE (SE)	1	1	0	2	
7		Food additives	DSE (AE)	2	0	-	2	
8		Healthy lifestyle and nutrition	DSE(GE)	4	-	-	4	
<b>To choose any 2 DSE</b>								
<b>III Semester</b>								
1		Food Preservation	DSC [14 credits]	1	1	2	4	20
2		Functional properties of foods		2	2	0	4	
3		Principles of Clinical Nutrition		2	1	0	3	
4		Food Fortification		2	1	0	3	
5		Biostatistics & its applications (Mandatory)	DSE - ID	3	1	0	4	
6		Food packaging technology	DSE (AE)	2	0	0	2	
7		Food Service Management	DSE (SE)	1	1	0	2	
8		Project work** /Internship*** – Part I	DSE (SE)	0	0	4	4	
<b>To choose any 2 DSE</b>								
<b>IV Semester</b>								
1		Product Development & Entrepreneurship	DSC [12 credits]	3	2	0	5	18
2		Advances in Nutritional Sciences		3	0	0	3	
3		Diet in diseases		3	1	0	4	
4		Project work**/Internship*** - Part II	DSE (SE)	0	0	4	4	
5		Research Methodology in Clinical Nutrition	DSE (AE)	2	0	0	2	
6		Food Biotechnology	DSE (SE)	1	1	-	2	
7		Sports Nutrition	DSE (AE)	1	1	-	2	
<b>To choose any 2 DSE</b>								

**Credits Obtained – DSC+DSE=76 + Generic elective (4) = 80 credits**

**Swayam MOOC Courses\* – (4) = 4 credits**

**Total credits = 84 credits**

**Note: MOOC Courses\* - self study**

**Note:**

**DSE (GE) - Generic elective papers are for students of other courses.**

**\*\* Project work/Dissertation** - To be assessed as Internal Assessment only. For all others, distribution of IA and Exam marks are 50% each.

**\*\*\*Internship** in Hospitals / Foods service institutions + hospital / clinics.  
Certificate to be issued by the Department.

Total credits needed for M.Sc. 76, [I year: 40, II year 36] Min credit 4 and maximum of 8 credits to be chosen from other courses during II, III, and IV Semesters.

**Important Note for Project work/ Internship students (Part I and II)**

**Part - I**

The candidate will select a topic under the guidance of a faculty, develops a research plan in Food science, Community nutrition, Clinical or Experimental nutrition. The formative research plan comprising of topic selected, related review of literature, objectives and study design shall be presented for approval. At the end of the III semester, this proposal shall be submitted for evaluation.

**Note: It is mandatory that students opting for this soft core in III semester will continue with the Part II in IV semester. Allotment of candidates is subject to availability of faculty.**

**Part – II**

The work planned in III semester will be undertaken by student under the guidance of an advisor. The research should be submitted at the end of IV semester in the form of a thesis. The project work can be undertaken at PG department Lab, affiliated research institutions, quality control laboratories, food industries or other institutions with prior approval.

During the first half of IV semester all the hard core and softcore papers, which are taught in the department will be completed. The second half will be devoted to Project work/Internship, for which students need to go outside the department for three/five days a week. Accordingly, C1 and C2 component marks will be submitted at the end of IV semester.

**FIRST YEAR - SEMESTER-1**

<b>Course Title</b>	<b>FOOD SCIENCE AND FOOD PROCESSING- I</b>	
<b>Course Type</b>	<b>DSC</b>	<b>Total Hours - 64</b>
<b>Course Code</b>		<b>Hours/Week – 04+04 (practical)</b>

**MAPPING of Course Outcomes (CO'S) with PO's AND CDL's**

<b>CO's</b>	<b>Course Outcomes On completion of the course the student will learn to</b>	<b>POs Addressed</b>	<b>CDL</b>
<b>CO-1</b>	To understand science of food and the concepts of food processing	<b>PO-1</b>	<b>Understand</b>
<b>CO-2</b>	Explain various cooking methods applicable to foods	<b>PO-1</b>	<b>Understand, Analyze</b>
<b>CO-3</b>	To be equipped to handle research and work in a food industry/establishment	<b>PO-3, PO-6</b>	<b>Apply</b>
<b>CO-4</b>	Discuss the factors influencing the nutritional composition	<b>PO-1</b>	<b>Understand and apply</b>

**Modules**

**Course Content**

**Duration**

- 1. Processing of foods:** **6hrs**
  - A.** Brief history of food processing, Types of processing- Primary, secondary and tertiary. Traditional technologies used in food processing.
  - B.** Effects of processing on physical properties (density, specific gravity, viscosity, emulsions), sensory characteristics and nutritive value of foods.
  
- 2. Processing of wheat:** **6hrs**

Structure, composition, primary processing, functionality in food system, role of gluten, study of preparation/ manufacture of common unleavened and leavened products like chapathi, bread, cake etc.
  
- 3. A. Rice:** **6hrs**

Structure, composition, primary and secondary processing, effect of processing and cooking on nutrient content, processed products.

  - B. Millets:** Types, composition, malting, other food uses.
  - C. Pseudo cereals-** Types, composition, food applications
  
- 4. A. Legume:** **6hrs**

Types, composition, milling, germination, cooking & processed products.

  - B. Oilseeds:** Use of oilseeds and oilseed meals, soya bean and groundnut– composition, processing and food uses.

**C. Fruits and Vegetables:** Composition, pectins, plant acids, types of pigments, Physico-chemical changes during harvesting, post-harvesting, ripening, cooking and Storage.

**Practical Sessions: Study of preparation variables and quality factors of products from the following food commodities:**

Modules	Commodities	Duration
1.	Wheat	8hrs
2.	Rice and millets	8hrs
3.	Legumes	8hrs
4.	Vegetables	8hrs
5.	Product preparation	8hrs

#### Reference

1. Potter, N. N., & Hotchkiss, J. H. (2012). Food science. Springer Science & Business Media.
2. Rahman, M. S. (Ed.). (2009). Food properties handbook. CRC press.
3. Fellows PJ(2009).Food processing technology, principle and practices. Wood head publishing India Pvt Ltd, New Delhi.
4. Manay, N. S. O. (2001). Food: facts and principles. New Age International.
5. Sharma, Avantina. Textbook of Food Science and Technology. CBS publication and Distributors Pvt. Ltd.
6. Srilakshmi B. Food Science. New Age International.

<b>Course Title</b>	<b>NUTRITIONAL BIOCHEMISTRY</b>	
<b>Course Type</b>	<b>DSC</b>	<b>Total Hours - 64</b>
<b>Course Code</b>		<b>Hours/Week – 04 + 04 (Practical)</b>

#### MAPPING of Course Outcomes (CO'S) with PO's AND CDL's

CO's	Course Outcomes On completion of the course the student will learn to	POs Addressed	CDL
CO-1	To learn chemistry of nutrients, their biochemical functions, metabolism in health and disease apply the same in nutrition research.	PO-2	Understand, Apply
CO-2	Enable the application of nutrient metabolism in clinical nutrition and dietetics	PO-3	Analyze
CO-3	Suggest strategies to manage the consequences due to altered nutrient metabolism	PO-10, PO-11	Apply

<b>CO-4</b>	Analyse the bioactive compounds by the application of biochemical techniques	<b>PO-1</b>	<b>Analyze and apply</b>
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<b>Modules</b>	<b>Course content</b>	<b>Duration</b>
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**1. Cell Structure and Function:**

**8hrs**

Components, cell membrane composition and functions, membrane receptors, mechanism of membrane transport, fundamentals of signal transduction.

**2. A. Enzymes:**

Classification, nomenclature, general properties, mechanisms of enzyme action, regulation of enzyme activity. Role of Coenzymes and cofactors in enzyme activity. Factors affecting enzyme activity, Enzyme inhibition, Iso-enzymes, immobilized enzymes, clinical significance of enzyme assays.

**B. Hormones:**

Classification, Second messengers, mechanism of action, neuro-endocrine control of metabolism.

**3. Metabolic pathways of macronutrients**

**8hrs**

- a. **Carbohydrates-** classification, physico-chemical properties. Aerobic and anaerobic degradation, Glycogenesis, Glycogenolysis, Gluconeogenesis, HMP shunt pathway. Alcoholic fermentation. Hormonal regulation of blood glucose.
- b. **Proteins and amino acids** - Classification and structure, physico-chemical properties. Protein degradation, metabolism of aromatic, sulfur containing, BCAA, amino acid pool, fate of nitrogen (urea cycle). Glutamine and alanine cycle, protein biosynthesis.
- c. **Lipids:** Classification, chemical structure, and properties of fatty acids. Metabolic pathways of triacylglycerol, fatty acids, cholesterol. Biosynthesis of fatty acids and ketone bodies.
- d. **Nucleic acids:** Classification, metabolism of nucleic acid components, biosynthesis of nucleotides.

**4.A. Integration and regulation of metabolism:**

**8hrs**

Interrelationship of carbohydrate, protein and lipid metabolism, role of liver, muscle and adipose tissues.

**B.Bioenergetics:** Principles, Endergonic and exergonic processes, High-energy compounds and their role in energy capture and transfer. Structure of mitochondria, Electron transport chain and oxidative phosphorylation.

### Practical Session:

#### Techniques used in biochemical analysis:

Modules	Content	Duration
<b>1. Determination of pH:</b>		<b>8hrs</b>
	in acids, alkalis and buffers using pH meter and indicators.	
<b>2. Colorimeters:</b>		<b>8hrs</b>
	Use of colorimeter in UV and visual range, Flame Photometer, fluorimeter (principle to be explained and demonstrated with one example for each).	
<b>3. Separation techniques:</b>		<b>8hrs</b>
	Chromatography- paper and column. Centrifugation, Electrophoresis and Dialysis. (One example for each may be demonstrated).	
<b>4. Enzyme Assays:</b>		<b>8hrs</b>
	Amylase, protease, lipase or alkaline phosphatase using suitable substrates, Effect of pH, temperature & substrate concentration on any one enzyme activity may be included.	

#### Reference:

1. David L. Nelson, Michael M. Cox. L. Lehninger Principles of Biochemistry. Macmillan
2. Murray, R K., Granner, D K., Mayes, P A., & Rodwell, V W. Harper's Illustrated Biochemistry. Lange medical book/ McGraw-Hill.
3. Damodaran, S., Parkin, K. L., & Fennema, O. R. (Eds.). (2007). Fennema's Food Chemistry. CRC press.
4. Shills ME, Olson JA, Shike M & Ross AC. 1999 Modern Nutrition in Health and Disease. Williams & Wilkins
5. Guyton. Human physiology and mechanism of disease. W.B. Saunders Company
6. Chatterjea MN & Rana Shinde. Textbook of Medical Biochemistry. Jaypee publication.
7. Satyanarayana U. & Chakrapani U. Biochemistry. Books & Allied (P) Ltd.

<b>Course Title</b>	<b>HUMAN NUTRITION</b>	
<b>Course Type</b>	<b>DSC</b>	<b>Total Hours - 48</b>
<b>Course Code</b>		<b>Hours/Week – 03+10hrs (activities)</b>

### MAPPING of Course Outcomes (CO'S) with PO's AND CDL's

CO's	Course Outcomes On completion of the course the student will learn to	POs Addressed	CDL
CO-1	Principles of nutrition in recommending suitable nutrients in deficiencies/malnutrition/diseases	PO-1	Understand, Apply
CO-2	To familiarize with fundamentals of nutrients, their functions, quality indicators and their relationship to health	PO-3	Understand
CO-3	Analyse and describe protein metabolism and various methods for evaluating protein quality	PO-1, PO-2	Apply and analyze
CO-4	Regulation concepts of energy metabolism, food intake	PO-1	Understand

Modules	Course Content	Duration
1.	<p><b>A. Basis for computing nutrient requirements</b></p> <p>Latest concepts in dietary recommendations, RDA- ICMR and WHO: their uses and limitations.</p> <p><b>B. Body fluids and water balance:</b> Body water compartments. Regulation of water balance, disorders of water imbalance</p>	10hrs
2.	<p><b>Body composition:</b></p> <p>Body compartment models, Compositional changes during life cycle, Methods of studying body composition- underwater weighing, air displacement technique, DXA (dual X-ray absorptiometry), anthropometry, bio-electrical impedance. Significance of Body composition analysis.</p>	8hrs
3.	<p><b>A. Energy metabolism:</b></p> <p>Basal and resting metabolism- influencing factors. Methods to determine energy requirements &amp; expenditure. Thermogenesis, adaptation to altered energy intake, latest concepts in energy requirements and recommendations for different age groups.</p> <p><b>B. Regulation of food intake:</b> Hunger, Appetite and satiety– neural centers for regulation of food intake.</p>	10hrs
4.	<p><b>A. Carbohydrates:</b></p> <p>Occurrence and physiological functions, Glycemic index and glycemic load of foods and their uses, intrinsic and extrinsic factors affecting glycemic index. Dietary fiber-types, sources, effect on intestinal physiology and its role in health and disease. Alternate sweeteners – Synthetic and natural. Role of carbohydrates in oral health and Dental caries.</p>	10hrs

## B. Lipids:

Occurrence, types (visible and invisible fats, EFA, SFA, MUFA, PUFA), sources and physiological functions. Lipoproteins – Types and functions. Role of lipoproteins, cholesterol & triglycerides in health and disease.

**C. Proteins and Amino Acids:** Nutritional classification, types, sources and physiological functions. Concepts of Biological value of proteins, essential and non-essential amino acids- their role in growth and development. Protein quality (PER, PDCAAS), digestibility, improving protein quality, Nitrogen balance.

## Reference:

1. Bamji, M. S., Krishnaswamy, K., & Brahmam, G. N. V. (Eds.). (2013). Textbook of human nutrition. Oxford & IBH.
2. Caballero, B. (2012). Encyclopedia of human nutrition. L. H. Allen, & A. Prentice (Eds.). Academic press.
3. Mann, J., & Truswell, S. (2012). Essentials of human nutrition. Oxford University Press.
4. Shills ME, Olson JA, Shike M & Ross AC. 1999 Modern Nutrition in Health and Disease. Williams & Wilkins

<b>Course Title</b>	<b>LIFE CYCLE NUTRITION</b>	
<b>Course Type</b>	<b>DSC</b>	<b>Total Hours - 48</b>
<b>Course Code</b>		<b>Hours/Week – 03+08 (activity)</b>

## MAPPING of Course Outcomes (CO'S) with PO's AND CDL's

<b>CO's</b>	<b>Course Outcomes On completion of the course the student will learn to</b>	<b>POs Addressed</b>	<b>CDL</b>
<b>CO-1</b>	Point out adequate nutritional requirements and dietary principles throughout the human life cycle	<b>PO-1, PO-4, PO-8</b>	<b>Understand, Apply</b>
<b>CO-2</b>	Plan a balanced diet and adequate nutritional support for different age groups	<b>PO-1, PO-4</b>	<b>Apply</b>
<b>CO-3</b>	To gain knowledge about the physiological considerations and nutritional needs during human life cycle	<b>PO-1, PO-6</b>	<b>Understand</b>
<b>CO-4</b>	To compute gender and age-specific recommended dietary allowances of various nutrients	<b>PO-1</b>	<b>Understand</b>



Modules	Course Content	Duration
<b>1. Nutrition during life span-</b>		<b>10hrs</b>
	<p><b>A.</b> Pregnancy: Physiological adjustments, Nutritional requirements, Nutritional status of Indian pregnant women. Effect of malnutrition on outcome of pregnancy.</p> <p><b>B.</b> Lactation: physiology of lactation, Factors affecting lactation, nutritional requirements. Effect of lactation on maternal malnutrition and fertility.</p>	
<b>2. Infancy-</b>		<b>10hrs</b>
	Growth and development, nutritional requirement in the first 1000 days ( <i>in utero</i> and post natal), advantages of breast feeding, compositional differences between human milk and milk substitutes and their suitability for infant feeding. Preterm babies, weaning practices, weaning and supplementary foods. Human milk bank - Benefits (Pre-term babies, NICU), Donor Breast milk – considerations, milk banking process, pasteurization of human breast milk. Human milk banks in India.	
<b>3.A. Preschool age:</b>		<b>10hrs</b>
	Growth and Development, nutrient requirements, factors influencing food intake, special care in feeding preschoolers, nutritional concerns.	
	<b>B. School age and adolescent children:</b> Growth and Development- physiologic and psychological changes, nutrient requirements, food choices and health habits, nutritional problems.	
<b>4.A. Young adults:</b>		<b>10hrs</b>
	Nutrient requirements, food choices and health habits, Nutritional status of Indian adult population, common nutritional problems.	
	<b>B. Elderly:</b> Physiologic changes, Nutrient requirements, Special needs, Nutritional problems.	
	<b>Reference:</b>	
	<ol style="list-style-type: none"> <li>Mary Kay Mitchell. (2015). Nutrition across the life span. MEDTECH, Scientific international Pvt ltd.</li> <li>Nnakwe, N. (2012). Community nutrition: planning health promotion and disease prevention. Jones &amp; Bartlett Publishers.</li> <li>Paul Insel, Don Ross et al (2013). Discovery nutrition, Library of congress cataloging. Jones and Bartlett Publisher</li> <li>Nutrition and the Developing Brain, edited by Victoria Hall Moran, Nicola M. Lowe, CRC Press</li> <li>Sari Edelstein and Judith Sharlin (2009). Essential of life cycle nutrition evidence-based approach Jones and Bartlett Publisher.</li> <li>Mahan, L. K., &amp; Raymond, J. L. (2016). Krause's food &amp; the nutrition care process. Elsevier Health Sciences.</li> <li>Shills ME, Olson JA, Shike M &amp; Ross AC. 1999 Modern Nutrition in Health and Disease. Williams &amp; Wilkins.</li> </ol>	

<b>Course Title</b>	<b>FOOD MICROBIOLOGY</b>	
<b>Course Type</b>	<b>DSE-G</b>	<b>Total Hours - 32</b>
<b>Course Code</b>		<b>Hours/Week - 02</b>

**MAPPING of Course Outcomes (CO'S) with PO's AND CDL's**

<b>CO's</b>	<b>Course Outcomes On completion of the course the student will learn to</b>	<b>POs Addressed</b>	<b>CDL</b>
<b>CO-1</b>	Enable to explain the interactions between microorganisms and the food environment	<b>PO-1, PO-4, PO-8</b>	<b>Understand, Apply</b>
<b>CO-2</b>	factors influencing their growth and survival	<b>PO-1, PO-4</b>	<b>Apply</b>
<b>CO-3</b>	apply the microbiological quality in food production	<b>PO-1, PO-6</b>	<b>Understand</b>
<b>CO-4</b>	Learn the rationale for the use of standard methods and procedures for the microbiological analysis of food	<b>PO-1</b>	<b>Analyze</b>

<b>Module</b>	<b>Content</b>	<b>Duration</b>
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- |           |   |              |
|-----------|---|--------------|
| <b>1.</b> | <b>Microorganisms of importance in food:</b>  | <b>10hrs</b> |
|           | <ul style="list-style-type: none"> <li>A. Food and microorganisms- bacteria, yeast, molds, fungi and viruses- general characteristics, classification and identification</li> <li>B. Factors affecting the growth or microorganisms in food- intrinsic and extrinsic parameters that affect microbial growth</li> <li>C. Microorganisms and their importance in food microbiology (fermentation, health foods and enzymes)</li> </ul> |              |
| <b>2.</b> | <b>Contamination and spoilage of foods:</b>   | <b>10hrs</b> |
|           | <b>sources of contamination, principles underlying spoilage- chemical changes caused by microorganisms in :</b> <ul style="list-style-type: none"> <li>A. Cereals, pulses and their products</li> <li>B. Vegetables and fruits</li> <li>C. Flesh foods, eggs and poultry</li> <li>D. Milk and milk products</li> </ul>  |              |
| <b>3.</b> | <b>Methods for the Microbiological examination and Microbial Quality of foods</b>   | <b>6hrs</b>  |
|           | <ul style="list-style-type: none"> <li>A. Identification of microorganisms</li> <li>B. Culture and enumeration techniques</li> <li>C. Rapid methods and detecting spoilage specific microorganisms</li> <li>D. Quality control using microbiological criteria</li> <li>E. Codes of GMP, HACCP concept and quality system</li> </ul>   |              |

**4. Food hazards of microbial origin****6hrs**

A. Food Borne Diseases-Types, Food Borne Intoxications-Staphylococcal poisoning,

Bacillus cereus poisoning, Botulism.

B. Food Borne Infections- Salmonellosis, Shigellosis, Vibrio gastroenteritis, E.Coli, Hepatitis A and Shellfish poisoning, Food Borne Toxic infections-Clostridium perfringens, E.coli gastroenteritis, Cholera, Listeriosis, Yersinia, Campylobacter, Mycotoxins- Aflatoxicosis, Ergotism

C. Naturally occurring toxicants-Lathyrism, epidemic dropsy and veno-occlusive disease

**Reference:**

1. William C Frazier, Dennis C Westoff, K N Vanitha. Food Microbiology. McGraw-Hill Education.
2. Geeta Sumbali, RS Mehrotra. Principles of microbiology. Tata McGraw-Hill education pvt ltd
3. Jeffrey Pommerville. Alcamo's fundamentals of microbiology. Jones & Bartlett India Pvt Ltd.

<b>Course Title</b>	<b>PUBLIC HEALTH NUTRITION</b>	
<b>Course Type</b>	<b>DSE-AE</b>	<b>Total Hours - 32</b>
<b>Course Code</b>		<b>Hours/Week - 02</b>

**MAPPING of Course Outcomes (CO'S) with PO's AND CDL's**

<b>CO's</b>	<b>Course Outcomes On completion of the course the student will learn to</b>	<b>POs Addressed</b>	<b>CDL</b>
<b>CO-1</b>	Enable to assess public health nutrition problems and design appropriate education strategies.	PO-2, PO-3, PO8, PO-9, PO-10	<b>Understand, Apply</b>
<b>CO-2</b>	To gain an understanding of the importance of nutrition education in bringing about behavior change in the community	PO-3, PO-8, PO9, PO-10PO	<b>Apply</b>
<b>CO-3</b>	Express the significance and scope of public nutrition, Apply the nutrition techniques and findings for the use of societal health needs	PO-1, PO-2, PO-6	<b>Understand</b>
<b>CO-4</b>	Examine the nutritional education and intervention programs to overcome the epidemic of communicable and non-communicable diseases	PO-3, PO-8, PO9, PO-10, PO-11, PO-12	<b>Analyze</b>

<b>Module</b>	<b>Course Content</b>	<b>Duration</b>
<b>1.</b>	<p><b>A. Concept of public health nutrition-</b></p> <p>relationship between health and nutrition, role of public health nutritionists in the health care delivery.</p> <p><b>B. Food and nutrition security-</b> food production, distribution, access, availability and consumption. Socio cultural aspects and dietary patterns: their implication for nutrition and health.</p>	<b>8hrs</b>
<b>2.</b>	<p><b>A. Health care facility-</b></p> <p>primary health care of the community, health care delivery system.</p> <p><b>B. Determinants of nutrition and health status-</b> socio cultural, biologic, environmental and economic factor, indicators of health and malnutrition.</p>	<b>8hrs</b>
<b>3.</b>	<p><b>Link between nutrition and demographic changes</b></p> <p>Health and nutrition transitions, Economical and public health implications of micro nutrient deficiencies, impact on productivity and national development.</p>	<b>8hrs</b>
<b>4.</b>	<p><b>A. Approaches and strategies for improving nutritional status and health:</b></p> <p><b>a.</b> National nutrition policy: need for nutrition policy, policy strategies and their implementation</p> <p><b>b.</b> Nutrition programs: National anemia prophylaxis program, Prevention of night blindness, Vitamin A prophylaxis program, National iodine prophylaxis program,</p> <p><b>c.</b> Goiter control program ICDS</p> <p><b>d.</b> National nutrition surveillance system (NNMB). Food for work etc.</p> <p><b>e.</b> NGO in community development operations</p> <p><b>B. Nutrition Education-</b> Importance of Nutrition Education in Public Health Nutrition.</p>	<b>8hrs</b>

**Reference:**

1. Sheila Chander Vir. Public Health Nutrition in developing countries (Part I & II). Woodhead Publishing India Pvt. Ltd.
2. Mark Lawrence & Tony Worsley. Public Health Nutrition- From principles to practice. Allen & Unwin.
3. Mishra RC. Health & Nutrition Education. APH Publication corporation.

<b>Course Title</b>	<b>ASSESSMENT OF NUTRITIONAL STATUS</b>	
<b>Course Type</b>	<b>DSE-AE</b>	<b>Total Hours - 32</b>
<b>Course Code</b>		<b>Hours/Week - 02</b>

**MAPPING of Course Outcomes (CO'S) with PO's AND CDL's**

<b>CO's</b>	<b>Course Outcomes On completion of the course the student will learn to</b>	<b>POs Addressed</b>	<b>CDL</b>
<b>CO-1</b>	Be able to use appropriate tools, data interpretation and assess nutritional status of the community	PO3, PO4, PO7	<b>Understand, Apply</b>
<b>CO-2</b>	To familiarize students with the fundamentals of anthropometric techniques	PO3	<b>Understand</b>
<b>CO-3</b>	Assessment of nutritional status and report submission- Self assessment and community assessment (any one educational institute to be selected and practical skill to be implemented).	PO4, PO7	<b>Apply</b>
<b>CO-4</b>	Identify the individual's body composition by using different assessment tools or methods	PO3, PO4, PO7	<b>Analyze</b>

**Module**

**Course Content**

**Duration**

**1. Indirect methods:**

**6hrs**

Demography, population dynamics and vital events and their health implications, indicators of health and nutrition (IMR, TMR, MMR).

**2. Direct methods:**

**10hrs**

Anthropometry, Biochemical, Clinical, Dietary and Functional indices of assessments

**A. Anthropometry:** Methods, reference standards in children and adults, scales of comparison (percentiles, Z score), classification and interpretation of somatic data, somatic indicators of PEM. Clinical application of Anthropometry

**B. Biochemical:** Use of specimen types, indicators of protein-energy status, anemia, immune function, CVD risk, oxidative stress. Urine and stool analyses.

**C. Dietary-** Methods, nutrient intake analysis, dietary assessment in special populations and specific situations, Dietary reference intakes, Application

**D. Clinical-** Components of clinical assessment, associations with nutrient deficiencies and biochemical status, Interpretation of clinical signs

**3. Assessing food and nutritional intake –**

**8hrs**

Definition and assessment schedules, National and household food security. Factors

affecting food security system. National and International systems to improve food security.

**4. Methods of dietary assessment:**

**8hrs**

(24hr recall, FFQ, Dietary diversity score) and its application, processing and analysis of dietary data.

**Reference**

1. Rosalind S Gibson. Principles of Nutritional assessment. Oxford University Press.
2. Robert D Lee, David C Nieman. Nutritional assessment. McGraw Hill Higher Education.
3. Jelliffe DB. 1966. The Assessment of the Nutrition Status of the Community. WHO.

**I YEAR - SECOND SEMESTER**

**COURSE I - FOOD SCIENCE AND FOOD PROCESSING- II**

<b>Course Title</b>	<b>FOOD SCIENCE AND FOOD PROCESSING- II</b>	
<b>Course Type</b>	<b>DSC</b>	<b>Total Hours - 64</b>
<b>Course Code</b>		<b>Hours/Week – 04+04 (practical)</b>

**MAPPING of Course Outcomes (CO'S) with PO's AND CDL's**

<b>CO's</b>	<b>Course Outcomes On completion of the course the student will learn to</b>	<b>POs Addressed</b>	<b>CDL</b>
<b>CO-1</b>	Students will be able to understand the effects of common food processing systems and food storage conditions	<b>PO-1</b>	<b>Understand and analyze</b>
<b>CO-2</b>	To Study of variables and quality factors of products from the food commodities	<b>PO-5</b>	<b>Understand, Analyze</b>
<b>CO-3</b>	Visit to food processing industries, food product preparation including various food groups.	<b>PO7</b>	<b>Apply</b>
<b>CO-4</b>	Apply skills to work in food processing industries and to build career as entrepreneur	<b>PO7</b>	<b>Understand and apply</b>

Modules	Course Content	Duration
1.	<b>Fats and oils:</b> Properties, manufacture, uses in food systems (as cooking media and shortening). Changes while cooking, Rancidity- types, mechanism and prevention. Use of fat replacers/ substitutes in processed foods.	6hrs
2.	<b>A. Milk and milk products:</b> Composition, functionality in food system, processing of different products like ghee, butter, milk powders, khoa, paneer, cheese, milk products and ice-cream. <b>B. Eggs:</b> Structure and composition, changes on cooking, functional properties and products, Quality grading.	6hrs
3.	<b>A. Flesh foods:</b> Meat and poultry- Types, composition, structure of muscle, conversion of muscle to meat (rigor mortis, ageing, tenderizing), physico -chemical changes, cooking and processing. <b>B. Marine foods:</b> Types, composition, cooking and processing, spoilage.	6hrs
4.	<b>A. Sugar and jaggery:</b> Principles of sugar crystallization, stages of cookery and role in Indian traditional sweet preparations, manufacturing of candies and sweets <b>B. Manufacturing process (in brief) of coffee, tea, cocoa, alcoholic beverages (fruit wines). Ready to serve beverages,</b>	6hrs

**Practical Sessions:** Study of preparation variables and quality factors of products from the following food commodities.

Modules	Commodities	Duration
1.	Fats and Oils.	8hrs
2.	Milk and egg.	8hrs
3.	Flesh Foods.	8hrs
4.	Sugar and Jaggery.	8hrs
5.	Food product preparation	8hrs

#### Reference:

1. Manay, N. S. O. (2001). Food: facts and principles. New Age International.
2. Potter, N. N., & Hotchkiss, J. H. (2012). Food science. Springer Science & Business Media.
3. Rahman, M. S. (Ed.). (2009). Food properties handbook. CRC press.
4. Fellows PJ(2009).Food processing technology, principle and practices. Wood head publishing India Pvt Ltd, New Delhi 3<sup>rd</sup> edition.
5. Dr. Swaminathan, Handbook of Food and Nutrition. Vol I and Vol II. The Bangalore Press.
6. B. Srilakshmi (2018). Food Science. 7<sup>th</sup> Multicolour Edition. New Age International Publishers.

7. Sharma, Avantina. Textbook of Food Science and Technology. CBS publication and Distributors Pvt. Ltd.

<b>Course Title</b>	<b>VITAMINS IN NUTRITION</b>	
<b>Course Type</b>	<b>DSC</b>	<b>Total Hours - 64</b>
<b>Course Code</b>		<b>Hours/Week – 04 + 04 (Practical)</b>

### MAPPING of Course Outcomes (CO'S) with PO's AND CDL's

CO's	Course Outcomes On completion of the course the student will learn to	POs Addressed	CDL
<b>CO-1</b>	To study the metabolism, functions and deficiencies of vitamins and factors affecting nutrient interactions, Proximate principles of the food samples,	<b>PO1</b>	<b>Understand, Apply</b>
<b>CO-2</b>	Differentiate the various analytical procedures available	<b>PO1, PO2</b>	<b>Analyze</b>
<b>CO-3</b>	Choose and implement the procedures best suited for sample preparation, and estimation of particular constituents in the food sample	<b>PO2, PO4</b>	<b>Apply</b>
<b>CO-4</b>	To suggest practical dietary based strategies for overcoming vitamins deficiencies in various age groups.	<b>PO1, PO2</b>	<b>Analyze and apply</b>

Modules	Course Content	Duration
<b>1. Introduction-</b>	History, Definition of terms- requirements, RNI, UTNI, protective nutrient intake, food-based approaches to meet the need for vitamins, physico-chemical properties, general functions,	<b>6hrs</b>
<b>2. Analytical methods and compositional data sources</b>	ADME concept, bioavailability, factors affecting variations/losses of vitamins in food.	<b>6hrs</b>
<b>3. Classification-</b> Fat soluble and Water-soluble vitamins		<b>6hrs</b>
<b>A. Water soluble vitamins</b>	Vitamin C, thiamin, riboflavin, niacin, pantothenic acid, biotin, folic acid (Physicochemical properties, stability, biochemical indicators, factors affecting requirements).	
<b>B. Fat soluble vitamins</b>	Vitamin A- stability and modes of degradation, role in visual cycle, functions of carotenoids Vitamin D- Formation in the skin, photochemical regulation and factors affecting synthesis of vitamin D3 in human body, supplements. Vitamin E – Vitamin E as a part of endogenous antioxidant system Vitamin K – Role in blood clotting process, anti-platelet aggregation, anti-clotting drugs (vitamin K- agonists and antagonists).	<b>6hrs</b>



## Practical Sessions: FOOD ANALYSIS

Modules	Course Content	Duration
	1. Determination of moisture, Ash - total, acid soluble and insoluble.	8hrs
	2. Determination of Protein in foods.	8hrs
	3. Determination of Fat – Crude fat.	8hrs
	4. Carbohydrates – Free sugars, Starch (Total & available), Dietary fiber.	8hrs
	5. Mineral estimation – Dry and wet ashing, calcium, iron, phosphorous.	8hrs
	6. Vitamin estimation – Ascorbic acid and $\beta$ carotene.	8hrs

### Reference:

- Bamji, M. S., Krishnaswamy, K., & Brahmam, G. N. V. (Eds.). (2013). Textbook of human nutrition. Oxford & IBH.
- Zimmermann, M. (2001). Burgerstein's Handbook of nutrition: micronutrients in the prevention and therapy of disease.
- David A Bender. (2003) Nutritional Biochemistry of the Vitamins. 2<sup>nd</sup> Ed. Cambridge Press.
- B. Srilakshmi (2017), Nutrition Science. 6<sup>th</sup> Multicolor Ed. New Age International Publishers.
- Sareen S Gropper, Jack L Smith. Advanced Nutrition and Human Metabolism. 6<sup>th</sup> Ed. Wadsworth Cengage Learning.
- Report of a joint FAO/WHO expert consultation Bangkok, Thailand. Human Vitamin and Mineral Requirements. 2001.
- L. Kathleen Mahan, Sylvia E Stump (2007). Krause's Food and Nutrition Therapy. 12<sup>th</sup> Ed.

<b>Course Title</b>	<b>MINERALS IN NUTRITION</b>	
<b>Course Type</b>	<b>DSC</b>	<b>Total Hours - 48</b>
<b>Course Code</b>		<b>Hours/Week – 03</b>

### MAPPING of Course Outcomes (CO'S) with PO's AND CDL's

CO's	Course Outcomes On completion of the course the student will learn to	POs Addressed	CDL
CO-1	To study the metabolism, functions and deficiencies of minerals and factors affecting nutrient interactions,	PO1	Understand, Apply
CO-2	Bioavailability, bio accessibility and enumerate its importance.	PO1, PO2	Analyze
CO-3	To impart in depth knowledge on ADME concept, functions and deficiency disorders.	PO2, PO3	Understand, Apply

<b>CO-4</b>	To suggest practical dietary based strategies for overcoming mineral deficiencies in various age groups. To minimize nutrient-mineral interactions for better absorption.	<b>PO1, PO2</b>	<b>Analyze and apply</b>
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<b>Modules</b>	<b>Course Content</b>	<b>Duration</b>
<b>1. Introduction –</b>	Characteristics of minerals, bioavailability, mineral-mineral interaction, mineral composition of the body, food-based approaches to meet the demand, physico- chemical properties, general functions, analytical methods and source of data, ADME concept, factors affecting variations/ losses in food, distribution in fluid compartments.	<b>10hrs</b>
<b>2. Classification – Macro minerals.</b>	Macro minerals – Calcium, Phosphorus, Magnesium, Sodium, Potassium, Sulphur and Chloride <b>Calcium</b> - determinants of calcium balance, disorders associated with calcium deficiency and toxicity, nutritional factors affecting calcium requirement, osteoporosis- factors determining peak bone mass and loss of bone. <b>Magnesium</b> – role in blood pressure control <b>Sodium</b> – sodium balance, sodium intakes among Indians, role in blood pressure control <b>Potassium</b> –potassium balance, role in acid-base balance, disorders associated with acid base imbalance, role in blood pressure control	<b>16hrs</b>
<b>3. Micro minerals –</b>	Iron, Zinc, copper, manganese, iodine, selenium, chromium, fluoride and molybdenum <b>Iron</b> –iron requirements – basal losses, growth, and menstrual losses. Dietary iron absorption (haem and non-haem), factors influencing non-haem iron absorption, deficiency- causes, symptoms, prevalence and prevention, iron overload <b>Zinc</b> –maternal zinc deficiency, RNA/ DNA synthesis, reproductive health, toxicity. <b>Copper</b> – Wilson’s disease <b>Selenium</b> – Immune function, role in antioxidant defense system, selenium and thyroid function <b>Chromium</b> – role in glucose utilization and insulin action <b>Iodine</b> - Iodine deficiency disorders <b>Fluoride</b> – Fluoridation of water, Fluoride belt and fluorosis	<b>18hrs</b>
<b>4. Ultra-trace minerals –</b>	Significance in Human nutrition.	<b>4hrs</b>

**Note:** All nutrients to be dealt in the following sub headings apart from the topics mentioned above with respect to each mineral.

Occurrence and distribution, physical properties, tissue distribution and physiological functions, metabolism (ADME) and body homeostasis, dietary sources, factors promoting and impairing absorption, bio availability, interactions with other nutrients, assessment of requirement and intake, assessment of status- biological indicators, risk factors, causes, symptoms and prevention of deficiency/ toxicity.

**Reference:**

1. Bamji, M. S., Krishnaswamy, K., & Brahmam, G. N. V. (Eds.). (2013). Textbook of human nutrition. Oxford & IBH.
2. Zimmermann, M. (2001). Burgerstein's Handbook of nutrition: micronutrients in the prevention and therapy of disease.
3. B. Srilakshmi (2017), Nutrition Science. 6<sup>th</sup> Multicolor Ed. New Age International Publishers.
4. Sareen S Gropper, Jack L Smith. Advanced Nutrition and Human Metabolism. 6<sup>th</sup> Ed. Wadsworth Cengage Learning.
5. Report of a joint FAO/WHO expert consultation Bangkok, Thailand. Human Vitamin and Mineral Requirements. 2001.
6. L. Kathleen Mahan, Sylvia E Stump (2007). Krause's Food and Nutrition Therapy. 12<sup>th</sup> Ed.

<b>Course Title</b>	<b>FOOD LAWS AND FOOD SAFETY</b>	
<b>Course Type</b>	<b>DSC</b>	<b>Total Hours - 48</b>
<b>Course Code</b>		<b>Hours/Week – 03</b>

**MAPPING of Course Outcomes (CO'S) with PO's AND CDL's**

<b>CO's</b>	<b>Course Outcomes On completion of the course the student will learn to</b>	<b>POs Addressed</b>	<b>CDL</b>
<b>CO-1</b>	The course will enable candidates to identify and minimize food related health hazards in food business operations	<b>PO1</b>	<b>Understand, Apply</b>
<b>CO-2</b>	Enables to implement FSSAI regulations, Demonstration of adulteration in food samples, Classroom level skit performances on related topics.	<b>PO1, PO2, PO8</b>	<b>Analyze</b>
<b>CO-3</b>	To study the importance of food safety, hygiene in handling, preparation and storage of food in food processing units and food service institutions	<b>PO7, PO2, PO3</b>	<b>Apply</b>
<b>CO-4</b>	To understand the regulatory aspects both at National and International level.	<b>PO5, PO1, PO2</b>	<b>Analyze and apply</b>

**Modules****Course Content****Duration****1. Concepts****12hrs**

General Concepts and meaning of Food quality and Food Safety, Total Quality Management, Food quality Factors -appearance, texture flavor, Food adulteration, food related hazards- biological, chemical, physical and trace elements. Microbial considerations in food safety.

- 2. Natural toxins in food-** **6 hrs**  
An overview, Regulatory concerns, Significance in health.
- 3. Food laws and regulations –** **16hrs**  
concepts and trends in Food Legislation. International and Federal standards – WHO, FAO, Codex, ISO series and Health Star ratings. Food laws in India, Governing bodies- Bureau of India standards (BIS), HACCP, Food Safety and Standards Act, 2006 (FSSAI), Food policies, Food certification, Nutritional labeling.
- 4. Exposure, estimation, toxicological requirements and risk assessment.** **14hrs**  
**A.** Safety aspects of water and beverages such as soft drinks, tea, coffee, cocoa.  
**B.** Safety assessment of food contaminants, pesticide residues and packaging material (plastics).  
**C.** Safety evaluation of processed foods (RTC, RTE, RTD, Nano-processed foods and related processing techniques.

**Reference:**

1. Kiron Prabhakar. A Practical guide to food laws and regulations. 1<sup>st</sup> Ed. Bloomsbury.
2. Sunetra Roday (2017). Food hygiene and sanitation. 2<sup>nd</sup> Ed. McGraw Hill Publications.
3. Pulkit Mathur (2018). Food Safety and Quality Control (2018).

<b>Course Title</b>	<b>NUTRITIONAL EPIDEMIOLOGY</b>	
<b>Course Type</b>	<b>DSE-G</b>	<b>Total Hours - 48</b>
<b>Course Code</b>		<b>Hours/Week – 03</b>

**MAPPING of Course Outcomes (CO'S) with PO's AND CDL's**

<b>CO's</b>	<b>Course Outcomes On completion of the course the student will learn to</b>	<b>POs Addressed</b>	<b>CDL</b>
<b>CO-1</b>	To improve health and nutritional status of the population	<b>PO1, PO2, PO3, PO5, PO7</b>	<b>Understand, Apply</b>
<b>CO-2</b>	To enable students to identify and contribute to the prevention of under-nutrition and non- communicable diseases prevalent in the population	<b>PO1, PO2, PO8</b>	<b>Analyze</b>
<b>CO-3</b>	Analyze the importance of epidemiology of policy and practice in the prevention and management of public health problems	<b>PO1, PO2, PO3, PO4, PO7</b>	<b>Apply</b>
<b>CO-4</b>	Summarize the use of epidemiological studies in malnutrition to combat malnourishment	<b>PO1, PO3</b>	<b>Analyze and apply</b>

<b>Modules</b>	<b>Course Content</b>	<b>Duration</b>
<b>1. Epidemiology-</b>	Historical aspects, Definition, Aims and uses, Principles and application of epidemiology. Measurement of morbidity and mortality, incidence, prevalence, age- adjustment and survival analysis, life expectancy, years of potential life lost, disability- adjusted life years (DALYs). Health-adjusted life expectancy (HALE), use of morbidity and mortality statistics.	<b>10hrs</b>
<b>2. Nutrition epidemiology-</b>	Definition, Determinants of disease, Link between eating behavior and chronic diseases. Importance of nutritional epidemiology in developing countries Diet- assessment methods used in epidemiologic research- Observation, diet history, 24-hour recall, Food frequency questionnaire, physical activity. Processing and analysis of dietary data.	<b>10hrs</b>
<b>3. Field based study designs –</b>	Observational studies, Cross-sectional, case-controlled, cohort studies. Methods of sampling, sample size.	<b>14hrs</b>
<b>4. Classic Nutritional epidemiology studies-</b>	Study design and methodology of selected studies - NNMB, National Family Health survey (NHFS), Framingham heart study, Dietary Approaches to stop Hypertension (DASH), Chennai urban rural epidemiological studies (CURES II).	<b>14hrs</b>

**Reference:**

1. Walter Willett (2012). Nutritional Epidemiology. 3<sup>rd</sup> Ed. Oxford University Press.
2. Gail C. Frank (2008) Community Nutrition- Applying epidemiology to contemporary Practice. 2<sup>nd</sup> Ed. Jones and Bartlett Publishers.
3. Sheila Chander Vir (2011). Public Health Nutrition in developing countries (Part I & II). Woodhead Publishing India Pvt. Ltd.
4. Mark Lawrence & Tony Worsley (2008). Public Health Nutrition- From principles to practice. 1<sup>st</sup> Ed. Allen and Unwin.

<b>Course Title</b>	<b>NUTRACEUTICALS AND FUNCTIONAL FOODS</b>	
<b>Course Type</b>	<b>DSE-SE</b>	<b>Total Hours - 48</b>
<b>Course Code</b>		<b>Hours/Week – 03</b>

**MAPPING of Course Outcomes (CO'S) with PO's AND CDL's**

<b>CO's</b>	<b>Course Outcomes On completion of the course the student will learn to</b>	<b>POs Addressed</b>	<b>CDL</b>
<b>CO-1</b>	To suggest practical diet-based approaches to improve consumption of nutraceutical/functional foods for all age groups and with special reference to disease specific groups	<b>PO1, PO2, PO3, PO4, PO7, PO9, PO10</b>	<b>Understand, Apply</b>
<b>CO-2</b>	To understand the classification and functions of nutraceuticals, functional foods, dietary supplements and antioxidants	<b>PO1, PO2, PO3, PO4, PO7, PO9,</b>	<b>Analyze</b>
<b>CO-3</b>	Product development using various functional food as key ingredients and report submission.	<b>PO1, PO2, PO4, PO9,PO10</b>	<b>Apply</b>
<b>CO-4</b>	Relate nutraceutical importance in risk reduction of diseases	<b>PO1, PO2, PO3,PO4,PO7, PO9, PO10</b>	<b>Analyze and apply</b>

<b>Modules</b>	<b>Course Content</b>	<b>Duration</b>
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**1. Nutraceuticals:**

**12hrs**

- A.** Use of nutraceuticals in traditional health sciences. Their role in prevention and control of diseases.
- B.** Definition, Classification, food and non-food sources, mechanism of action. Role Of omega-3, fatty acids, carotenoids, dietary fiber, phytoestrogens; glucosilates; organo-sulphur compounds as nutraceuticals.

**2. Prebiotics, Probiotics, Synbiotics, Postbiotics:**

**12hrs**

definition, characteristics, types, sources, their effects on gut microbes. Role in health promotion and in chronic diseases. Production, application in health foods and safety issues.

**3. Functional foods**

**12hrs**

Definition, development of functional foods, benefits and sources of functional foods in Indian diet. Effects of processing conditions and storage; Development of biomarkers to indicate efficacy of functional ingredients; Research frontiers in functional foods.

**4. Development of nutraceutical and functional foods – 12hrs**

Standards for health claims. Process of developing, preclinical & clinical studies, Marketing and Regulatory issues, Regulatory bodies in India.

**Reference:**

1. Debasis Bagchi. Nutraceutical & Functional Food Regulation in the US and around the world (2014). 2<sup>nd</sup> Ed. Academic Press, Elsevier.
2. Yasha Jahu Pomeranz (1991). Functional Properties of Food Components. 2<sup>nd</sup> Ed. Academic Press Elsevier.
3. Geoffrey P. Webb (2011) Dietary Supplements & Functional Foods. 2<sup>nd</sup> Ed. Wiley Blackwell.

<b>Course Title</b>	<b>FOOD ADDITIVES</b>	
<b>Course Type</b>	<b>DSE-AE</b>	<b>Total Hours - 32</b>
<b>Course Code</b>		<b>Hours/Week – 02</b>

**MAPPING of Course Outcomes (CO'S) with PO's AND CDL's**

<b>CO's</b>	<b>Course Outcomes On completion of the course the student will learn to</b>	<b>POs Addressed</b>	<b>CDL</b>
<b>CO-1</b>	Diverse food additives used in the food industries for various purposes.	PO1, PO2, PO3, PO4, PO7, PO9, PO10	<b>Understand, Apply</b>
<b>CO-2</b>	Food additives intake assessments, their risk and benefits and some hypersensitivity reactions related to food additives usage.	PO1, PO2, PO3, PO4, PO7, PO9,	<b>Analyze</b>
<b>CO-3</b>	Application of food additives in food and food application	PO1, PO2, PO4, PO9, PO10	<b>Apply</b>
<b>CO-4</b>	Chemical, technological and toxicological aspects additives	PO1, PO2, PO3, PO4, PO7, PO9, PO10	<b>Analyze and apply</b>

**Modules**

**Course Content**

**Duration**

**1. Food additives-**

**8hrs**

Definition, history, classification, role of additives in processed foods, e- numbers, role of codex commission, safety evaluation of food additives, setting ADI for food additives.

**2. Chemical, technological and toxicological**

**8hrs**

aspects of acid, base buffer systems, salts and chelating/sequestering agents, leavening agents, antioxidants, emulsifying and stabilizing agents, anti-caking agents, thickeners, firming agents, flour bleaching agents and bread improvers, additives used in dietetic formulations.

**3. A. Sweetening agents-**

**8hrs**

History, properties and food applications of various artificial sweeteners, ADI, food applications, advantages and disadvantages, safety evaluation.

**B. Natural and synthetic colors-** history, need for food coloring, classification, basic properties, benefits of natural colors, types, health hazards associated with synthetic food colors, permissible levels, safety evaluation, food applications.

**4. Food flavors-**

**8hrs**

Classification, spices and flavoring constituents, methods of extracting flavoring compounds, factors affecting flavor perception, application of flavor in food industries.

**Reference:**

1. WHO. Evaluation of Certain Food Additives: WHO Technical Report Series-913. 2002.
2. B. Srilakshmi (2004). Dietetics. 7<sup>th</sup> Ed. New Age International pvt. ltd.
3. Manay, N. S. O. (2001). Food: facts and principles. New Age International.
4. A Larry Branen, P Michael Davidson, Seppo Salimen, John H Thorngate III (2002). Food Additives. 2<sup>nd</sup> Ed. Marcel Dekker Inc.

**OPEN ELECTIVE FOR OTHER STUDENTS**

<b>Course Title</b>	<b>HEALTHY LIFESTYLE AND NUTRITION</b>	
<b>Course Type</b>	<b>DSE-GE</b>	<b>Total Hours - 64</b>
<b>Course Code</b>		<b>Hours/Week – 03+01 (Demo Practical)</b>

**MAPPING of Course Outcomes (CO'S) with PO's AND CDL's**

<b>CO's</b>	<b>Course Outcomes On completion of the course the student will learn to</b>	<b>POs Addressed</b>	<b>CDL</b>
<b>CO-1</b>	Healthy lifestyle which could be adopted for preventing lifestyle related disorders	PO1, PO2, PO3, PO4, PO7,	<b>Understand, Apply</b>
<b>CO-2</b>	To gain knowledge on consequences of poor eating habits	PO1, PO2, PO3, PO4, PO7, PO9,	<b>Apply, understand</b>
<b>CO-3</b>	Understand the link between health, nutrition and diseases	PO1, PO2, PO4, PO9, PO10	<b>Apply</b>
<b>CO-4</b>	Will be able to identify the key vitamins and minerals	PO1, PO2,	<b>understand and</b>



	and their contribution to health	PO3,PO4,PO7, PO9, PO10	<b>apply</b>
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<b>Modules</b>	<b>Course Content</b>	<b>Duration</b>
<b>1.</b>	<b>Factors affecting food habits, choices and dietary patterns</b> – Definition of Food, Nutrition, Health, Fitness. Interrelationship between nutrition and health, concept of a desirable diet for optimum nutrition, health and fitness.	<b>6hrs</b>
<b>2.</b>	<b>A brief review of nutrients in general</b> <b>A.</b> Energy and macronutrients – Carbohydrates, Protein, functions, sources deficiency disorders and recommended intakes. <b>B.</b> Micronutrients: Minerals – calcium, Iron, Iodine, and other elements. <b>C.</b> Vitamins – A, D, E, K, B-complex, Vitamin C.	<b>16hrs</b> Fat -
<b>3.</b>	<b>a. Basic principles of planning diet</b> – DDP Concept, Menu Planning, b. Nutritional assessment, RDA for Indians, Food groups, Dietary guidelines and balanced diets. c. Basics of Body composition and changes during life span.	<b>24hrs</b>
<b>4.</b>	<b>a. Nutrition and physical fitness:</b> Exercise and Fitness- Definition, benefits, components and indicators of fitness. Nutritional requirements of exercise – fluids, vitamins and minerals, energy, Macronutrient needs and distribution, body adaptation. Approaches to the management of fitness and health in weight management. b. <b>Alternative systems for health and fitness</b> – Ayurveda, yoga and meditation and other methods.	<b>16hrs</b>

**References:**

1. Rosalind S Gibson. Principles of nutritional Assessment. Oxford University Press.
2. Srilakshmi (2018). Food Science. 7<sup>th</sup> Multicolour Edition. New Age International Publishers.
3. Manay, N. S. O. (2001). Food: facts and principles. New Age International.

**SECOND YEAR- THIRD SEMESTER**

<b>Course Title</b>	<b>FOOD PRESERVATION</b>	
<b>Course Type</b>	<b>DSC</b>	<b>Total Hours - 64</b>
<b>Course Code</b>		<b>Hours/Week – 2+4 (Practical)</b>

**MAPPING of Course Outcomes (CO'S) with PO's AND CDL's**

<b>CO's</b>	<b>Course Outcomes On completion of the course the student will learn to</b>	<b>POs Addressed</b>	<b>CDL</b>
<b>CO-1</b>	Apply major food preservation techniques and explain underlying principles	<b>PO1, PO2, PO3, PO4,PO7,</b>	<b>Understand, Apply</b>
<b>CO-2</b>	Identify and evaluate the suitability of processing and packaging techniques for various foods.	<b>PO1, PO2, PO3,PO4, PO7,PO9,</b>	<b>Apply, Analyze</b>
<b>CO-3</b>	Fundamental understanding of food preservation and food packaging techniques and to ensure students are technically ready for the food industry through a practical, problem-solving approach.	<b>PO1, PO2, PO4, PO9,PO10</b>	<b>Apply</b>
<b>CO-4</b>	Apply the knowledge of preservation in new food product development	<b>PO 1, PO4, PO7, PO11</b>	<b>Understand and apply</b>

<b>Modules</b>	<b>Course Content</b>	<b>Duration</b>
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- |  |                                       |
|--|---------------------------------------|
| <p><b>1. A. Classification of food in relation to shelf life-</b></p> <p>Spoilage in food and its control: spoilage caused by microorganism (bacteria, fungi and virus), enzymes, pests and rodents.</p> <p><b>B. Food dehydration and concentration:</b> methods of drying and concentration, types of dryers, factors affecting drying process.</p> <p><b>2. Heat processing:</b></p> <p>Mechanism of action, methods of application to foods (Equipment), effect on food and micro-organisms in the following processes:</p> <p><b>A.</b> Sterilization,</p> <p><b>B.</b> Pasteurization,</p> <p><b>C.</b> Blanching,</p> <p><b>D.</b> Canning.</p> | <p><b>8hrs</b></p> <p><b>8hrs</b></p> |
|--|---------------------------------------|

**3. Cold preservation: 8hrs**

Mechanism of action, methods of application to foods (Equipment), effect on food and micro-organisms

- A. Refrigeration,
- B. Freezing,
- C. Freeze drying,
- D. Refrigerated gas storage.

**4. A. Food irradiation: 8hrs**

technology, application and safety assessments, effects on food and microorganisms

- B. Chemicals in food preservation, safety of preserved foods.

**Practical Sessions:**

Food preservation techniques (use of different techniques in product formulation and analysis of product for quality standards).

- 1. Sun drying and dehydration-cereals, legumes, vegetable based. **12hrs**
- 2. Preservation with sugar-jams, jelly, preserves, etc. **8hrs**
- 3. Preservation - salt, oil, vinegar-pickling. **8hrs**
- 4. Preservation of foods using chemicals –tomato ketchup, squash. **4hrs**

**References:**

- 1. Potter, N. N., & Hotchkiss, J. H. (2012). Food science. Springer Science & Business Media.
- 2. Rahman, M. S. (Ed.). (2009). Food properties handbook. CRC press.

<b>Course Title</b>	<b>FUNCTIONAL PROPERTIES OF FOODS</b>	
<b>Course Type</b>	<b>DSC</b>	<b>Total Hours - 48</b>
<b>Course Code</b>		<b>Hours/Week –4 + Tutorials</b>

**MAPPING of Course Outcomes (CO'S) with PO's AND CDL's**

<b>CO's</b>	<b>Course Outcomes On completion of the course the student will learn to</b>	<b>POs Addressed</b>	<b>CDL</b>
<b>CO-1</b>	Understand and describe the general chemical structures of the major components of foods	<b>PO1, PO2, PO3, PO4,PO7,</b>	<b>Understand, Apply</b>
<b>CO-2</b>	To be able to explain the observed physical properties and reactivity of major food components.	<b>PO1, PO2, PO3,PO4, PO7,PO9,</b>	<b>Apply, understand</b>
<b>CO-3</b>	Browning reactions in foods and its	<b>PO1, PO2,</b>	<b>Apply</b>

	applications	PO4, PO9,PO10	
<b>CO-4</b>	To understand the chemistry of foods - composition of food, role of each component and their interaction.	PO 1, PO4, PO7, PO11	<b>Understand and apply</b>

<b>Modules</b>	<b>Course Content</b>	<b>Duration</b>
<b>1.</b>	<b>Physico-chemical properties of foods-</b> Organic food components, colloids, osmotic pressure, food dispersions (sols, gels, emulsion, foam), Hydrogen ion concentration	<b>12hrs</b>
<b>2.</b>	<b>Role of water in foods-</b> <b>A.</b> Functions of water in food system, free and bound water, importance of water activity in food quality, sorption characteristics of foods, factors influencing moisture uptake. <b>B.</b> Intermediate moisture foods- definition, steps in manufacturing, additives used, manufacturing of IMF based on – fruits, vegetables, meat and fish.	<b>12hrs</b>
<b>3.</b>	<b>Functional Properties of Protein-</b> <b>A.</b> General functional properties, need for modification, techniques of modification, effect of modification on functional properties. <b>B.</b> Food applications of modified proteins- Textured vegetable proteins and meat analogues- characteristics, manufacturing process and their application in food sector.	<b>12hrs</b>
<b>4.</b>	<b>A. Carbohydrates:</b> Starch, cellulose, hemicelluloses, hydrocolloids and gums: occurrence, functions in food systems, properties, gelatinization, retro gradation and modified starches. <b>B. Browning in foods:</b> Enzymatic and non-enzymatic- mechanism, method of prevention, relationship to health.	<b>12hrs</b>
	<b>Tutorials Session:</b>	
	1. Water activity – water sorption isotherms of different foods.	
	2. Functional properties of proteins – Water and fat absorption, emulsion and foaming properties, protein gels, (application in food products)	
	3. Starch Gelatinization and retrogradation – Factors affecting and measurement of viscosity of starch gels, use of hydrocolloids/gums.	
	4. Browning reactions in foods.	

**References:**

1. Food processing technology, principle and practices. Wood head publishing India Pvt Ltd, New Delhi 3<sup>rd</sup> edition.

<b>Course Title</b>	<b>PRINCIPLES OF CLINICAL NUTRITION</b>	
<b>Course Type</b>	<b>DSC</b>	<b>Total Hours - 48</b>
<b>Course Code</b>		<b>Hours/Week –3</b>

**MAPPING of Course Outcomes (CO'S) with PO's AND CDL's**

<b>CO's</b>	<b>Course Outcomes On completion of the course the student will learn to</b>	<b>POs Addressed</b>	<b>CDL</b>
<b>CO-1</b>	Develop competence in the skills of assessment, planning, management and evaluation of food service in nutrition	<b>PO1, PO2, PO3, PO4,PO7,</b>	<b>Understand, Apply</b>
<b>CO-2</b>	Dietetic services in institutional food, community nutrition, and clinical dietetics	PO1, PO2, PO3,PO4, PO7,PO9,	<b>Apply, Understand</b>
<b>CO-3</b>	The principles of therapeutic nutrition needs of adults and children	PO1, PO2, PO4, PO9,PO10	<b>Apply</b>
<b>CO-4</b>	Design appropriate dietary plans based on individual and group needs.	PO 1, PO4, PO7, PO11	<b>Understand and apply</b>

<b>Modules</b>	<b>Course Content</b>	<b>Duration</b>
<b>1. Introduction to Clinical Nutrition and Dietetics</b>		<b>6hrs</b>
	- Definition and history of dietetics. Concepts of a desirable diet for optimum health. Interrelationship between food, nutrition and health. Factors affecting food choices, Physiologic factors regulating food intake- role of neurotransmitters and nutrients in hunger and satiety.	
<b>2. Role and responsibilities of dieticians-</b>		<b>5hrs</b>
	Specific functions, team approach in patient care, psychological consideration, interpersonal relationship with patients. Nutrition and medical ethics. Hospital dietary- scope and importance, types of food service, quality management.	
<b>3. Nutrition screening and assessment in clinical settings-</b>		<b>15hrs</b>
	Nutrition screening and assessment methods (MNA, SGA, PG-SGA, MUST, disease specific tools). Nutrition care process- Assessment, Diagnosis, Interpretation, Monitoring, and Evaluation (ADIME). Usage of International Dietetic terminologies.	
<b>4. Principles and Objectives of Medical nutrition therapy-</b>		<b>12hrs</b>
	<b>A.</b> Characteristics of a Regular diet, rationale for modifications in terms of energy and other nutrients, texture, consistency. Translation of diet orders into menu: defining nutrient needs, desirable dietary pattern, menu plan, use of exchange list, types of menu. Monitoring food intake.	

**B. Enteral and Parenteral feeding:** indications, types (commercial and kitchen-based feeds), methods of administration, monitoring and associated complications.

**C. Dietary principles and management of special conditions-**

- ii) Protein and energy malnutrition (hospital and domiciliary treatment)
- iii) Febrile diseases-classification of fevers, metabolism, general dietary considerations, diet in acute and chronic fevers (typhoid and tuberculosis)
- iv) Surgical conditions, Burns and organ transplants.

**D. Nutrition in adverse reactions to food:**

**10hrs**

- i) Food allergies - pathogenesis, food allergens, symptoms, tests for diagnosis, latex – fruit syndrome, food dependent, exercise- induced anaphylaxis, food induced anaphylaxis, food –protein induced enter colitis syndrome, cow’s milk protein allergy (CMPA).
- ii) Food intolerances - lactose, fructose intolerance. Management - restricted diets, elimination diets and hypo- sensitization.

**References**

1. Bamji, M. S., Krishnaswamy, K., & Brahmam, G. N. V. (Eds.). (2013). Textbook of human nutrition. Oxford & IBH.
2. Srilakshmi, B. (2007). Dietetics. New Age International.
3. Zimmermann, M. (2001). Burgerstein's Handbook of nutrition: micronutrients in the prevention and therapy of disease.

<b>Course Title</b>	<b>FOOD FORTIFICATION</b>	
<b>Course Type</b>	<b>DSC</b>	<b>Total Hours - 48</b>
<b>Course Code</b>		<b>Hours/Week –3</b>

**MAPPING of Course Outcomes (CO’S) with PO’s AND CDL’s**

<b>CO’s</b>	<b>Course Outcomes On completion of the course the student will learn to</b>	<b>POs Addressed</b>	<b>CDL</b>
<b>CO-1</b>	Apply dietary based food fortification as an important nutrition intervention to fight micronutrient deficiencies	<b>PO1, PO2, PO3, PO4, PO7,</b>	<b>Understand, Apply</b>
<b>CO-2</b>	Reduce the incidence of micronutrient deficiencies in low- and middle-income countries.	<b>PO1, PO2, PO3, PO4, PO7, PO9,</b>	<b>Apply, understand</b>
<b>CO-3</b>	To understand the basic principles of food fortification and the use of diet-based approaches to control micronutrient malnutrition to learn the legal considerations	PO1, PO2, PO4, PO9, PO10	<b>Understand</b>
<b>CO-4</b>	Criteria governing the selection of mandatory or voluntary fortification.	PO 1, PO4, PO7, PO11	<b>Apply</b>

<b>Modules</b>	<b>Course Content</b>	<b>Duration</b>
<b>1. Food fortification-</b>	<p><b>A.</b> Needs, objectives, principles and rationale, selection and basis of fortificants, selection and use of specific food vehicles, ongoing programs, food laws for fortification, types of fortification.</p> <p><b>B.</b> Characteristics of nutrients used in fortification of food- types and levels of nutrients added (vitamin A, vitamin D, iodine, zinc, B-vitamins, calcium, selenium, fluorine and other nutrients)</p>	<b>12hrs</b>
<b>2. Technology of fortifying cereal products.</b>	<p><b>A.</b> Characteristics of nutrients used in cereal fortification, Types and levels micronutrients to be added.</p> <p><b>B.</b> Fortification methods – commercial and industrial fortification (Encapsulation, spray drying, freeze drying and nanotechnology - in brief), Bio- fortification, domestic fortification.</p> <p><b>C.</b> Fortification premixes, Design and composition of premixes and quality control Fortification of Rice, Wheat, bread, pasta, noodles, biscuits, and breakfast cereals.</p>	<b>12hrs</b>
<b>3. Technology of fortifying beverages, candies, snack products</b>	<p><b>A.</b> Technology of fortifying beverages - Importance of beverage fortification, Health benefits of fortification, Bioavailability, Organic v/s inorganic salts and role of enzymes in beverage processing</p> <p><b>B.</b> Technology of fortifying candies - Product formulation, Nutrient bioavailability, Packaging, storage, shelf life and cost.</p> <p><b>C.</b> Snack products - Rationale for micronutrient fortification of snack products, Choice of products and selection of micronutrients, Challenges in fortifying snack products, Nutrient interaction and bioavailability.</p>	<b>14hrs</b>
<b>4. Other special fortified products –</b>	<p>salt, sugar, oil, Nutri-bars, Granola bars- technology, stability of nutrients, challenges in fortification, safety issues, packaging and cost.</p>	<b>10hrs</b>

**References:**

1. Coles, L. (Ed.). (2013). Functional foods: The connection between nutrition, health, and food science. Apple Academic Press.
2. NIN (2017), Indian food composition tables.
3. Lindsay Allen and Bruno De Benoist (2006). Guidelines for food fortification with micronutrients WHO-FAO library of congress cataloguing.

<b>Course Title</b>	<b>BIO-STATISTICS AND ITS APPLICATIONS</b>	
<b>Course Type</b>	<b>DSE-ID</b>	<b>Total Hours - 64</b>
<b>Course Code</b>		<b>Hours/Week –4</b>

**MAPPING of Course Outcomes (CO'S) with PO's AND CDL's**

<b>CO's</b>	<b>Course Outcomes On completion of the course the student will learn to</b>	<b>POs Addressed</b>	<b>CDL</b>
<b>CO-1</b>	Will acquire skills to use the appropriate research methodology for data collection,	<b>PO1, PO2, PO3, PO4,PO7,</b>	<b>Understand, Apply</b>
<b>CO-2</b>	to apply statistical tests for data interpretation and conclusion	<b>PO1, PO2, PO3,PO4, PO7,PO9,</b>	<b>Apply, understand</b>
<b>CO-3</b>	To understand the principle, concepts about biostatistics and its application in food science and nutrition research relation.	<b>PO1, PO2, PO4, PO9, PO10</b>	<b>Understand</b>
<b>CO-4</b>		<b>PO 1, PO4, PO7, PO11</b>	<b>Understand and apply</b>

<b>Module</b>	<b>Course content</b>	<b>Duration</b>
<b>1. i) Introduction to Statistics –</b>	Conceptual understanding of statistical measures, Sampling Design and Different types of sampling techniques – Probability sampling and non-probability sampling, Classification and Tabulation of data.	<b>10hrs</b>
<b>ii) Measurement</b>	of Central tendency, Measures of Variation, Graphical methods of data presentation.	
<b>2. Binomial distribution-</b>	nature and properties of Normal distribution; Meaning of parametric and nonparametric tests.	<b>4hrs</b>
<b>3. A.Hypothesis testing-</b>	Z test; Unpaired and Paired t test; Chi-square test.	<b>20hrs</b>
<b>B. Analysis of Variance:</b>	One way ANOVA; Post Hoc tests; Factorial, ANOVA; ANCOVA; Introduction to Multivariate analysis: MANOVA, MANCOVA, Factor Analysis, Discriminant analysis.	
<b>4.A. Correlation and Regression:</b>	Meaning; Regression; Methods of Correlation – Biserial, Point biserial, Tetrachoric, Phi coefficient, Kendal's Tau.	<b>30hrs</b>
<b>B. Use of Computers in Statistical Analysis –</b>	The computer system and technology, Important characteristics of computer applications in research using SPSS Package, usage of statistical calculators available in web.	
<b>C. Practical Exercises under Tutorials -</b>	Introduction to Computer application in Statistics – Data entry, spread sheets – data analysis and statistical interpretation using statistical software like SPSS and MINITAB – reporting.	



## References

1. Arun Bhadra Khanal (2016), Methods in biostatistics for medical students and research workers, Jaypee Brother Medical Publisher.
2. CR Kothari (1990). Research methodology –Methods and techniques, 2nd Edition, New age International.
3. Rajinith Kumar (2016). Research Methodology step by step guide for beginners. Pearson India Education.

<b>Course Title</b>	<b>FOOD PACKAGING TECHNOLOGY</b>	
<b>Course Type</b>	<b>DSE-AE</b>	<b>Total Hours - 32</b>
<b>Course Code</b>		<b>Hours/Week –2</b>

### MAPPING of Course Outcomes (CO'S) with PO's AND CDL's

CO's	Course Outcomes On completion of the course the student will learn to	POs Addressed	CDL
CO-1	To acquaint the students with detail knowledge of modern technology involved in food packaging and their applications	PO1, PO2, PO3, PO4, PO7,	Understand, Apply
CO-2	To relate the properties of food packages to conversion technologies	PO1, PO2, PO3, PO4, PO7, PO9,	Apply, understand
CO-3	Processing and packaging technologies and user requirements including safety, convenience and environmental issues.	PO1, PO2, PO4, PO9, PO10	Understand
CO-4	Demonstration of various packaging materials in food industries	PO 1, PO4, PO7, PO11	Understand and apply

Module	Course content	Duration
1.	<b>Food packaging –</b> Need and role in extending shelf life of foods. Design and testing of package materials, package performance. Principles in the development of safe and protective packing, safety assessment of food packaging materials.	<b>8hrs</b>
2.	<b>Food packaging systems-</b> <b>Product characteristics and package requirements:</b> Different forms of packaging such as rigid, semi-rigid, flexible forms and different packaging system for: (a) dehydrated foods (b) frozen foods (c) dairy products (d) fresh fruits and vegetables (e) meat, poultry and sea foods.	<b>8 hrs</b>

**3. Types of packaging materials****8hrs**

(metals, glass, paper and plastics), their characteristics and uses. Paper: pulping, fibrillation and beating, types of papers and their testing methods.

Glass: composition, properties, types of closures, methods of bottle making;

Metals: Tinplate containers, tinning process, components of tinplate, tin free steel (TFS), types of cans, aluminum containers, lacquers; Plastics: types of plastic films, laminated plastic materials, co-extrusion.

**4. A. Package accessories and advances in packaging technology 8hrs**

(active packaging, modified atmosphere packaging, aseptic packaging, and packages for microwave ovens, biodegradable plastics, edible gums and coatings).

**B. Packaging equipment and machinery:** Vacuum, CA and MA packaging machine; gas packaging machine; seal and shrink-packaging machine; form and fill sealing machine; aseptic packaging systems; retort pouches, bottling machines; carton making machines, package printing.

**References:**

Robertson, G. L. (2016). Food packaging: principles and practice. CRC press.

Course Title	FOOD SERVICE MANAGEMENT	
Course Type	DSE-SE	Total Hours - 32
Course Code		Hours/Week -2

**MAPPING of Course Outcomes (CO'S) with PO's AND CDL's**

CO's	Course Outcomes On completion of the course the student will learn to	POs Addressed	CDL
CO-1	Will enable to work in various types of food service institutions	PO4,PO7,	Understand, Apply
CO-2	To impart knowledge of basic aspects of food service operations and management in hospitals and other food service institutions	PO1, PO2, PO4, ,	Apply, understand
CO-3	Formulate menu, calculate food costs, loss and profit made	PO3,	Understand
CO-4	Apply the knowledge to work in different food service institutes	PO1, PO4,	Understand and apply

Module	Course content	Duration
<b>1. Food service Institutions-</b>	<p><b>A.</b> Definition and importance, various types of food service institutions like hospitals, school meals, hostels, industrial canteens, commercial hotel/ canteens etc. Institutions catering to different types of handicapped personnel.</p> <p><b>B. Theories about approaches to food service management</b>  <b>Developing objectives and goals-</b> Definition and importance, types of goals Policies, procedures and rules.</p> <p><b>C. Principles and procedures of management-</b> Managerial roles and responsibilities, the manager and leadership quality. Tools of management – organization chart, types, structure, function; work improvement techniques.</p>	<b>8hrs</b>
<b>2. Human resource management –</b>	<p>recruitment, training, placement, promotion, personnel records, work appraisals.</p> <p><b>A. Material management</b> – Principles of quantity food purchase- selection, buying and accounting of different foods. Inventory management- assessing requirements, receiving and release of stocks. Record maintenance.</p>	<b>8hrs</b>
<b>3. Quantity food preparation and service-</b>	<p>Factors in menu planning for large groups, systems for maintaining quality in food preparation and service. Menu planning, Selection, purchasing, receiving, storage and waste management. Maintenance of food supply records.</p>	<b>8hrs</b>
<b>4.A. Financial management –</b>	<p>Budgeting, costing and cost control, accounting.</p> <p><b>B. Hazards and safety standards in food service units</b></p> <p>i-Sanitation measures for Food, Personnel and Unit Hygiene, Training techniques for food service personnel in Sanitation.</p> <p>ii-Safety- causes of accidents, types and sources of contamination, 3 Es of Safety</p> <p>iii-Food laws - FPO, ISI, AGMARK, PFA, New Food Bill 2018</p> <p>iv Quality standards-HACCP, ISO, NABH, licensing by FSSAI</p>	<b>8hrs</b>

#### **PRACTICAL SESSION**

\*Report submission (internal valuation)

1. Standardization of recipes- costing of recipes.

Survey of hostels and cafeteria to assess various aspects of food service management. Submit a report.

<b>Course Title</b>	<b>INTERSHIP/PROJECT WORK Part - I</b>	
<b>Course Type</b>	<b>DSE-SE</b>	<b>Total Hours - 64</b>
<b>Course Code</b>		<b>Hours/Week –4</b>

### **Course content**

The candidate will select a topic under the guidance of a faculty, develops a research plan in Food science, Community nutrition, Clinical or Experimental nutrition. The formative research plan comprising of topic selected, related review of literature, objectives and study design shall be presented for approval. At the end of the semester, this proposal shall be submitted for evaluation.

**Note: It is mandatory that students opting for this soft core in III semester will continue with the Part II in IV semester. Allotment of candidates is subject to availability of faculty.**

## SECOND YEAR - FOURTH SEMESTER

<b>Course Title</b>	<b>PRODUCT DEVELOPMENT &amp; ENTREPREUNERSHIP</b>	
<b>Course Type</b>	<b>DSC</b>	<b>Total Hours - 64</b>
<b>Course Code</b>		<b>Hours/Week –3+4hrs (practical)</b>

### MAPPING of Course Outcomes (CO'S) with PO's AND CDL's

<b>CO's</b>	<b>Course Outcomes On completion of the course the student will learn to</b>	<b>POs Addressed</b>	<b>CDL</b>
<b>CO-1</b>	Apply marketing and advertising principles to describe consumer behavior in food selection.	<b>PO4,PO7,</b>	<b>Understand, Apply</b>
<b>CO-2</b>	To describe techniques that can be used to monitor quality of raw ingredients and final products	<b>PO1, PO2, PO4, ,</b>	<b>Apply, understand</b>
<b>CO-3</b>	Learn marketing techniques	<b>PO3,</b>	<b>Understand and apply</b>
<b>CO-4</b>	Sensory evaluation of foods	<b>PO1, PO4,</b>	<b>Understand and apply</b>

<b>Module</b>	<b>Course content</b>	<b>Duration</b>
<b>1.</b>	<b>Sensory evaluation of foods</b>	<b>8hrs</b>
	<ul style="list-style-type: none"> <li><b>A.</b> Importance, need and application for product formulation</li> <li><b>B.</b> Basic tastes, threshold tests for basic tastes,</li> <li><b>C.</b> Sensory panel, type, selection and training,</li> <li><b>D.</b> Types of sensory tests- Subjective and objective sensory evaluation,</li> <li><b>E.</b> Instrumental tests for sensory attributes – color, texture and odor.</li> </ul>	
<b>2.</b>	<b>Product Development</b>	<b>8hrs</b>
	<ul style="list-style-type: none"> <li><b>A.</b> Designing new product – types and drawing forces</li> <li><b>B.</b> Need for product development</li> <li><b>C.</b> Stages of product development</li> <li><b>D.</b> Consumer research</li> <li><b>E.</b> Role of sensory evaluation in consumer product acceptance.</li> </ul>	
<b>3.</b>	<b>Entrepreneurship –</b>	<b>4hrs</b>
	Starting and managing an enterprise - Steps in preparing a business plan, Components of management, Developing managerial skills, Managing a food industry. Qualities of an entrepreneur	
<b>4.</b>	<b>A.Quality Control –</b>	<b>8hrs</b>
	assurance, Total Quality Management; GMP/GHP; GLP, GAP; Sanitary and hygienic practices; Quality manuals, documentation and audits; Indian & International quality systems and standards like ISO and Food Codex; Export import policy, export	

documentation; Laboratory quality procedures and assessment of laboratory performance; Applications in different food industries. Implementation of HACCP in processing and food service institutions.

**B.Consumer Behavior & Marketing:** Factors influencing food purchases, product acceptance, purchasing trends. Changing food trends.

**C.Special food processing technologies and novel food ingredients** – Membrane technology (reverse osmosis and ultra-filtration), agglomeration, agitation, air classification, extrusion, automation in food industries.

**Practical Sessions**

1. Sensory analysis: Different types of sensory tests for basic tastes and sensory attributes of products. **4hrs**
2. Project on different sensory techniques and responses utilizing prepared food products, analysis and presentation of sensory data. **16hrs**
3. Stepwise development of a new food product, standardization, acceptability studies and submission of project report. **12hrs**
4. Survey on types of convenience foods / consumer behavior / analysis of food labeling.

**References:**

1. Earle, R., & Anderson, A. (Eds.). (2001). Food Product Development: Maximizing Success. CRC Press.
2. Fuller, G. W. (2016). New food product development: from concept to marketplace. CRC Press.
3. Gordon W Fuller., (2004) New Food Product Development: from Concept to Market place,
4. HalMacfie, (2007) Consumer- led food product development, CRC.
5. Mary Earle &Richard Earle., Food Product Development: Maximizing Success., CRC, Woodhead Publishing Ltd.,2001

<b>Course Title</b>	<b>ADVANCES IN NUTRITIONAL SCIENCES</b>	
<b>Course Type</b>	<b>DSC</b>	<b>Total Hours - 48</b>
<b>Course Code</b>		<b>Hours/Week – 3</b>

## MAPPING of Course Outcomes (CO'S) with PO's AND CDL's

CO's	Course Outcomes On completion of the course the student will learn to	POs Addressed	CDL
CO-1	Demonstrate critical understanding of key concepts and potential applications in the field of nutritional sciences, nutrigenomics	PO4,PO7,	Understand, Apply
CO-2	Aspects on personalized nutrition	PO9, PO3	Apply, understand
CO-3	Advanced topics in nutritional sciences focusing on the most recent nutrition research and current topics in the media	PO3,	Understand and apply
CO-4	To study the nutrient needs in extreme environment.	PO1, PO4,	Understand and apply

Module	Course content	Duration
1.	<p><b>A. Preclinical and clinical research methods in Nutrition</b>                      – Preclinical research (<i>in vitro</i>, <i>ex vivo</i> and animal studies). Clinical - Cross sectional Longitudinal, Retrospective, Prospective, cohort studies etc.</p> <p><b>B. Nutrition and brain development</b> – critical periods of brain and cognitive development, maternal status and brain development, role of macronutrients in general and specific nutrients – Long chain PUFA, omega 3 fatty acids, antioxidants, nutrient interactions, nutrient supplementation.</p>	12hrs
2.	<p><b>A. Nutrition and work performance</b> –</p> <p>a. Diet and Exercise- Effect of specific nutrients on work performance and physical fitness. Components of fitness, benefits of fitness. Health issues in athletes - sports anemia, bone density, micronutrient deficiencies. Energy expenditure (metabolic pathways) and nutrient demands. Mobilization of fuel stores during exercise.</p> <p>b. Fluid and electrolyte balance - fluid requirements, losses, heat stroke, fluid replacement.</p> <p>Ergogenic aids – dietary supplements, sports drinks, beverage choices, FSSAI Regulatory aspects.</p>	12hrs
3.	<p><b>A. Nutrition for Space, Mines, Underwater</b></p> <p>– Introduction - Environmental challenges - Changes in body composition – Changes in nutritional intake – Nutritional requirements – Special diets – Designer foods.</p> <p><b>B. Nutrition and Infection</b> – Introduction – Patho-physiology of immune response to infection - nutritional modulation of immune function – malnutrition and immunocompetence - nutrients of importance – metabolic consequences of infection – altered nutritional requirements – nutrient recommendations – Immuno-nutrition for the critically ill.</p>	12hrs

- 4. Recent concepts in Human Nutrition- 12hrs**
- A.** Nutrigenomics- Definition (nutrigenomics, metabolomics, proteomics, pharmacogenomics and transcriptomics), nutrient-gene interactions, nutrigenomics and non-communicable diseases, impact of nutrigenomics – nutrition research, nutrition therapy, food industry and nutrition policy
- B.** Fetal origins of adult disease – nutritional basis and genetic link – intrauterine nutrition-birth weight, maternal nutrition, Barker’s hypothesis.
- C.** Microbiome in Health and Disease- The Gut-Brain axis, tools for studying the microbiome, impact of gut microbiota on health and disease.

**References**

1. Bemadette. M. Marriott and Sydne J Carlson, Nutritional needs in cold and high altitude environments.
2. Eldon W Askew, Cold weather and high-altitude nutrition- overview of the issues
3. Yoshinori Mine, Kazuo Miyashita, Fereidoon Shahidi. (2009).
4. Nutrigenomics and proteomics in health and disease, Food factors and Gene Interactions, Wiley-Blackwell.
5. Sari Edelstein and Judith Sharlin (2009). Essential of life cycle nutrition evidence-based approach Jones and Bratlett Publisher.
6. Caballero, B. (2012). Encyclopedia of human nutrition. L. H. Allen, & A. Prentice (Eds.). Academic press.
7. Debra AK and Penny NK. (1996). Nutrition in women’s health
8. Mark L and Tony W (2008). Public health nutrition from principles to practice, Library of congress cataloging, first south Asian edition.
9. Bao, Y., & Fenwick, R. (Eds.). (2004). Phytochemicals in health and disease. CRC Press.
10. Nelms, M., & Sucher, K. (2015). Nutrition therapy and pathophysiology. Nelson Education.
11. Doug kechinjan, Optimizing nutrition for performance at altitude- A literature review.

<b>Course Title</b>	<b>DIET IN DISEASES</b>	
<b>Course Type</b>	<b>DSC</b>	<b>Total Hours - 48</b>
<b>Course Code</b>		<b>Hours/Week – 3</b>

**MAPPING of Course Outcomes (CO’S) with PO’s AND CDL’s**

<b>CO’s</b>	<b>Course Outcomes On completion of the course the student will learn to</b>	<b>POs Addressed</b>	<b>CDL</b>
<b>CO-1</b>	Acquire skills to develop appropriate medical nutrition therapy for specific disease states	<b>PO4, PO7,</b>	<b>Understand, Apply</b>
<b>CO-2</b>	Provide the appropriate intervention, including calculating and defining diets	<b>PO3, PO10</b>	<b>Apply, understand</b>
<b>CO-3</b>	Identify the patho-physiology of diseases and how they relate to nutrition.	<b>PO3</b>	<b>Understand and apply</b>
<b>CO-4</b>	Modify the disease risk through nutrition care process	<b>PO4, PO9,</b>	<b>Understand</b>



<b>Module</b>	<b>Course content</b>	<b>Duration</b>
<b>1. A. Overweight &amp; Obesity-</b>		<b>12hrs</b>
	Classification, causative factors (behavioral risk factors), overview of approaches to treatments and interventions.	
	<b>B. Cardiovascular disease</b> --etiology, incidence, symptoms, long-term and short-term treatment in coronary disease (myocardial & cerebral infarction), congestive heart failure and hypertension.	
<b>2. A. Diabetes-</b>		<b>12hrs</b>
	Etiology, symptoms, classification, Metabolism, nutrition therapy (OHA and Insulin), prevention, monitoring criteria. Short term and long-term complications and management.	
	<b>B. Diseases of Liver, Gall bladder &amp; Pancreas</b> -Hepatitis, (A, B, and C), Cirrhosis, alcoholic liver disease, Gall stones, pancreatitis, pancreatic surgery- Causes, Prevention and dietary management.	
<b>3. A. Renal disease –</b>		<b>12hrs</b>
	Nephrotic syndrome, Acute and Chronic renal failure- diagnostic procedures and principles of dietary management. Dialysis, medical nutrition therapy.	
	<b>B. Gastrointestinal diseases/disorders</b> –Gastro-esophageal reflux and esophagitis, Gastritis and Peptic ulcer. Characteristics of and comparison of the stomach and duodenal ulcers. Diagnostic tests for mal-absorption, sprue and tropical sprue, diarrhea, constipation, diverticular disease, IBD and IBS.	
<b>4. A. Cancer, HIV/AIDS-</b>		<b>12hrs</b>
	Diagnosis, role of dietary factors in cancer incidence, metabolic effects of cancer, Nutritional implications of cancer therapy, Nutritional management. Stages of HIV infection, Medical and nutritional therapy, Nutrition impact symptoms – diarrhea, mal-absorption, disorders of oral cavity.	
	<b>B. Case studies</b> – Select any two conditions and collect patient’s details and feeding care offered in hospital.	

### **Practical Tutorial Sessions**

- Menu planning, food selection, planning and preparation of related dietary modification
- Food exchange list and application
- Portion size and its application
- Introduction to case studies (NCP) – Apply the components of nutrition care process - includes interpretation of an individual’s anthropometric measures, biochemical data, history, and dietary intake followed by writing a nutrition diagnosis, identifying nutritional goals of management and formulation of nutritional intervention.
- Preparation and implementation of counselling aids for the above disease conditions.

## References

1. Cresci, P. D. (Ed.). (2015). Nutrition support for the critically ill patient: A guide to practice. CRC Press.
2. Escott-Stump, S. (2008). Nutrition and diagnosis-related care. Lippincott Williams & Wilkins.
3. Gopalan C and Shetty P.(1998). Diet nutrition and chronic disease – An Asian perspective Smith-Gordon-Nishimura.
4. Mahan, L. K., & Raymond, J. L. (2016). Krause's food & the nutrition care process. Elsevier Health Sciences.
5. Mark L and Tony W (2008). Public health nutrition from principles to practice, Library of congress cataloging, First south Asian edition.
6. Robinson, Lawler: Normal & Therapeutic Nutrition (17th ed.) Macmillan Publishing Co.
7. Robinson. HC et al., (1986) Normal and therapeutic nutrition (17th edition), Macmillan publishing company.
8. Shills and Young. Modern Nutrition in Health and Disease
9. Thibodeau, G. A., & Patton, K. T. (2010). Human body in health & disease. Mosby/Elsevier.

<b>Course Title</b>	<b>INTERSHIP/PROJECT WORK Part-II</b>	
<b>Course Type</b>	<b>DSE-SE</b>	<b>Total Hours - 64</b>
<b>Course Code</b>		<b>Hours/Week –4</b>

## Course Content

The work planned in III semester will be undertaken by student under the guidance of an advisor. The research should be submitted at the end of semester in the form of a thesis. The project work can be undertaken at PG department Lab, affiliated research institutions, quality control laboratories, food industries or other institutions with prior approval.

<b>Course Title</b>	<b>RESEARCH METHODS IN CLINICAL NUTRITION</b>	
<b>Course Type</b>	<b>DSC-AE</b>	<b>Total Hours - 32</b>
<b>Course Code</b>		<b>Hours/Week – 2</b>

**MAPPING of Course Outcomes (CO'S) with PO's AND CDL's**

<b>CO's</b>	<b>Course Outcomes On completion of the course the student will learn to</b>	<b>POs Addressed</b>	<b>CDL</b>
<b>CO-1</b>	Describing and evaluating the most appropriate research method in the field of experimental and clinical nutrition research	<b>PO7, PO9,</b>	<b>Understand, Apply</b>
<b>CO-2</b>	To acquire skills to undertake systematic research in the area of food science and nutrition	<b>PO3, PO10</b>	<b>Apply, understand</b>
<b>CO-3</b>	Review articles, recall research terminologies, recognize and reproduce the research techniques employed to conduct nutrition research	<b>PO7, PO9</b>	<b>Understand and apply</b>
<b>CO-4</b>	Determine the suitable hypothesis and sampling methods for a research problem	<b>PO4, PO9,</b>	<b>Understand</b>

**Module**

**Course content**

**Duration**

**1.Principles of research –**

**8hrs**

Introduction to research and evidence-based practice, scientific literature and peer-review process. Research problem: Definition, selection of research problem, Justification and Limitations. Hypothesis: Definition, sources, characteristics, importance, formation of hypothesis. Research terminologies - Subjects: control and experimental group. Placebo, placebo effect. Variables, correlation and validity. Formulation of research proposal.

**2.Research methods –**

**12hrs**

- a. Descriptive: correlation, case-control, cross-sectional surveys,
- b. Experimental: clinical/intervention trials, randomized controlled, single- blind and double blind,
- c. Analytical studies: observational, case-control, cohort studies-retrospective and prospective. Sampling methods and sample size.

**3. Nutrition Intervention studies –**

**4hrs**

pilot study, randomized controlled trial, nutritional biomarkers.

**4. Regulations and guidelines-**

**8hrs**

Indian Good Clinical Practice guideline (GCP), Clinical Trials Registry of India (CTRI). Ethical guidelines of ICMR (risks and benefits, informed consent). Best practices for Food clinical trials.

**References**

1. Nutrition Research Methodologies Julie A. Editors- Lovegrove , Leanne Hodson , Sangita Sharma 2015, Wiley-Blackwell.

2. Foundations of clinical research: applications to practice (3rd ed.) by Leslie Gross Portney; Mary P. Watkins.
3. Research: successful approaches in Nutrition and Dietetics by Linda Van Horn (Editor), Judith A Beto (Editor) 4<sup>th</sup> edition, 2019.

<b>Course Title</b>	<b>FOOD BIOTECHNOLOGY</b>	
<b>Course Type</b>	<b>DSC-SE</b>	<b>Total Hours - 32</b>
<b>Course Code</b>		<b>Hours/Week – 2</b>

**MAPPING of Course Outcomes (CO'S) with PO's AND CDL's**

<b>CO's</b>	<b>Course Outcomes On completion of the course the student will learn to</b>	<b>POs Addressed</b>	<b>CDL</b>
<b>CO-1</b>	The principles and current practices of processing techniques and the effects of processing parameters on product quality.	<b>PO7, PO9,</b>	<b>Understand, Apply</b>
<b>CO-2</b>	Principles and application of biotechnology in food production	<b>PO3, PO10</b>	<b>Apply, understand</b>
<b>CO-3</b>	Principles of fermentation processes to make a food product safe for consumption.	<b>PO2, PO4</b>	<b>Understand and apply</b>
<b>CO-4</b>	Evaluate risks and public concern of genetically modified foods	<b>PO2,</b>	<b>Understand &amp; Analyze</b>

**Module**

**Course content**

**Duration**

**1. Historical perspective of biotechnology and fermentation technology- 6hrs**

Branches of biotechnology, Global scenario, use of biotechnology in food processing, agriculture and pharmaceutical field. Types and mechanism of fermentation, effect on nutritional value, health benefits. Single cell protein- production, importance and its application.

**2. Genetically modified foods – 6hrs**

Need for GM foods – The food challenges, DNA recombinant technology, cell and tissue culture (plant and animal), Potential benefits in agriculture, Crop engineered for input and output traits, nutritional improvement, animal foods, issues of concern, tests for detecting GM foods, safety of GM foods.

**3. Technology for production of alcoholic beverages- 4hrs**

Manufacturing of wine, beer, whisky, brandy, neutral spirits etc- Raw materials, processing, storage and packaging.

**4. Microbial fermentation of Indian Traditional foods -****16hrs**

- A.** Cereal and legume-based products, traditional and yeast leavened products-role of leavening, manufacturing of bread, sour dough, rye bread, kulcha, naan, bhatura.
- B.** Vegetables and fruits – lactic acid fermentation – principles, difference processes of lactic acid fermentation, factors affecting lactic acid fermentation, products based on lactic acid fermentation.
- C.** Milk products – yoghurt, butter- milk, cheese: general requirements for fermented milk product production and factors affecting the quality of product.
- D.** Meat and fish- fermentation and drying procedures, starter cultures, processing steps, sensory quality and physical properties.

**References**

1. Byang. H Lee (2014), Fundamentals of Food Biotechnology, John Wiley and sons.
2. Lloyd Ryall A and Pentzer WT (2017). Handling transportation and storage of fruits and vegetables, Medtech scientific international pvt limited (Vol 1 & 2).

<b>Course Title</b>	<b>SPORTS NUTRITION</b>	
<b>Course Type</b>	<b>DSE-AE</b>	<b>Total Hours - 32</b>
<b>Course Code</b>		<b>Hours/Week – 2</b>

**MAPPING of Course Outcomes (CO'S) with PO's AND CDL's**

<b>CO's</b>	<b>Course Outcomes On completion of the course the student will learn to</b>	<b>POs Addressed</b>	<b>CDL</b>
<b>CO-1</b>	Concept of fitness and basic terminologies and nutritional guidelines/ recommendations for fitness and sports	PO7, PO9,	<b>Understand, Apply</b>
<b>CO-2</b>	Basic knowledge of significance of fitness and sports in maintaining health & nutritional supplements	PO3, PO10	<b>Apply, understand</b>
<b>CO-3</b>	Formulate pre, during and post exercise diet plans for athletes	PO3,PO4, PO7, PO9	<b>Understand and apply</b>
<b>CO-4</b>	Dietary supplements and Ergogenic aids	PO2,	<b>Understand &amp; Analyze</b>

**Module****Course content****Duration****1. Approaches to the management of fitness and health-****8hrs**

Nutrition, exercise, physical fitness and health- their inter relationship. Significance of physical fitness and nutrition in prevention and management of weight control regimes. Nutrition guidelines for maintenance of health and fitness.

**Physical fitness and health-** Physiological changes during exercise, inter relationship between physical fitness and health, nutrition management and body composition among various sports.

**2. Nutritional requirements of exercise-**

**8hrs**

Various types of energy systems during exercise, effect of specific nutrients on work performance and physical fitness. Nutrients that support physical activity, Mobilization of fuel stores during exercise. Fluid requirements. Nutrition in different altitudes.

**3.Nutrition in sports-**

**8hrs**

Sports specific requirements- Importance of carbohydrate loading, pre-game and post-game meals, Diets for persons with high energy requirements, stress, fracture and injury.

A.Nutrition during sports performance- pre- during and post recommendation of fluids and other nutrients, guidelines for young athletes and in pediatrics.

B.Nutrition deficiencies among athletes-anemia, triad syndrome, RED-S, eating disorders, stress, fractures and injuries.

**4.Dietary supplements and Ergogenic aids-**

**8hrs**

Definitions, use of different nutraceuticals and ergogenic aids and their effect on performance, recommended dosage, banned supplements, organisations to prevent doping. Definitions, Use of different nutragenic / ergogenic aids and commercial supplements, Sports drinks, sports bars etc

**REFERENCE:**

1. Berning, J. R., & Steen, S. N. (2005). Nutrition for sport and exercise. Jones & Bartlett Learning.
2. Campbell, B. I. (2013). Sports nutrition: enhancing athletic performance. CRC Press.
3. Fink, H. H., Fink, W. S. L. H. H., & Mikesky, A. E. (2013). Practical applications in sports nutrition. Jones & Bartlett Publishers.

**St. Philomena's College (Autonomous), Mysruru**

**M.Sc Food Science and Nutrition**

**Time: 3 Hours**

**Max Marks: 70**

**PART-A**

**Answer any TEN of the following:**

**10x2=20**

<b>1.</b>	<b>a</b>	
	<b>b</b>	
	<b>c</b>	
	<b>d</b>	
	<b>e</b>	
	<b>f</b>	
	<b>g</b>	
	<b>h</b>	
	<b>i</b>	
	<b>j</b>	
	<b>k</b>	
	<b>l</b>	

**PART-B**

**Answer any SIX questions:**

**6x5=30**

<b>1.</b>		
<b>2.</b>		
<b>3.</b>		
<b>4.</b>		
<b>5.</b>		
<b>6.</b>		
<b>7.</b>		
<b>8.</b>		

**PART -C**

**Answer any TWO of the following:**

**2x10=20**

<b>1</b>		
<b>2</b>		
<b>3</b>		