The **Department of Home Science** offers the following Post Graduate Programmes:

**Masters Programmes in –**

**M.Sc. Food & Nutrition**
M.Sc. Human Development & Childhood Studies  
M.Sc. Development Communication & Extension  
M.Sc. Resource Management & Design Application  
M.Sc. Fabric & Apparel Science

**Post Graduate Diploma Programmes in-**
Post Graduate Diploma in Dietetics & Public Health Nutrition  
Post Graduate Diploma in Health and Social Gerontology
# PG Admission Eligibility

## PART I Candidates seeking admission through entrance examination

<table>
<thead>
<tr>
<th>8 A</th>
<th>M.Sc. course in Food &amp; Nutrition:</th>
<th>Intake Capacity: 21</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intake Capacity: 21</td>
<td>ELIGIBILITY CONDITIONS 55% or above marks in aggregate in Home Science or Food Technology or equivalent grade points.</td>
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<tr>
<td></td>
<td>B.Sc. (Hons.) in Home Science / B.Sc. (Pass) in Home Science / B.Sc (Hons.) in Food Technology: after (10+2)/ PGDDPHN (1 yr), from Delhi University or any other University whose Examination is recognized by the University of Delhi as equivalent and fulfill other conditions of eligibility. Should have passed Nutritional Biochemistry and any two subjects in the following areas: Food &amp; Nutrition / Nutrition through the life cycle / Public Nutrition / Food Science and Processing / Diet therapy / Microbiology/ Nutrition for Adults and Elderly/ Nutrition for Children and Adolescents</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>8 B</th>
<th>M.Sc. course in Human Development and Childhood Studies:</th>
<th>Intake Capacity: 11</th>
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<tbody>
<tr>
<td></td>
<td>Intake Capacity: 11</td>
<td>ELIGIBILITY CONDITIONS 55% or above marks in aggregate in Home Science or equivalent grade points.</td>
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<tr>
<td></td>
<td>B.Sc. (Hons.) in Home Science / B.Sc. (Pass) in Home Science: after (10+2), from Delhi University or any other University whose Examination is recognized by the University of Delhi as equivalent and fulfill other conditions of eligibility. Should have passed any three subjects in the following areas: Introduction to Human Development / Socio-cultural Dimensions of family in India / Foundations of Human Development: Theories and Principles / Gender Empowerment and Justice / Human Development: Lifespan / Child Rights &amp; Social Action</td>
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<table>
<thead>
<tr>
<th>8 C</th>
<th>M.Sc. course in Resource Management and Design Application:</th>
<th>Intake Capacity: 11</th>
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<tbody>
<tr>
<td></td>
<td>Intake Capacity: 11</td>
<td>ELIGIBILITY CONDITIONS 55% or above marks in aggregate in Home Science or equivalent grade points.</td>
</tr>
<tr>
<td></td>
<td>B.Sc. (Hons.) in Home Science / B.Sc. (Pass) in Home Science: after (10+2) from Delhi University or any other University whose Examination is recognized by the University of Delhi as equivalent and fulfill other conditions of eligibility. Should have passed any three subjects in the following areas: Resource Management / Family Finance &amp; Consumer Studies / Housing and Space Design / Ergonomic in Design Development /Interior Design and Decoration/ Entrepreneurship and Enterprise Management / Resources and Sustainable Development / Human Resource Management</td>
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</tr>
<tr>
<td>8 D</td>
<td>M.Sc. course in Development Communication and Extension:</td>
<td>Intake Capacity: 11</td>
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<tr>
<td>-----</td>
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<td>---------------------</td>
</tr>
<tr>
<td></td>
<td>B.Sc. (Hons.) in Home Science / B.Sc. (Pass) in Home Science: after (10+2) from Delhi University or any other University whose Examination is recognized by the University of Delhi as equivalent and fulfill other conditions of eligibility. Should have passed any three subjects in the following areas: Communication and Extension / Gender and Development / Media Systems / Mass Communication / Sustainable Development/ Training and Development/Extension Programme Design and Management/ Development Communication and Journalism / Training and Development Programme Design and Management</td>
<td>ELIGIBILITY CONDITIONS  55% or above marks in aggregate in Home Science or equivalent grade points.</td>
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<table>
<thead>
<tr>
<th>8 E</th>
<th>M.Sc. course in Fabric and Apparel Science:</th>
<th>Intake Capacity: 19</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>B.Sc. (Hons.) in Home Science / B.Sc. (Pass) in Home Science: after (10+2) from Delhi University or any other University whose Examination is recognized by the University of Delhi as equivalent and fulfill other conditions of eligibility. Should have passed any three subjects in the following areas: Fundamentals of Fabric and Apparel Science / Fabric Science / Indian Textile Heritage / Apparel Construction / Applied Textile Design / Dyeing and Printing / Design Concepts / Fashion Design Development / Fashion Studies</td>
<td>ELIGIBILITY CONDITIONS  55% or above marks in aggregate in Home Science or equivalent grade points.</td>
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</table>

**PART II (FORM B) Candidates seeking admission on merit on the basis of marks obtained in the B.Sc. (Hons) Home Science, University of Delhi in the year in which admission is sought**

<table>
<thead>
<tr>
<th>7 A</th>
<th>M.Sc. course in Food &amp; Nutrition:</th>
<th>Intake Capacity: 20</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>B.Sc. (Hons.) in Home Science: Food &amp; Nutrition (3 years course) after (10+2) from Delhi University only.</td>
<td>ELIGIBILITY CONDITIONS 60% or above marks in aggregate or equivalent grade points in Home Science (Hons.) with specialization in Food and Nutrition</td>
</tr>
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<table>
<thead>
<tr>
<th>7 B</th>
<th>M.Sc. course in Human Development and Childhood Studies:</th>
<th>Intake Capacity: 11</th>
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<tbody>
<tr>
<td></td>
<td>B.Sc. (Hons.) in Home Science: Human Development (3 years course) after (10+2) from Delhi University only.</td>
<td>ELIGIBILITY CONDITIONS 60% or above marks in aggregate or equivalent grade points in Home Science (Hons.) with specialization in Human Development</td>
</tr>
<tr>
<td>7 C</td>
<td>M.Sc. course in Resource Management and Design Application:</td>
<td>Intake Capacity: 11</td>
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<tr>
<td>-----</td>
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<tr>
<td></td>
<td>B.Sc. (Hons.) in Home Science: Resource Management (3 years course) after (10+2) from Delhi University only.</td>
<td><strong>ELIGIBILITY CONDITIONS</strong> 60% or above marks in aggregate or equivalent grade points in Home Science (Hons.) with specialization in Resource Management</td>
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<tr>
<td>7 D</td>
<td>M.Sc. course in Development Communication and Extension:</td>
<td>Intake Capacity: 11</td>
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<tr>
<td></td>
<td>B.Sc. (Hons.) in Home Science: Communication and Extension (3 years course) after (10+2) from Delhi University only.</td>
<td><strong>ELIGIBILITY CONDITIONS</strong> 60% or above marks in aggregate or equivalent grade points in Home Science (Hons.) with specialization in Communication and Extension</td>
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<tr>
<td>7 E</td>
<td>M.Sc. course in Fabric and Apparel Science:</td>
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<td>B.Sc. (Hons.) in Home Science: Fabric and Apparel Science (3 years course) after (10+2) from Delhi University only.</td>
<td><strong>ELIGIBILITY CONDITIONS</strong> 60% or above marks in aggregate or equivalent grade points in Home Science (Hons.) with specialization in Fabric and Apparel Science</td>
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Eligibility for reserved categories will be as per University guidelines.

For details concerning University guidelines visit [www.du.ac.in](http://www.du.ac.in)
M.Sc. FOOD AND NUTRITION
Department of Home Science
University of Delhi

Course Credit Structure-CBCS
2018
Introduction:
The Department of Home Science offers M.Sc. Food and Nutrition. The programme is offered in three areas of specialization namely, Clinical Nutrition, Public Health Nutrition and Food Science and Processing. The programme endeavors to train a cadre of professionals who can create nutrition awareness for promotion of healthy lifestyle among the population. The courses of this programme have been designed to enhance the core competency of students in the fields of public health nutrition, dietetics and food science. The curriculum provides a strong theoretical base and also includes experiential learning through field placements and practicals. The programme aims to strengthen the research acumen of students to enable them to develop into academicians and researchers in the field of food science and nutrition.

Programme Specific Objectives:
The objectives of M.Sc. Food and Nutrition programme are:

- To impart the understanding of the concepts of biochemistry, food chemistry and food microbiology
- To enable the students to learn the methods of assessing human nutritional requirements, nutritional assessment and diet planning
- To apply theoretical concepts in laboratory setting as per standard methods in the above mentioned areas
- To understand the applications of nutritional sciences in clinical interventions, communication for health promotion, food service management, food science and processing
- To improve understanding and develop skills for planning, management and monitoring of public health nutrition programmes implemented by the government.
- To acquire skills to undertake systematic research in the area of food science, clinical nutrition and public health nutrition

Programme Specific Outcomes:
The programme trains students to become professionals who can work as public health nutritionists, dieticians and food scientists. After completing this programme the student will be able to:

- Assess nutritional status and plan appropriate diets.
- Use the knowledge of nutritional sciences in clinical interventions and communication for health promotion
- Work as program planners and managers in the field of public health nutrition
- Work as food scientists, quality assurance managers and analysts.
- Manage a food service establishment
- Apply theoretical concepts and practical training for research in the field of food science, clinical nutrition and public health nutrition
**COURSE CREDIT SCHEME**

**Total Credits:** 100  
**Total No. of Core Papers:** 15  
**Total No. of Electives:** 05  
**Total No. of Open Electives:** 01

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<tr>
<th>Semester</th>
<th>Core Courses</th>
<th>Elective Course</th>
<th>Open Elective Course</th>
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* Student must clear 100 credits.
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<thead>
<tr>
<th>Core courses</th>
<th>Credits in each core course</th>
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<td>Theory</td>
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<tr>
<td>Core course 1 FNCC 101 Research Methods</td>
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<td>Core course 2 FNCC 102 Advanced Nutritional Biochemistry and Techniques-I</td>
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<td>Core course 3 FNCC 103 Principles of Food Science</td>
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<td>Core course 4 FNCC 104 Human Physiology</td>
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<p>| Total credits in Semester I          | 20     |           |          |          |</p>
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<th>Core courses</th>
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<td>Core course 5  FNCC 205 Statistics and Computer Application</td>
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<td>Core course 6  FNCC 206 Food Microbiology and Food Safety</td>
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<td>Core course 7  FNCC 207 Advanced Human Nutrition – I</td>
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<td>Core course 8  FNCC 208 Advanced Nutritional Biochemistry and Techniques –II</td>
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<td>Core course 9  FNCC 209 Integrated Nutrition Practical</td>
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<td><strong>Total credits in Semester II</strong></td>
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### Semester III

#### Core courses

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<th>Tutorial</th>
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<td>FNCC 310 Advanced Human Nutrition-II</td>
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<td>FNCC 311 Clinical Nutrition</td>
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<td>FNCC 312 Integrated practical</td>
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<td>FNCC 313 Internship</td>
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<td>FNCC 314 Dissertation I: Technical Writing and Seminar</td>
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**Total credits in core course** 16

#### Elective courses

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<th>Group</th>
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<td>Group B</td>
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<td>Group C</td>
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**Total credits in elective courses** 12

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<th>Credits in each Open Elective</th>
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<tbody>
<tr>
<td>Theory</td>
</tr>
<tr>
<td>Open Elective</td>
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</table>

**Total credits in open elective** 4

**Total credits in Semester III** 32

*Elective courses for Semester III (Choose two elective papers of one specialization)*

**Specialization A: Clinical Nutrition**

Elective Course 1: FNEC 31 A: Public Health Aspects of Malnutrition
Elective Course 2: FNEC 32 A: Institutional Food Management

**Specialization B: Public Health Nutrition**

Elective Course 1: FNEC 31 B: Public Health Nutrition
Elective Course 2: FNEC 32 B: Programme Planning in Public Health Nutrition

**Specialization C: Food Science and Processing**

Elective Course 1: FNEC 31 C: Principles of Food Processing
Elective Course 2: FNEC 32 C: Food Processing Technology -I

**Open Elective Courses for Semester III - Select any one of the following:**

- FNOE31 : Community Nutrition Assessment
- HDCSOE31 : Parenting & High Risk Infants
- DCEOE31 : Communication Processes and Techniques
- RMDAOE31 : Entrepreneurship & Innovation
- FASOE31: Fabric Study
### Semester IV

<table>
<thead>
<tr>
<th>Core courses</th>
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<td>Theory</td>
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<td>Core course 15 FNCC 415</td>
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<tr>
<td>Dissertation II / Experiential Learning Project</td>
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<td>Total credits in core course</td>
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</table>

<table>
<thead>
<tr>
<th>Elective courses**</th>
<th>Credits in each Elective course</th>
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<td>Elective Course 5</td>
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<tr>
<td>Group C</td>
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<tr>
<td>Total credits in elective courses</td>
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</table>

**Total credits in Semester IV** 24

**TOTAL CREDITS IN SEMESTER I/II/III/IV : 100**

**Elective courses for Semester IV (Choose three elective papers of one specialization)**

**Specialization A: Clinical Nutrition**
- Elective Course 3: FNEC 43 A: Advanced Clinical Nutrition
- Elective Course 4: FNEC 44 A: Nutrition Communication and Diet Counselling
- Elective Course 5: FNEC 45 A: Nutrition for Fitness and Sports

**Specialization B: Public Health Nutrition**
- Elective Course 3: FNEC 43 B: Problems, Policies and Programmes in Public Health Nutrition
- Elective Course 4: FNEC 44 B: Nutritional Epidemiology
- Elective Course 5: FNEC 45 B: Nutrition Communication for Health Promotion

**Specialization C: Food Science and Processing**
- Elective Course 3: FNEC 43 C: Food Processing Technology -II
- Elective Course 4: FNEC 44 C: Advanced Food Science
- Elective Course 5: FNEC 45 C: Applied Food Microbiology
SEMESTER I
CC 101: RESEARCH METHODS
THEORY

Marks: 100          Duration: 3 Hrs.

Course Objectives:
To provide students understandings about the basic concepts, approaches and methods in conducting research thereby enabling them to appreciate and critique the nuances of designing a research study as well the ethical dimensions of conducting researches.

Course Learning Outcomes:
Student will be able to -
1. Demonstrate knowledge of the scientific method, purpose and approaches to research
2. Compare and contrast quantitative and qualitative research
3. Explain research design and the research cycle
4. Prepare key elements of a research proposal
5. Explain ethical principles, issues and procedures

CONTENTS PERIODS
UNIT I: Purpose of Research 10
• Definition, objectives and significance of research
• Types of research
• Scientific method: induction and deduction
• Research approaches: quantitative, qualitative and mixed
• Issues of relevance and cultural appropriateness

UNIT II: Principles of Research in Quantitative and Qualitative Approaches 30
Research design
• Meaning and need of research design
• Components and types of research design
• Issues in design construction
Sampling, methods
• Concept of sampling, key differences in the two approaches
• Sampling methods, sample size and sampling error
• Selecting participants and contexts to examine social phenomenon
Data collection and analyses
• Methods and measurement: Measurement in research, scales and errors in measurement, reliability and validity of measurement tools
• Methods of data collection and types of data
• Immersion, deep engagement, triangulation and reflexivity in qualitative data collection
• Data management and quality control
• Transcription in qualitative data analyses
• Errors in inference – Bias and confounding, reliability and validity issues
• Ensuring reliability and validity in qualitative research
UNIT III: The Research Cycle
- Systematic literature review and referencing
- Formulating a research problem – Developing research questions and objectives, exploring research context/phenomenon
- Identifying variables, constructing hypotheses
- Deciding research approach and design
- Selection of sample/participants, choice of methods and analysis.
- Writing a research report-Styles and format.

UNIT IV: Values, Social Responsibility and Ethics in Research
- Ethical principles guiding research: from inception to completion and publication of research
- Ethical issues relating to research participants and the researcher
  - Rights, dignity, privacy and safety of participants
  - Informed consent, confidentiality anonymity of respondents, voluntary participation, harm avoidance
  - Conflicts of interest or bias, Use of inappropriate research methodology, Incorrect reporting, misuse of information

Teaching Plan:
Week 1: Definition, objectives and significance of research
Week 2: Types of research, Scientific method: induction and deduction
Week 3: Research approaches: quantitative, qualitative and mixed. Issues of relevance and cultural appropriateness
Week 4: Meaning and need of research design; types of research design, issues in design construction
Week 5: Concept of sampling, key differences in the two approaches, Selecting participants and contexts to examine social phenomenon
Week 6: Sampling methods, Sample size and sampling error
Week 7: Measurement in research, scales and errors in measurement, reliability and validity of measurement tools
Week 8: Methods of data collection and types of data, Immersion, deep engagement, triangulation and reflexivity in qualitative data collection
Week 9: Data management and quality control; Transcription in qualitative data analyses
Week 10: Errors in inference – Bias and confounding, reliability and validity issues; Ensuring reliability and validity in qualitative research
Week 11: Research Cycle and writing research report
Week 12: Ethics in Research

Facilitating the achievement of Course Learning Outcomes:

<table>
<thead>
<tr>
<th>Unit No.</th>
<th>Course Learning Outcomes</th>
<th>Teaching and Learning Activity</th>
<th>Assessment Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Demonstrate knowledge of the scientific method, purpose and approaches to</td>
<td>Unit transaction through power point</td>
<td>Assignments, Open book test</td>
</tr>
<tr>
<td>II</td>
<td>Compare and contrast quantitative and qualitative research</td>
<td>Unit transaction through power point presentations and classroom discussion about review and critique of journal articles</td>
<td>Quizzes and objective test</td>
</tr>
<tr>
<td>------</td>
<td>----------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>III</td>
<td>Explain research design and the research cycle</td>
<td>Unit transaction through power point presentations and classroom discussion using research case studies</td>
<td>Assignments, Open book test</td>
</tr>
<tr>
<td>IV</td>
<td>Prepare key elements of a research proposal</td>
<td>Unit transaction through power point presentations Students to develop a live research project in groups</td>
<td>Assignments, Open book test</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>Assessment of live project</td>
</tr>
<tr>
<td>V</td>
<td>Explain ethical principles, issues and procedures</td>
<td>Unit transaction through power point presentations and classroom discussion about research proposals</td>
<td>Class assignments and quizzes</td>
</tr>
</tbody>
</table>

**Suggested Readings:**
FNCC 102: ADVANCED NUTRITIONAL BIOCHEMISTRY AND TECHNIQUES – I
THEORY

Marks: 100 Duration: 3 Hrs.

Course Objectives:
The course will acquaint the students with properties and applications of enzymes, give the knowledge on carbohydrate and lipid metabolism, role of hormones in metabolism and impart knowledge on spectrophotometry.

Course Learning Outcomes:
Student will be able to:
1. Understand the enzymes, their types, enzyme activity and their diagnostic role
2. Have coherent and systematic knowledge on carbohydrate metabolic regulation
3. Understand the lipid metabolism and its regulation
4. Correlate the action of hormones with metabolic regulation
5. Learn the principles of spectrophotometry

CONTENTS PERIODS

UNIT I: Enzymes 8
• Classification of enzymes, Cofactor & Prosthetic groups, Concept of active site.
• Effect of pH, temperature, substrate concentration (Km and Vmax, Michaelis-Menten equation) & metal ions on enzyme activity
• Isozyme and Ribozyme
• Application of enzymes in diagnostics (SGPT, SGOT, Creatine kinase & Alkaline phosphatase)

UNIT II: Carbohydrates 12
• Metabolic regulation of glycolysis, gluconeogenesis, citric acid cycle and glycogen metabolism.
• Pentose phosphate pathway and its significance
• Disorders of carbohydrate metabolism: galactosemia, hereditary fructose intolerance, fructosuria and Glycogen storage disease (Von Gierke, Pompe, Cori and McArdle diseases)

UNIT III: Lipids 14
• Fatty acids – Synthesis of saturated and unsaturated fatty acids
• Triacylglycerols – Synthesis
• Phospholipids – Synthesis
• Lipoproteins – Types, synthesis, degradation and clinical significance
• Cholesterol – Synthesis and regulation
• Integration of carbohydrate and lipid metabolism
UNIT IV: Biosignaling and Hormones

- Concept of Hormones
- Six types of signaling mechanisms
- Role of insulin, glucagon & epinephrine in intracellular signaling
- Steroid hormones

UNIT V: Spectrophotometric Techniques

- Beer-Lambert’s law
- Colorimetry and spectrophotometry
- Atomic absorption spectroscopy
- Flame photometry

Suggested Readings:

Teaching Plan:

**Week 1:** Classification of enzymes, Cofactor & Prosthetic group Concept of active site. Effect of pH, temperature & metal ions on enzyme activity

**Week 2:** Effect of substrate concentration (K_m and V_max, Michaelis-Menten equation) Isozyme and Ribozyme, Application of enzymes in diagnostics (SGPT, SGOT, Creatine kinase & Alkaline phosphatase)

**Week 3:** Metabolic regulation of glycolysis, gluconeogenesis, citric acid cycle and glycogen metabolism-I

**Week 4:** Metabolic regulation of glycolysis, gluconeogenesis, citric acid cycle and glycogen metabolism-II, Pentose phosphate pathway and its significance

**Week 5:** Test, Disorders of carbohydrate metabolism: galactosemia, hereditary fructose intolerance, fructosuria and Glycogen storage disease (Von Gierke, Pompe, Cori and McArdle diseases)

**Week 6:** Fatty acids – Synthesis of saturated and unsaturated, Triacylglycerols – Synthesis

**Week 7:** Phospholipids – Synthesis, Lipoproteins – Types, synthesis, degradation and significance

**Week 8:** Cholesterol – Synthesis and regulation; Integration of carbohydrate and lipid metabolism

**Week 9:** Concept of Hormones, Signalling mechanisms, Test

**Week 10:** Role of insulin, glucagon & epinephrine in intracellular signalling, Steroid hormones

**Week 11:** Assignment, Beer-Lambert’s law, Colorimetry and spectrophotometry

**Week 12:** Atomic absorption spectroscopy, Flame photometry
Facilitating the achievement of Course Learning Outcomes

<table>
<thead>
<tr>
<th>Unit No.</th>
<th>Course Learning Outcomes</th>
<th>Teaching and Learning Activity</th>
<th>Assessment Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Classification of enzymes, enzyme activity and diagnostic relevance</td>
<td>Classroom lectures, Experiments on enzyme assay</td>
<td>Short assignment and quiz</td>
</tr>
<tr>
<td>II</td>
<td>Metabolic regulation of major carbohydrate metabolic pathways</td>
<td>Classroom lectures, Discussion on important discoveries in metabolism, Practical</td>
<td>Test</td>
</tr>
<tr>
<td>III</td>
<td>Lipid metabolism regulation and Lipoproteins</td>
<td>Classroom lectures, short presentations, Practical</td>
<td>Assignment</td>
</tr>
<tr>
<td>IV</td>
<td>Mechanisms of hormone signaling</td>
<td>Classroom lectures, short presentations</td>
<td>Test and quiz</td>
</tr>
<tr>
<td>V</td>
<td>Principles of Spectrophotometry</td>
<td>Classroom lectures, demonstration on principle and working of spectrophotometer, Practical</td>
<td>Oral and practical test</td>
</tr>
</tbody>
</table>

FNCC 102: ADVANCED NUTRITIONAL BIOCHEMISTRY AND TECHNIQUES – I
PRACTICAL

Marks: 50 Duration: 3 Hrs.

Course Objectives:
The objective of the course is to acquaint the students with colorimetry in biochemical estimations and give skills on enzyme assays

Course Learning Outcomes:
The student will be able to:
1. Acquire skills on preparation of solutions
2. Colorimetric estimation of biochemical molecules
3. Detect the enzymatic activity
CONTENTS PERIODS
UNIT I: Solutions 2
• Preparation of normal and molar solutions.

UNIT II: Spectrophotometry 7
• Estimation of Phosphorous
• Estimation of Proteins.
• Estimation of Iron.
• Estimation of Cholesterol.
• Estimation of glucose

UNIT III: Enzyme Assays 3
• Assay of salivary amylase
• Assay of alkaline phosphatase

Suggested Readings:

FNCC 103: PRINCIPLES OF FOOD SCIENCE
THEORY

Marks: 100 Duration: 3 Hrs.

Course Objectives
The course aims to provide systematic knowledge and understanding of chemistry of food components like water, proteins, carbohydrates and lipids, various aspects of food product development and systematic interpretation of sensory evaluation and get an insight into the additives that are relevant to processed food industry for shelf life extension, processing aids and sensory appeal.

Course Learning Outcomes
The student will be able to understand:
1. Understand the chemistry of food components like proteins, carbohydrates and lipids.
2. Understand basic concepts of new food product development.
3. Enable to learn about the food additives that are relevant to processed food industry for shelf life extension, processing aids and sensory appeal.

CONTENTS PERIODS
UNIT I: Food Chemistry 26
• Water: Definition of water in foods, structure, water activity, phase diagram of water, phase transition of food containing water, interaction of water solute and food compounds, water activity and its influence on quality and stability of foods, methods for stabilization of food systems by control of water activity, sorption isotherm, colloidal properties of foods.
• pH: Hydrogen ion concentration in food, oxidation reduction potential of foods and their applications in food systems.
• Protein: Physical, chemical, nutritional and functional properties and interactions with other food constituents
• Enzymes: Classification, application of enzymes in food industry and immobilized enzymes.
• Sugars: Composition and properties of different types of sugars, their application in food systems, crystallization, caramelization, Maillard reaction and its industrial application. Fondants, fudges and icings etc.
• Lipids: Properties of fats, functional properties of fats and oils, fat stabilizers, fat deterioration and antioxidants, Emulsions such as mayonnaise, interesterification of fats, auto-oxidation of lipids and rancidity

UNIT II: Basic Concepts of New Product Development
• Stages of product development and standardization, sensory evaluation of foods, packaging, labelling and marketing of new food products.

UNIT III: Food Ingredients and Additives
• Food additives- definitions, classification and functions, Preservatives, antioxidants, colours and flavours (synthetic and natural), emulsifiers, sequestrants, humectants, hydrocolloids, sweeteners, acidulants, bufferingsalts, anticaking agents, etc. - chemistry, food uses and functions in formulations; indirect food additives; toxicological evaluation of food additives.

Suggested Readings:
• Peter Murano, Understanding Food Science and Technology (with InfoTrac)
• BIS standards for food products and analysis manual.
• Manuals of methods of analysis of various food products, FSSAI, 2016

Teaching Plan:
Week 1: Water: Definition of water in foods, structure, water activity, phase diagram of water, phase transition of food containing water, interaction of water solute and food compounds, water activity and its influence on quality and stability of foods
Week 2: Methods for stabilization of food systems by control of water activity, sorption isotherm, colloidal properties of foods.
Week 3: pH: Hydrogen ion concentration in food, oxidation reduction potential of foods and their applications in food systems. Protein: Physical, chemical, nutritional and functional properties and interactions with other food constituents
Week 4: Enzymes: Classification, application of enzymes in food industry and immobilized enzymes.
Week 5: Sugars: Composition and properties of different types of sugars, their application in food systems, crystallization, caramelization, Maillard reaction and its industrial application

Week 6: Lipids: Properties of fats, functional properties of fats and oils, fat stabilizers, fat deterioration and antioxidants, interesterification of fats, auto-oxidation of lipids and rancidity

Week 7: Basic concepts of new product development: Stages of product development and standardization

Week 8: Sensory evaluation of foods, packaging, labelling and marketing of new food products.

Week 9: Food additives- definitions, classification and functions: Preservatives, antioxidants

Week 10: Colours and flavours (synthetic and natural), emulsifiers, sequesterants, humectants, hydrocolloids

Week 11: Sweeteners, acidulants, buffering salts, anti- caking agents

Week 12: Chemistry, food uses and functions in formulations; indirect food additives; toxicological evaluation of food additives.

Facilitating the achievement of Course Learning Outcomes

<table>
<thead>
<tr>
<th>Unit No.</th>
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</tr>
</thead>
</table>
| I        | Imparting knowledge of Food Chemistry and interaction of food components during food processing | Lectures, discussions and visit to processing industry | • Assessment of quality of food ingredient-practical based  
• Visit report |
| II       | Understanding of stage involved in food product development and their commercialization. | Lectures, discussions based on processing methods used in new product development | • Presentation/quiz  
• Practical on assessment of quality parameters of new products. |
| III      | Imparting knowledge about use of food ingredients and food additives in food processing industry. | Lectures, discussions based on food additives and their use in different processed food products. | • Presentation  
• Practical on analysis of different additives used in processed food. |
Course Objectives
The aim is to learn quality control of raw and processed food products, physical, chemical and nutritional analysis of commonly consumed raw and processed foods and develop an understanding of estimation of various additives in food.

Course Learning Outcome:
1. Learn quality control of raw and processed food products
2. Perform physical, chemical and nutritional analysis of commonly consumed raw and processed foods
3. Develop an understanding of estimation of various additives in food

CONTENTS PERIODS

1. Proximate composition of foods: 4
   Analysis of carbohydrates, proteins, fats, total ash, moisture content, active alcoholic and aqueous acidity in foods, ascorbic acid/dehydroascorbic acid ratio in foods
2. Estimation of sugar in foods and reducing properties in honey. 1
3. Refractive index, melting point, solidification point of fats & oils. 1
4. Determination of peroxide value and acid value in fats & oils. 2
5. Estimation of polyphenols in foods. 1
6. Analysis of food ingredients and additives 3

Suggested Readings:
• Peter Murano (2003) Understanding Food Science and Technology (with InfoTrac)
• BIS standards for food products and analysis manual.
• Manuals of methods of analysis of various food products, FSSAI, 2016
FNCC 104: HUMAN PHYSIOLOGY
THEORY

Marks: 100                                                               Duration: 3 Hrs.

Course Objectives:
To understand the normal functioning of various organ systems of the body and their
interactions and to be able to comprehend the pathophysiology of commonly occurring diseases

Course Learning Outcomes:
Student will be able to -
1. Understand the current state of knowledge about the functional organization of the human
   body.
2. Develop insight of normal functioning of all the organ systems of the body and their
   interactions.
3. Comprehend the pathophysiology of commonly occurring diseases.
4. Correlate physiology with various disorders and their pathogenesis.

CONTENTS

UNIT I: Blood and Cardio-Thoracic Physiology 20
- Blood and Plasma Protein -Composition and Function
- Blood formation and factors controlling Erythropoiesis.
- Pathophysiology of Anaemia and Jaundice
- Cardiac cycle, Cardiac output, Heart sounds
- E.C.G. & its interpretation, Heart rate & regulation
- Blood pressure, Hypertension
- Coronary Artery Disease
- Hemorrhage; Compensatory changes after hemorrhage
- Transport and exchange of gases
- Control of Respiration and Respiratory function tests
- Lung volume & Capacities and COPD

UNIT II: Excretory Physiology and Exercise Physiology 10
- Urine formation 0
- Renal function tests
- Acid Base balance
- Pathophysiology of Renal Stones, Urinary Tract Infection, Glomerulonephritis
- Concept of Fitness, Adaptations to exercise
- Energy Metabolism in Sports
- Overview of Diet and Physical Performance

UNIT III: Gastrointestinal Physiology 16
- Functions of Stomach, Liver, Pancreas and Gall Bladder
- Composition, function and regulation of:
  - Salivary juice
  - Gastric juice
  - Pancreatic juice
  - Bile juice
  - Intestinal juice
- GI hormones
• Pathophysiological overview of some common diseases in relation to Gastrointestinal Tract (Peptic ulcer/GERD, Cholelithiasis, Portal Hypertension, Fatty liver and Liver Cirrhosis

UNIT IV: Neuro-Endocrine and Reproductive Physiology
• Overview of organization of nervous system
• Effects of Pituitary, Thyroid, Parathyroid, Adrenal and Pancreatic hormones
• Pathophysiology of Diabetes Mellitus, Metabolic Syndrome, Hashimoto’s disease. Tetany and Cushing Syndrome
• Physiology of Menstruation and Menopause
• Physiology of Ageing
• Physiology of Pregnancy, Lactation
• Pathophysiology of PCOD and Infertility

Suggested Readings:

Teaching Plan:
Week 1: Blood and Plasma Protein -Composition and Function, Blood formation and factors controlling Erythropoiesis, Pathophysiology of Anaemia and Jaundice
Week 2: Cardiac cycle, Cardiac output ,Heart sounds, E.C.G. & its interpretation, Heart rate & its regulation
Week 3: Blood pressure, Hypertension, Coronary Artery Disease, Hemorrhage, Compensatory changes after hemorrhage
Week 4: Transport and exchange of gases, Control of Respiration and Respiratory function test, Lung volume & Capacities and COPD
Week 5: Urine formation , Renal function tests, Acid Base balance, Pathophysiology of Renal Stones, Urinary Tract Infection, Glomerulonephritis
Week 6: Concept of Fitness, Adaptations to exercise, Energy Metabolism in Sports, Overview of Diet and Physical Performance
Week 7: Functions of Stomach, Liver, Pancreas and Gall Bladder, Composition ,function and regulation of Salivary juice, Gastric juice
Week 8: Pancreatic juice, Bile juice Intestinal juice; GI hormones
Week 9: Pathophysiological overview of some common diseases in relation to Gastrointestinal Tract: Peptic ulcer/GERD, Cholelithiasis, Portal Hypertension, Fatty liver and Liver Cirrhosis
Week 10: Overview of organization of nervous system, Physiology of Ageing
Week 11: Effects of Pituitary, Thyroid, Parathyroid, Adrenal and Pancreatic hormones,
Pathophysiology of Diabetes Mellitus, Metabolic Syndrome, Hashimoto’s disease, Tetany and Cushing Syndrome

**Week 12:** Physiology of Menstruation and Menopause, Physiology of Pregnancy, Lactation
Pathophysiology of PCOD and Infertility
SEMESTER II
Course Objectives:
To understand the basic concepts, theories and methods in statistics, learn basic statistical procedures for research and understand applications of statistical techniques for analysis and interpretation

Course Learning Outcomes
Student will be able to-
1. Differentiate between the qualitative and quantitative methods of analysis of data
2. Suitably apply data reduction strategies and illustrate data using various graphical methods
3. Use appropriate parametric and non-parametric statistical tests
4. Draw conclusions and interpretations from the analysis of data using various statistical softwares

CONTENTS

UNIT I: Introduction to Statistics
- Basic principles and concepts in statistics
- Orientation to qualitative and quantitative research procedures
- Measurement and computation- Scales of measurement, Reliability and validity

UNIT II: Organisation and Presentation of Data
- Qualitative and quantitative data- Coding & data reduction strategies
- Organisation of Data: Frequency distributions vs. thematic analysis
- Percentage, percentile ranking and frequencies
- Univariate, bivariate and multivariate tables
- Graphic representation: Graphs, diagrams and charts

UNIT III: Descriptive Statistics
- Applications of descriptive statistics
- Measures of Central tendency and Variability

UNIT IV: Probability and Normal Distribution
- Basic principles and applications of probability
- Normal curve
- Characteristics of distributions: Skewness, kurtosis
- Testing hypotheses: Levels of significance and p values
- Errors in hypothesis testing: Type I, Type II
- Sampling distribution
- Standard scores, calculation and application
UNIT V: Statistical Tests

- Concept of parametric and non-parametric tests, statistical tests and level of measurement
- Parametric tests of difference: T test, ANOVA and post hoc analysis of significance
- Parametric tests of association: Pearson’s product moment r
- Non-parametric tests of difference: Mann-Whitney, Sign, Median, and Kruskal-Wallis
- Non-parametric tests of association: Spearman’s r
- Chi-square test
- Regression and its applications
- Tests for ascertaining reliability of instruments

UNIT VI: Analysis and Interpretation

- Guidelines for selecting an appropriate test
- Interpreting results- Statistical inference
- Research Conclusion and recommendations

Suggested Readings:


Teaching Plan:

Week 1: Basic principles and concepts in statistics, Orientation to qualitative and quantitative research procedures, Scales of measurement, Reliability and validity

Week 2: Qualitative and quantitative data- Coding and data reduction strategies, Organisation of Data: Frequency distributions vs. thematic analysis

Week 3: Percentage, percentile ranking and frequencies, Univariate, bivariate and multivariate tables

Week 4: Graphic representation: Graphs, diagrams and charts, Applications of descriptive statistics
**Week 5:** Measures of Central tendency and Variability  
**Week 6:** Basic principles and applications of probability, Normal curve  
**Week 7:** Characteristics of distributions: Skewness, kurtosis, Testing hypotheses: Levels of significance and p values  
**Week 8:** Errors in hypothesis testing: Type I, Type II, sampling distribution, standard scores, calculation and application  
**Week 9:** Concept of parametric and non-parametric tests, statistical tests and level of Measurement, Parametric tests of difference: T test, ANOVA and post hoc analysis of significance  
**Week 10:** Parametric tests of association: Pearson’s product moment r, Non-parametric tests of difference: Mann-Whitney, Sign, Median, and Kruskal-Wallis  
**Week 11:** Non-parametric tests of association: Spearman’s r, Chi-square test, Regression and its applications, Tests for ascertaining reliability of instruments  
**Week 12:** Guidelines for selecting an appropriate test, Interpreting results- Statistical inference, Research Conclusion and recommendations

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**Facilitating the achievement of Course Learning Outcomes**

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<th>Assessment Tasks</th>
</tr>
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<tbody>
<tr>
<td>I</td>
<td>Understand the basic concepts, theories and methods in statistics and Differentiate between the qualitative and quantitative methods of analysis of data</td>
<td>Unit transaction through power point presentations,</td>
<td>Assignments, Open book test</td>
</tr>
<tr>
<td>II</td>
<td>Suitably apply data reduction strategies and illustrate data using various graphical methods</td>
<td>Unit transaction through power point presentations and classroom discussion</td>
<td>Quizzes and objective test</td>
</tr>
<tr>
<td>III</td>
<td>Learn basic statistical procedures for research</td>
<td>Unit transaction through power point presentations and classroom discussion</td>
<td>Assignments, Open book test</td>
</tr>
<tr>
<td>IV</td>
<td>Learn basic statistical procedures for research</td>
<td>Unit transaction through power point presentations and classroom discussion</td>
<td>Assignments, Open book test</td>
</tr>
<tr>
<td>V</td>
<td>Use appropriate parametric and non-parametric statistical tests</td>
<td>Unit transaction through power point presentations and classroom discussion</td>
<td>Class assignments and quizzes</td>
</tr>
</tbody>
</table>
**CC 205: STATISTICS AND COMPUTER APPLICATIONS PRACTICAL**

**Marks: 50**

**Duration: 3 Hrs.**

**Course Objectives**
To understand the basic concepts, theories and methods in statistics, learn basic statistical procedures for research and understand applications of statistical techniques for analysis and interpretation.

**Course Learning Outcomes:**
Student will be able to-

1. Identification of various types of data measurement tools/tests/procedures and understanding the concept of standardisation and reliability and validity.
2. Application of various data reduction and coding methods on quantitative and qualitative data.
3. To be able to organise the data and effectively use appropriate quantitative and qualitative statistical softwares for analysis of data.
4. Draw conclusions and interpretations from the analysed data and write reports.

**FNCC 206: FOOD MICROBIOLOGY AND FOOD SAFETY THEORY**

**Marks: 100**

**Duration: 3 Hrs.**

**Course Objectives:**
The course aims to provide theoretical and practical knowledge about the micro-organisms involved in the food spoilage, infections and intoxications. The course also enables to understand the concept of preservation and microbiological safety in various food operations.

**Course Learning Outcomes:**
Student will be able to -

1. Understand the nature of microorganisms involved in food spoilage, food infections and intoxications.
2. Comprehend principles of various preservation and control techniques.
3. Understand microbial safety in various foods operations.

**CONTENTS**

**UNIT I: Basic Microbiology**
- Introduction to microbiology
- Characteristics of microorganisms
- Factors effecting microbial growth

**UNIT II: Food Spoilage and Preservation**
- Cultivation of micro-organisms
- Controlling agents for micro-organism
- Food spoilage
- Principles and methods of food preservation

UNIT III: Beneficial Role of Food Microbes in Health
- Importance of normal flora, prebiotics and probiotics
- Fermentation
- Single cell proteins
- Fermented food products

UNIT IV: Food Borne Microbial Diseases
- Public health hazards: Food borne infections and intoxications
- Symptoms, mode of transmission and methods of prevention
- Emerging food pathogens

Unit V: Food Safety and Quality Control
- Indicator micro-organisms
- Concept of Food Safety Management System, GHP and GMP
- HACCP, ISO 22000
- Food Laws, Regulations and Standards

Suggested Readings:

Teaching Plan:

Week 1: Introduction to Microbiology
Week 2: Characteristics of Micro-organisms
Week 3: Cultivation of Micro-organisms
Week 4: Controlling agents for Micro-organisms
Week 5: Factors affecting growth of Micro-organisms
**Week 6:** Food spoilage  
**Week 7:** Methods of food preservation  
**Week 8:** Beneficial role of food microbes  
**Week 9:** Food infection and Intoxication, symptoms and mode of transmission  
**Week 10:** Food borne illnesses  
**Week 11:** Emerging food pathogens  
**Week 12:** Concept of FSMS, HACCP, ISO & National and International food laws and standards

**Facilitating the achievement of course learning outcomes**

<table>
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</tr>
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<tbody>
<tr>
<td>I</td>
<td>Basic Microbiology</td>
<td>Understand the nature of various groups of micro-organism, their morphology, extrinsic and intrinsic factors affecting their growth.</td>
<td>Simple staining and Differential staining, Assignments and Quizzes</td>
</tr>
<tr>
<td>II</td>
<td>Food Spoilage and Preservation</td>
<td>Understand the nature of micro-organism involved in food spoilage</td>
<td>Analysis of Canned product, MBRT, MPN, TPC, Assignments and Quizzes</td>
</tr>
<tr>
<td>III</td>
<td>Beneficial role of Food Microbes in Health</td>
<td>Understand the beneficial role of food microbes used for fermentation etc.</td>
<td>Analysis of Curd, Sauerkraut, Probiotic count, Assignments and Quizzes</td>
</tr>
<tr>
<td>IV</td>
<td>Food Borne Microbial Diseases</td>
<td>Understand the role of microbes in causing public health hazard due to food contamination</td>
<td>Rapid detection test for pathogens, Swab Test, Ringers Test, Assignments and Quizzes</td>
</tr>
<tr>
<td>V</td>
<td>Food Safety and Quality Control</td>
<td>Acquaint with various laws and microbiological standards to be maintained during food processing, FSMS, HACCP, ISO, GMP, FSSAI, CODEX</td>
<td>HACCP plan, Assignments and Quizzes</td>
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</tbody>
</table>
FNCC 206: FOOD MICROBIOLOGY AND FOOD SAFETY
PRACTICAL

Marks: 50                                             Duration: 3Hrs

Course Objectives:
To familiarize with the techniques and methods used for cultivation, purification and identification of microbes

Course Learning Outcomes:
Student will be able to-
1. Understand the morphology and structural features of various micro-organisms.
2. Comprehend various techniques used for isolation, purification, identification and controlling the growth of micro-organisms
3. Assess the microbial safety of personal hygiene, water, milk and other food products.

CONTENTS                     PERIODS

UNIT I: Morphology and Structural Features of Various Micro-organisms      2
• Simple staining
• Differential staining

UNIT II: Various Techniques and Instruments Used in Microbiology         2
• Sterilization and Disinfection
• Filtration, biosafety cabinets

UNIT III: Isolation of Microorganisms                                                                              3
• Pure Culture Technique
• Standard Plate Count Method

UNIT IV: Microbiological Analysis For                                                                             5
• Water (Most Probable Number)
• Milk (Methylene Blue Reduction Test)
• Curd and probiotic count
• Adulteration test for various food products.

UNIT V: Biochemical Test                                                                                                      4
• Rapid detection test
• Phenol co-efficient method
• Zone of Inhibition technique

UNIT VI: HACCP Plan                                                                                                 1
• HACCP plan for a food process

Suggested Readings:
FNCC 207: ADVANCED HUMAN NUTRITION -I
THEORY

Marks : 100          Duration: 3 Hrs

Course Objectives:
To understand how Dietary Reference Intakes are derived for the population. To appreciate
the role of nutrition in cellular and physical growth and assess nutritional status.

Course Learning Outcomes:
After doing this course the student will be able to:
1. Critically evaluate and derive requirements for specific macronutrients.
2. Understand critical periods in growth and development and impact of malnutrition.
3. Assess the nutritional status of children and adults.

CONTENTS  PERIODS

UNIT I: Human Nutrient Requirements – Macronutrients 18
- Historical perspective of nutrient requirements
- Methods of assessment of nutrient needs – a critical review
- Critical evaluation of sensitive methods and derivations of requirements and dietary
  allowances of macronutrients for all age groups:
  o Energy
  o Carbohydrates and dietary fibre
  o Proteins and amino acids
  o Lipids and fatty acids
  o Water
- Critical evaluation of national and international nutrient allowances; factors affecting the
  requirements.
- Protein quality and its assessment

UNIT II: Growth and Development through the Life Cycle 10
- Different aspects of growth – cellular to physical
UNIT III: Assessment of Nutritional Status

- Analysis and Interpretation of results
- National and International Growth Standards/References, development of WHO Child Growth Standards
- National Nutrition Surveys

UNIT IV: Nutrition Transition

- Changing trends in life style and dietary patterns in population groups and their implications on nutritional status and disease.
- Triple burden of malnutrition
- Improving nutritional quality of diets- fortification, bioavailability of nutrients, dietary diversity, new food basket

Suggested Readings:

- ICMR (2010). Nutrient Requirements and Dietary Allowances for Indians and its revised documents. New Delhi. ICMR.
Teaching Plan:

**Week 1:** Historical perspective of nutrient requirements and definitions, critical overview of methods of assessing requirements, derivation of energy requirements  
**Week 2:** Derivation of requirements of energy, carbohydrates, fibre  
**Week 3:** Derivation of requirements of energy, lipids  
**Week 4:** Derivation of requirements of energy, protein  
**Week 5:** Derivation of requirements of energy, water, protein quality  
**Week 6:** Different aspects of growth – cellular to physical, measurement of growth  
**Week 7:** Determinants of growth and development, changes in body composition through lifecycle and impact of altered nutrition on growth and development  
**Week 8:** Impact of malnutrition on pregnancy outcome and cognitive development, triple burden of malnutrition  
**Week 9:** Critical overview of various methods of nutritional assessment, analysis, interpretation – Diet surveys, anthropometric measurements  
**Week 10:** Critical overview, analysis, interpretation of biochemical and clinical methods, rapid methods of assessment  
**Week 11:** Growth Standards and References, National nutrition surveys, nutrition transition  
**Week 12:** Impact of nutrition transition, improving diet quality

### Facilitating the Achievement of Course Learning Outcomes

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<tbody>
<tr>
<td>I</td>
<td>Critically evaluate the methodology and derivation of requirements for specific macronutrients</td>
<td>Discussion, PowerPoint presentations, Videos of methods of assessment</td>
<td>Class Quiz, Assignment</td>
</tr>
<tr>
<td>II</td>
<td>Understand critical periods in growth and development and impact of malnutrition</td>
<td>Reading of research on impact of malnutrition on growth, discussion of findings of classical studies, Power Point presentations</td>
<td>Class quiz</td>
</tr>
</tbody>
</table>
| III      | Assess the nutritional status of children and adults | Power Point presentation, discussion, demonstration of software for analysis of anthropometric data | Presentations by students on sources of data on nutritional status  
Assignment on formulation of a tool for diet survey |
| IV       | Appreciate implications of poor dietary and lifestyle practices | Power Point presentations, Discussion on nutrition transition | Presentations by students of research papers on nutrition transition and its consequences |

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FNCC 208: ADVANCED NUTRITIONAL BIOCHEMISTRY AND
TECHNIQUES – II
THEORY

Marks: 100                  Duration:  3 Hrs

Course Objectives:
The aim of the course is to understand the basics of genetic material, get an insight into DNA and RNA metabolism and understand the principles and use of techniques for purification and estimation of DNA and protein

Course Learning Outcomes:
Student will be able to
1. Understand the purine, pyrimidine, iron and heme metabolism
2. Develop insight into structure, functioning and repair of DNA
3. Learn basics of RNA and translation process
4. Comprehend the principles and application of various chromatographic and electrophoretic techniques

UNIT I: Nucleotides, Iron and Heme Metabolism 12
- Structure of Nucleotides.
- De novo synthesis of purines & pyrimidines nucleotides, regulation and salvage pathways
- Catabolism of purine and pyrimidine nucleotides
- Disorders of purine catabolism (Lesch Nyhan syndrome, Gout, Adenosine deaminase deficiency, Hypouricemia)
- Iron metabolism- Mechanisms of transport and cellular uptake
- Basic concept of Heme biosynthesis and degradation

UNIT II: DNA Organization, Replication and Repair 16
- Basic structure of DNA
- DNA organization basic, replication and repair
- Regulation of gene expression (lac operon)
- Genetic mutations
- Basic principles in Nutrigenomics

UNIT III: RNA and Protein Synthesis 12
- Basic structure of RNA
- RNA synthesis and processing (in eukaryotes)
- Genetic code
- Translation
- Post translational modification

UNIT IV: Biochemical Techniques 8
- Chromatographic Techniques
  - Gel filtration
  - Ion exchange chromatography
- Affinity Chromatography
- HPLC
- Gas Chromatography

- Electrophoretic Techniques
  - Electrophoresis-Polyacrylamide gel electrophoresis (Native and SDS)
  - Agarose gel electrophoresis

**Suggested Readings:**


**Teaching Plan**

**Week 1:** Structure of Nucleotides. De novo synthesis of purines & pyrimidines nucleotides, regulation and salvage pathways-I

**Week 2:** De novo synthesis of purines & pyrimidines nucleotides, regulation and salvage pathways-II; Catabolism of purine nucleotides

**Week 3:** Catabolism of pyrimidine nucleotides; Disorders of purine catabolism (Lesch Nyhan syndrome, Gout, Adenosine deaminase deficiency, Hypouricemia)

**Week 4:** Iron metabolism- Mechanisms of transport and cellular uptake, Basic concept of Heme biosynthesis and degradation

**Week 5:** Test, Basic structure of DNA ; DNA organization, replication and repair

**Week 6:** Regulation of gene expression (lac operon); Genetic mutations

**Week 7:** Basic structure of RNA; RNA synthesis and processing (in eukaryotes); Genetic code

**Week 8:** Translation; Post translational modification

**Week 9:** Basic principles in Nutrigenomics; Gel filtration; Ion exchange chromatography

**Week 10:** Affinity Chromatography; HPLC; Gas Chromatography

**Week 11:** Electrophoresis-Polyacrylamide gel electrophoresis (Native and SDS), Assignment

**Week 12:** Agarose gel electrophoresis, test

**Facilitating the achievement of Course Learning Outcomes**

<table>
<thead>
<tr>
<th>Unit No.</th>
<th>Course Learning Outcomes</th>
<th>Teaching and Learning Activity</th>
<th>Assessment Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Purine, pyrimidine, iron and heme metabolism</td>
<td>Classroom lectures, Presentations</td>
<td>Test</td>
</tr>
<tr>
<td>II</td>
<td>Structural organization, function and repair of DNA</td>
<td>Classroom lectures, Practical</td>
<td>Assignment, Practical test</td>
</tr>
</tbody>
</table>
III  RNA synthesis and processing, Protein translation  Classroom lectures, Practical  Test
IV  Principles and use of chromatography and Electrophoresis  Classroom lectures, Demonstration of instruments  Quiz Assignment

FNCC 209: INTEGRATED NUTRITION PRACTICAL

Marks : 100 Duration: 3 Hrs

PART A: ADVANCED NUTRITIONAL BIOCHEMISTRY AND TECHNIQUES – II

Course Objectives:
The aim of the practical is to understand principle and preparation of buffer solutions, understand various methods of quantitative estimations of biomolecules and gain information on various blood analysis tests

Course Learning Outcomes:
Student will be able to
1. Gain skill on preparation of buffers
2. Learn DNA and RNA estimation in solutions
3. Comprehend the application of chromatography and electrophoresis in biochemistry
4. Knowledge on blood analysis

CONTENTS PERIODS
UNIT I: Buffers 3
• Preparation of acidic buffers.
• Preparation of basic buffers

UNIT II: Spectrophotometry 3
• DNA estimation
• RNA estimation

UNIT III: Chromatographic Techniques 2
• Separation of amino acids.

UNIT IV: Electrophoresis 2
• Agarose gel electrophoresis.
• SDS polyacrylamide gel electrophoresis

UNIT IV Blood Analysis 2
• Survey of pathological laboratory to obtain the information on blood and serum analysis tests.
Suggested Readings:

PART B: ADVANCED HUMAN NUTRITION

Marks : 50 Duration: 3 Hrs

Course Objectives:
To learn techniques of measurement of energy expenditure, protein quality, nutritional status.

Course Learning Outcomes:
After completing this course, the student will be able to:
1. Measure energy expenditure in individuals
2. Assess the protein quality of diets and dishes
3. Assess nutritional status of individuals and groups.

CONTENTS PERIODS
UNIT I: Energy Expenditure 3
- Oxygen consumption measurements / Heart rate measurements.
- Computing energy expenditure and energy balance – minute to minute record, GPAQ.

UNIT II: Assessment of Protein Quality 2
- Calculation of NDpCal % and PDCAAS of diets and dishes.

UNIT III: Assessment of Nutritional Status 7
- Dietary surveys – 24 hour recall, Food frequency questionnaire. Standardization of recipes
- Anthropometry – Height, weight, waist circumference, hip circumference, MUAC, skin fold measurements. Analysis of data using WHO AnthroPlus software
- Body composition – bioelectrical impedance method
- Demonstration of cognition tests (to measure intelligence) relevant to the study of nutrition.

UNIT IV: Field Visits 1
- To institutions conducting research in human nutrition and report writing of the visits

Suggested Readings:

• WHO (2009). *WHO Child growth standards: Growth velocity based on weight, length and head circumference.* Available at http://www.who.int
SEMESTER III
FNCC 310: ADVANCED HUMAN NUTRITION –II
THEORY

Marks : 100 Duration: 3 Hrs

Course Objectives:
To understand the basis of derivation of Dietary Reference Intakes for micronutrients and how requirements change under special conditions.

Course Learning Outcomes:
After this course the student should be able to:
1. Critically evaluate the methodology and derivation of requirements for micronutrients.
2. Understand nutritional management in special conditions.
3. Appreciate importance of nutrition immunity interactions and their operational implications.
4. Track emerging concepts in the field of nutrition.

CONTENTS PERIODS

UNIT I: Human Nutrient Requirements -Micronutrients 22
Critical evaluation of sensitive methods and derivations of requirements and dietary allowances of micronutrients for all age groups:
- Water soluble vitamins
- Fat soluble vitamins
- Minerals and trace elements
- Critical evaluation of national and international nutrient allowances; factors affecting the requirements.
- Critically evaluate national and international dietary guidelines.

UNIT II: Interactions of Nutrition, Immunity and Infection 8
- Host defense mechanisms and nutrients essential in the development of immune system.
- Effect of infections on the nutritional status of an individual.
- Nutrient deficiencies and excesses affecting the immuno-competence and to infections.
- Operational implications.

UNIT III: Nutrition in Special Conditions 6
- Extreme temperatures - low and high
- High altitude
- Space nutrition and food systems
- Introduction to sports nutrition

UNIT IV: Emerging Concepts in Human Nutrition 12
- Nutrigenomics
- Functional foods and bioactive compounds
- Nutraceuticals
- Genetically modified foods and advances in biotechnology
Suggested Readings:

Teaching Plan:
**Week 1**: Derivation of requirements of thiamine, calcium, selenium
**Week 2**: Derivation of requirements of riboflavin, iron, magnesium
**Week 3**: Derivation of requirements of niacin, zinc, iodine, sodium, potassium
**Week 4**: Derivation of requirements of pyridoxine, other trace minerals
**Week 5**: Derivation of requirements of folic acid, national and international dietary guidelines
**Week 6**: Derivation of requirements of vitamin B12, host defence mechanisms, effect of infection on nutritional status
**Week 7**: Derivation of requirements of vitamin A, effect of malnutrition on immunity, operational implications
**Week 8**: Derivation of requirements of vitamins A and D, nutrition in extreme hot, cold locations and high altitude
**Week 9**: Derivation of requirements of vitamins D and E, space food systems and space nutrition, sports nutrition
**Week 10**: Derivation of requirements of vitamin K, sports nutrition, nutraceuticals
**Week 11**: Functional foods, GM foods and other advances in biotechnology
**Week 12**: Nutrigenomics

Facilitating the achievement of Course Learning Outcomes

<table>
<thead>
<tr>
<th>Unit No.</th>
<th>Course Learning Outcomes</th>
<th>Teaching and Learning Activity</th>
<th>Assessment Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Critically evaluate the methodology and derivation of requirements for specific micronutrients</td>
<td>Discussion, PowerPoint presentations, Videos of methods of assessment</td>
<td>Class Quiz, Assignment</td>
</tr>
<tr>
<td>II</td>
<td>Understand nutritional management in special conditions</td>
<td>Reading of research on sports nutrition and derivation of nutrient requirements in special</td>
<td>Class quiz</td>
</tr>
</tbody>
</table>
FNCC 311: CLINICAL NUTRITION
THEORY

Marks: 100 Duration: 3 Hrs

Course Objectives:
To understand the nutrition assessment, planning, implementation, monitoring and follow up in nutrition care process, the causative factors and metabolic changes in various diseases/disorders and acquire knowledge on the principles of diet therapy and comprehend principles of dietary Counselling and the rationale of prevention of various diseases/disorders.

Course Learning Outcomes:
The student will be able to
1. Understand the importance of nutritional assessment in the care of patients.
2. Gain knowledge about causative factors and metabolic changes in various diseases/disorders and the associated principles of diet therapy.
3. Learn the principles of dietary Counselling.
4. Comprehend the rationale of prevention of various diseases/disorders.

CONTENTS

UNIT I  Nutritional Assessment and Care of Patients
- Nutrition care process
  - Nutritional screening and assessment of
  - Patients – out patient & hospitalized
  - Tools for screening
  - Nutritional interpretation of routine medical and laboratory data
  - Nutrition care plan and implementation
  - Monitoring and follow up
  - Ethical issues
- Dietary Counselling
- Nutrition Support: Enteral Nutrition

UNIT II Medical Nutrition Therapy in metabolic diseases
- Diabetes Mellitus – Type 1, Type 2 and Gestational diabetes
- Endocrine disorders – Polycystic ovary disease, thyroid

PERIODS
9
10
Unit III  Coronary Heart Diseases  
- Etiopathophysiology, metabolic & clinical aberrations, diagnosis, complications, treatment, MNT, dietary counselling and recent advances in  
  o Hypertension, dyslipidemia, Congestive heart failure  

Unit IV  Gastrointestinal Tract Disorders  
- Etiopathophysiology, metabolic & clinical aberrations, diagnosis, complications, treatment, MNT, dietary counselling and recent advances in  
  o GERD, peptic ulcer, dyspepsia, flatulence, celiac disease, inflammatory bowel disease, diverticular disease, hernia, hemorrhoids, intestinal surgery, bariatric surgery.  
  o Nutrition for oral and dental disorders  

Unit V Overview of Some Degenerative Disorders  
- Cancer – General and specific cancers, effect of cancer therapy on MNT,  
- Role of diet in etiology and management  
- Chronic Obstructive Pulmonary Disease  
- Systemic Lupus Erythematosis  
- Nutrition for bone health  

Unit VI Pediatric Nutrition  
- Inborn errors of metabolism – Phenylketonuria, Galactosemia, Maple Syrup Urine Disease, Glycogen Storage Disease  
- Severe Acute Malnutrition  
- Cystic fibrosis  

Suggested Readings:  

Teaching Plan:  
Week 1: Nutrition care process and steps of NCP  
Week 2: Ethical issues, Dietary Counselling  
Week 3: Enteral Nutrition, Medical Nutrition Therapy in Diabetes Mellitus – Type 1, Type 2
Week 4: Medical Nutrition Therapy in Gestational diabetes Endocrine disorders – Polycystic ovary disease, thyroid
Week 5: Etiopathophysiology, metabolic & clinical aberrations, diagnosis, Complications and recent advances in prevention, treatment, MNT and dietary Counselling in Hypertension, dyslipidemia
Week 6: Etiopathophysiology, metabolic & clinical aberrations, diagnosis, Complications and recent advances in prevention, treatment, MNT and dietary Counselling in Congestive heart failure
Week 7: Etiopathophysiology, metabolic & clinical aberrations, diagnosis, Complications and recent advances in prevention, treatment, MNT and dietary Counselling in GERD, peptic ulcer, dyspepsia, flatulence
Week 8: Etiopathophysiology, metabolic & clinical aberrations, diagnosis, Complications and recent advances in prevention, treatment, MNT and dietary Counselling in Inflammatory bowel disease, diverticular disease, hernia, hemorrhoids
Week 9: Complications and MNT and dietary Counselling in Intestinal surgery, bariatric surgery Nutrition for oral and dental disorder, Cancer – General and specific cancers, effect of cancer therapy on MNT, Role of diet in etiology and management
Week 10: Chronic Obstructive Pulmonary Disease, Systemic Lupus Erythematosis, Nutrition for bone health
Week 11: Inborn errors of metabolism – Phenylketonuria, Galactosemia, Maple Syrup Urine Disease, Glycogen Storage Disease, Severe Acute Malnutrition, Cystic fibrosis

Facilitating the achievement of Course Learning Outcomes

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Understand the importance of nutritional assessment in the care of patients.</td>
<td>Discussion</td>
<td>Assignment on nutritional assessment and care of patients.</td>
</tr>
<tr>
<td>II</td>
<td>Gain knowledge about causative factors and metabolic changes in various diseases/disorders and the associated principles of diet therapy.</td>
<td>Discussion</td>
<td>Assignment on etiology, pathophysiology and metabolic changes in various disorders Diet plan for management of diseases.</td>
</tr>
<tr>
<td>III</td>
<td>Learn principles of dietary counselling</td>
<td>Discussion</td>
<td>Practice interactive session on dietary counselling</td>
</tr>
<tr>
<td>IV</td>
<td>Comprehend the rationale of prevention of various diseases/disorders</td>
<td>Discussion</td>
<td>Assignment on role of diet in prevention and management of these disorders</td>
</tr>
</tbody>
</table>
PART A: ADVANCED HUMAN NUTRITION

Course Objectives:
To learn techniques in nutrient analysis of foods and assessment of micronutrient status.

Course Learning Outcomes:
1. Understand how requirements are derived using sensitive methods like nutrient balance studies and load tests
2. Analyze nutrients in foods and biological fluids like urine
3. Recognize clinical symptoms of deficiency and excess
4. Appreciate research done in the field of nutrition

CONTENTS

UNIT I: Human Balance Studies
- Nitrogen balance.
- Mineral balance: Ca/Fe/Zn.

UNIT II: Estimation of Micronutrient Status
- Iodine in salt and urine
- Carotenoids/phytochemicals in fruits/vegetables
- Estimation of iron content of a food
- Load test of Vitamin C
- Clinical assessment of micronutrient status

UNIT III: Exposure to Research in Human Nutrition
- Field visits to institutions conducting research in human nutrition and report
- Writing of the visits
- Critical review of original research articles

Suggested Readings:

PART –B CLINICAL NUTRITION

Course Objectives:
To enable students to plan and prepare suitable therapeutic diets based on patient needs, provide dietary counselling for prevention/treatment of various diseases/disorders and familiarize with special therapeutic/health foods

Course Learning Outcomes:
Student will be able to:
1. Assess the needs of patients.
2. Plan and prepare diets suitable for patients of different diseases
3. Comprehend types and availability of foods for special dietary uses.

CONTENTS

PERIODS

Unit I: Assessment of patient needs – nutritional assessment and screening 2
- Recording of BP by using a Sphygmomanometer
- Use of Pulse Oximeter
- Use of Glucometer
- Interpretation of OGTT, HbA1c values
- Interpretation of RFT and LFT

Unit II: Planning and preparation of diets for following diseases 9
- Type 1 diabetes
- Type 2 diabetes
- Gestational Diabetes
- Peptic ulcer
- Hypertension and dyslipidemia
- Congestive heart failure
- Ulcerative colitis
- Diverticular disease
- Cancer
- IEM and SAM
- Antenatal clinic, high risk pregnancy

Unit III: Market Survey of the Following Products 1
- Food supplements
- Enteral formulas
- Functional foods
- Disease specific foods

Suggested Readings:
FNCC 313: INTERNSHIP  
(To be assessed by a Board of three teachers)

Marks: 50

Course Objectives:
To gain hands on experience of working in various institutions related to the area of Food and Nutrition.

The students could work with NGOs / Government agencies / International agencies/ Hospitals / Food Industries etc. They would be required to present are a report of their Internship in their Department.

FNCC 314: DISSERTATION- I: TECHNICAL WRITING & SEMINAR  
(Seminar to be assessed by three teachers)  
(Technical writing to be assessed by Continuous Evaluation)

Marks: 50

Course Objectives:
To understand the nuances of scientific writing, develop skills in collation and presentation of scientific information and learn the process of developing a research proposal/ project proposal

Course Learning Outcomes:
Student will be able to:
1. Demonstrate knowledge of scientific writing method and styles
2. Develop a research design on a topic relevant to their field
3. Prepare a systematic literature review on a select topic
4. Present a seminar of the literature review

CONTENTS PERIODS

The practical will have three components. Based on option of students for either dissertation or project work, due emphasis will be provided

A) Research Design / Project proposal  12
• Under the guidance of supervisor allocated prepare a research design / project proposal

B) Skills in Technical Writing  24
• Learn the nuances of select technical writing styles/ guides
• Analyze technical posters of researches in the fields

• Analyze dissertations, research reports systematic reviews/ secondary research and project evaluation reports and their presentations

C) Review of Literature & Seminar
• Prepare a literature review on a select topic using an approved style guide
• Conduct Plagiarism check of document prepared
• Present an oral seminar on the topic

Facilitating the achievement of Course Learning Outcomes

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</thead>
<tbody>
<tr>
<td>I</td>
<td>Demonstrate knowledge of scientific writing method and styles</td>
<td>Students oriented the nuances of select technical writing styles/ guides Analyze technical posters of researches in the fields Analyze dissertations, research reports and project evaluation reports Videos on scientific writing shown</td>
<td>Quiz and exercises will be given to students</td>
</tr>
<tr>
<td>II</td>
<td>Develop a research design on a topic relevant to their field</td>
<td>Along with allocated supervisors students will work on deciding a topic of research, review literature and develop an appropriate research design</td>
<td>Students submit the research design to technical review board for review and comments</td>
</tr>
<tr>
<td>III</td>
<td>Prepare a systematic literature review on a select topic</td>
<td>Students collate the literature review done about their research topic selected and prepare a document based on it. Students review old seminar documents and critique their presentation</td>
<td>Students literature review document reviewed by seminar committee Plagiarism test done of final document</td>
</tr>
<tr>
<td>IV</td>
<td>Present a Seminar based on the literature review done</td>
<td>Students watch videos of seminar presentations and critique them. Prepare a seminar presentation.</td>
<td>Students presentations evaluated by the departmental seminar committee</td>
</tr>
</tbody>
</table>
Suggested Readings:
- http://www.apastyle.org/
- http://www.citethisforme.com/guides

### ELECTIVE PAPERS

**GROUP –A**

**FNEC 31 A: PUBLIC HEALTH ASPECTS OF MALNUTRITION**

**THEORY**

Maximum Marks: 100  
Duration: 3 Hrs

**Course Objectives:**
This Course will familiarize the students with the concepts of Public Health aspects of malnutrition- both under-nutrition and over-nutrition, health care of the community, and food and nutrition security. The students will acquire knowledge about the causes, consequences and preventive strategies for nutritional problems in the community and also strategies for improving the nutritional and health status of communities.

**Course Learning Outcomes:**
Student will be able to
1. Become familiar with the concept of public health aspects of malnutrition and health care of the community.
2. Understand the causes, consequences and preventive strategies for nutritional problems in the community.
4. Acquire knowledge about the concept of food and nutrition security and the various programmes for improving food and nutrition security.

**CONTENTS**

<table>
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<tr>
<th>UNIT I: Public Health Nutrition and Health Care Systems</th>
<th>PERIODS</th>
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</thead>
<tbody>
<tr>
<td>Aim, scope and content of Public Health Nutrition</td>
<td>8</td>
</tr>
<tr>
<td>Role of Public Health Nutritionist in national development</td>
<td></td>
</tr>
<tr>
<td>Health – definition, dimensions, determinants and indicators</td>
<td></td>
</tr>
<tr>
<td>Health care of the community</td>
<td></td>
</tr>
</tbody>
</table>
• Health care systems, ICDS, Rural Development (National Rural Livelihood Mission, Panchayat Raj Institutions)

UNIT II: Public Health Aspects of Undernutrition 10
• Etiology, public health implications, preventive strategies for CED/PEM, Severe Acute Malnutrition, major micronutrient deficiencies (Vitamin A Deficiency, Nutritional Anemias, Iodine Deficiency Disorders, Vitamin D Deficiency and Osteoporosis, Zinc Deficiency) and emerging nutrient deficiencies of public health significance
• Maternal/Reproductive health, Adolescent Nutrition and Anemia
• National strategies and programmes for prevention of malnutrition

Unit III: Epidemiology: Basic Concepts, Methods and Applications 12
• Introduction and overview to epidemiology
• Epidemiologic study methods- observational and experimental studies
• Epidemiology of non-communicable diseases
• Demographic, epidemiological and social determinants of NCD’s and their mapping: Cardiovascular diseases and Type 2 diabetes, Cancer, Respiratory diseases (COPD and asthma) and other emerging issues and ongoing challenges of non-communicable diseases
• Public health strategies for prevention of NCD’s: Policies, programmes, taxation and pricing, improving built environment

Unit IV: Approaches/ Strategies for Improving Nutrition and Health Status of the Community 10
• Health based interventions including immunization, provision of safe drinking water/sanitation, prevention and management of diarrhoeal diseases and National Policies to address sanitation
• Food based interventions including food fortification, dietary diversification, supplementary feeding and biotechnological approaches
• Education based interventions including growth monitoring and promotion (GMP), health/nutrition related behaviour change communication

UNIT V: Food and Nutrition Security 8
• Concepts and definitions of food and nutrition security at national, household and individual levels.
• Public Sector programmes for improving of food and nutrition security and POSHAN Abhiyaan

Suggested Readings:
• Gopalan C (Ed) (1987) Combating Under nutrition- Basic Issues and Practical Approaches, Nutrition Foundation of India
• Park K (24th ed) (2017) Park’s Textbook of Preventive and Social Medicine, Jabalpur M/s. BanarsidasBhanot
• IFCT (2017) Indian food composition table, NIN
• Ross A C (Eds) (2012) *Nutrition in health and disease*, Lippincott Williams & Wilkins
• Shils M E (Eds) (1998) *Nutrition in health and disease*, Lippincott Williams & Wilkins
• NNM: http://www.icds-wcd.nic.in/nnm/home.html
• Vir S (2011) *Public health nutrition in developing countries*, Woodhead Publishing India limited

**Teaching Plan:**

**Week 1:** Concept of public health nutrition, Aim, scope and content of Public Health Nutrition, Role of Public Health Nutritionist in National development, Health - definition, dimensions

**Week 2:** Health - determinants and indicators, Health care of the community, Health care systems

**Week 3:** Etiology, public health implications, preventive strategies for CED/PEM, Severe Acute Malnutrition

**Week 4:** Etiology, public health implications, preventive strategies for micronutrient deficiencies of public health significance

**Week 5:** National strategies and programmes for prevention of malnutrition. Introduction and overview to epidemiology.

**Week 6:** Epidemiology of non-communicable diseases. Demographic, Epidemiological and social determinants of NCD’s: Cardiovascular diseases and Type 2 diabetes, Cancer, Respiratory diseases (COPD and asthma) and other emerging issues and ongoing challenges of non-communicable diseases

**Week 7:** Demographic, Epidemiological and social determinants of NCD’s: Cardiovascular diseases and Type 2 diabetes, Cancer, Respiratory diseases (COPD and asthma) and other emerging issues and ongoing challenges of non-communicable diseases

**Week 8:** Public health strategies for prevention of NCD’s: Policies, programmes, taxation and pricing, improving built environment

**Week 9:** Health based interventions including immunization, provision of safe drinking water/sanitation, prevention and management of diarrhoeal diseases. Food based interventions including food fortification

**Week 10:** Food based interventions including food fortification, dietary diversification, supplementary feeding and biotechnological approaches. Education based interventions - nutrition related behaviour change communication,

**Week 11:** Concepts and definitions of food and nutrition security at national, household and individual levels

**Week 12:** Public Sector programmes for improving of food and nutrition security, POSHAN Abhiyaan
## Facilitating the Achievement of Course Learning Outcomes

<table>
<thead>
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<th>Unit No.</th>
<th>Course Learning Outcomes</th>
<th>Teaching And Learning Activity</th>
<th>Assessment Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Become familiar with the concept of public health nutrition and health care of the community.</td>
<td>Lecture-cum-Discussion</td>
<td>Assignment/ Test/ Quiz</td>
</tr>
<tr>
<td>II</td>
<td>Understand the causes, consequences and preventive strategies for nutritional problems in the community.</td>
<td>Lecture-cum-Discussion, Presentations</td>
<td>Student presentations/ Assignment/ Test</td>
</tr>
<tr>
<td>III</td>
<td>Comprehend the strategies for improving the nutrition and health status of communities.</td>
<td>Lecture-cum-Discussion, Presentations</td>
<td>Student presentations/ Assignment/ Test</td>
</tr>
<tr>
<td>IV</td>
<td>Understanding the basic concepts, methods and applications of Epidemiology with ref to NCD’s</td>
<td>Lecture-cum-Discussion, Presentations</td>
<td>Student presentations/ Assignment/ Test</td>
</tr>
<tr>
<td>V</td>
<td>Acquire knowledge about the concept of food and nutrition security and the various programmes for improving food and nutrition security</td>
<td>Lecture-cum-Discussion, Presentations</td>
<td>Student presentations/ Assignment/ Test</td>
</tr>
</tbody>
</table>

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**FNEC 31 A: PUBLIC HEALTH ASPECTS OF MALNUTRITION PRACTICAL**

**Maximum Marks: 50**  
**Duration: 3 Hrs**

**Course Objectives:**  
To develop nutrition education programmes for vulnerable groups and planning nutritious recipes for micronutrient deficiencies and field visit to ongoing national nutrition and health programmes.

**Course Learning Outcome:**  
Student will be able to develop nutrition education programmes for vulnerable groups and plan nutritious recipes for micronutrient deficiencies.

**CONTENTS**

<table>
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<tr>
<th>Unit</th>
<th>PERIODS</th>
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</thead>
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<tr>
<td><strong>Unit-I</strong></td>
<td>4</td>
</tr>
<tr>
<td>• Development of a plan for conducting nutrition education programmes in the community.</td>
<td></td>
</tr>
<tr>
<td>• Preparation of communication aids for different groups</td>
<td></td>
</tr>
<tr>
<td><strong>Unit-II</strong></td>
<td>3</td>
</tr>
</tbody>
</table>
• Development of low cost recipes for infants, preschoolers, adolescents, pregnant and lactating mothers

**Unit-III**

• Planning and preparation of diet/ dishes for Protein Energy Malnutrition (PEM), Vitamin A Deficiency (VAD), Iron Deficiency Anaemia (IDA), obesity, hypertension, diabetes
• Field visits to ongoing national nutrition and health programmes

**Suggested Readings:**

• IFCT (2017) *Indian Food Composition Tables*, NIN

**FNEC 32 A: INSTITUTIONAL FOOD MANAGEMENT THEORY**

**Marks : 100**

**Duration: 3 Hrs**

**Course Objectives:**
To develop a knowledge base about the facilities required for different types of food service units and to equip individuals in understanding and managing resources in a food service institution

**Course Learning Outcomes:**
Student will be able to:
1. Gain expertise to function as a food service manager.
2. Develop knowledge in managing various food service systems.
3. Understand and manage resources in a food service institution.
4. Provide practical experience in managing food material for food service management
UNIT I: Managing Catering Processes
- Approaches to management
- Classical, Scientific, Systems approach, Management by Objective, Just-in Time, Total Quality Management, Quality of Work Life
- Tools of Management
- Tangible Tools: Organization chart, Job description, Job specification, Job analysis: Path way chart, Process chart, Work schedule, Production schedule, Staff and service analysis, Budget
- Intangible tools: Communication, Leadership, Decision making

UNIT II: Food Production Cycle in Various Food Service Institutions
- Meal Ordering System (manual, electronic)
- Menu construction (hospital, canteen, MDM, food stall)
- Menu card/display
- Food production processes for various situations
- Guidelines of regulatory bodies

UNIT III: Managing Resources
- Manpower
- Functions of a personnel manager, absenteeism, labour turnover
- Recruitment and selection process - Process and Sources-Internal and External, Process interview, Tests
- Orientation and Training- Importance of orientation and training, content of programme, Steps of developing an Orientation programme, Types of training - OJT, Group; continuous training, training for development, Developing a training programme
- Appraisal of employees – Importance, Methods, Limitation
- Motivating employees- Motivation theories and approaches - Content theories: Maslow, Herzberg, McClelland; Process theories: Vroom, Equity; Reinforcement theory; Techniques of motivating employees
- Employee behavior and policies
- Finance and Marketing
- Managing finances in a catering establishment
- Records: Menu, Purchase, Store, Production, Sales, Personnel, Utilities
- Reports :Cost analysis: Concept of Trial Balance, Profit and Loss Account
- Marketing techniques and strategies
- Equipment and Layouts
- Types of equipment
- Steps in layout planning and architectural features
- Feasibility assessment in terms of layout planning

UNIT IV. Food Safety, Hygiene and Regulations in Food Service Institutions
- HACCP
- Good Manufacturing Practices (GMP), Good Hygiene Practices (GHP)
- Food Safety and Standards Regulations
- Food safety in different food service units
- Accreditations for healthcare systems: NABH, JCI

Suggested Readings:

**Teaching Plan:**

**Week 1:** Classical, Scientific, Systems approach, Management by Objectives, Just-in Time, Total Quality Management, Quality of Work Life, Tools of management (Introduction)

**Week 2:** Tools of management: Tangible Tools: Organization chart, Job description, Job specification, Job analysis: Path way chart, Process chart, Work schedule, Production schedule, Staff and service analysis, Budget

**Week 3:** Intangible tools: communication, leadership, decision making, food production cycle in various institutions: meal ordering system (manual, electronic)

**Week 4:** Food production cycle in various institutions: Meal ordering system, menu construction ( hospital, canteen, MDM, food stall), menu card/ display, food production processes for various situations

**Week 5:** Food production cycle in various institutions: Guidelines of regulatory bodies, Managing Resources: Functions of a personnel manager, absenteeism, labour turnover Recruitment and selection process - Process and Sources-Internal and External, Process interview, Tests

**Week 6:** Manpower: Orientation and Training- Importance of orientation and training, content of programme, Steps of developing an Orientation programme, Types of training - OJT, Group; continuous training, training for development, Developing a training programme ; Appraisal of employees – Importance, Methods, Limitation

**Week 7:** Manpower: Motivating employees- Motivation theories and approaches -Content theories: Maslow, Herzberg, McClelland; Process theories: Vroom, Equity; Reinforcement theory; Techniques of motivating employees; Employee behavior and policies

**Week 8:** Finance and Marketing: Managing finances in a catering establishment Records: Menu, Purchase, Store, Production, Sales, Personnel, and Utilities

**Week 9:** Finance and Marketing: Reports: Cost analysis: Concept of Trial Balance, Profit and Loss Account, Marketing techniques and strategies

**Week 10:** Equipment and Layouts: Types of equipment, Steps in layout planning and architectural features

**Week 11:** Equipment and Layouts: Feasibility assessment in terms of layout planning Food safety, hygiene and regulations in food service institutions: HACCP, Good Manufacturing Practices (GMP), Good Hygiene Practices (GHP), FSSA 2006

**Week 12:** Food safety, hygiene and regulations in food service institutions: Food safety in different food service units. Accreditations for healthcare systems: NABH, JCI
Facilitating the achievement of Course Learning Outcomes

<table>
<thead>
<tr>
<th>Unit No.</th>
<th>Course Learning Outcomes</th>
<th>Teaching and Learning Activity</th>
<th>Assessment Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Develop insight about basic concept of catering management</td>
<td>Discussion</td>
<td>Assignment on various theories of management</td>
</tr>
<tr>
<td>II</td>
<td>Understand manage food service in healthcare</td>
<td>Discussion, visits to healthcare system</td>
<td>Report of the visits</td>
</tr>
<tr>
<td>III</td>
<td>Understand resource management in a food service unit</td>
<td>Discussion</td>
<td>Assignment on collecting information on various resources in management</td>
</tr>
<tr>
<td>IV</td>
<td>Develop insight of new laws and regulation in food safety for food service units</td>
<td>Discussions</td>
<td>Assignment</td>
</tr>
</tbody>
</table>

FNEC 32 A: INSTITUTIONAL FOOD MANAGEMENT PRACTICAL

Marks: 50  Duration: 3 Hrs.

Course Objectives
To develop skills in menu planning, quantity food production for various food service organizations within specific budgets

Course Learning Outcomes
Student will be able to
1. Understand the operations of food service units.
2. Develop insight about products and their price in market.
3. Develop skills in planning menus for various food service organizations within specific budgets.
4. Application of acquired skills in menu planning and quantity food production

CONTENTS

<table>
<thead>
<tr>
<th>Unit I: Market Survey</th>
<th>PERIODS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food products raw and processed in different kind of markets</td>
<td>1</td>
</tr>
</tbody>
</table>

Unit II: Planning Menus for the following:

<table>
<thead>
<tr>
<th>PERIODS</th>
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</thead>
<tbody>
<tr>
<td>Conference</td>
</tr>
<tr>
<td>Food stall</td>
</tr>
<tr>
<td>Mid Day Meal</td>
</tr>
<tr>
<td>Cyclic menu for hospital (government/private)</td>
</tr>
</tbody>
</table>

Unit III: Standardizing Recipes in Quantity Cooking

<table>
<thead>
<tr>
<th>PERIODS</th>
</tr>
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<tbody>
<tr>
<td>6</td>
</tr>
</tbody>
</table>
• Canteen project/ Event catering
• Development of sale promotion tool
• Training Food service unit personnel in hygiene and sanitation

Suggested Readings:

FNEC 31 B: PUBLIC HEALTH NUTRITION
THEORY

Marks: 100 Duration: 3 Hrs.

Course Objectives:
The course will familiarize the students with understanding of the concept of public health nutrition and the national health care delivery system, the current concerns in public health nutrition and the strategies for improving the nutritional status of the communities. The course will also orient students towards concept of food and nutrition security and critical appraisal of the current scenario.

Course Learning Outcomes:
Students will be able to:
1. Understand the concept and current concerns of Public Health Nutrition.
2. Comprehend the National Health Care Delivery System.
3. Get exposed to population dynamics and economics of malnutrition and how it impacts national development
4. Understand the causes and consequences of nutritional problems in the community.
5. Be familiar with the concept of food and nutrition security.

CONTENTS

UNIT I: Public Health Nutrition and Health Care System

<table>
<thead>
<tr>
<th>PERIODS</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
</tr>
</tbody>
</table>

• Aim, scope and content of public health nutrition
• Current concerns in public health nutrition: An overview
• Role of public health nutritionists in national development
  o Health - definition, dimensions, determinants, indicators
  o Community health care
• National Health Care Delivery System, ICDS, Rural Development (National Rural Livelihood Mission), Panchayat Raj Institutions

UNIT II: Population Dynamics

• Demographic transition
Population structure: Implications on quality of life
Population Policy

Unit III: Economics of Malnutrition
- Health Economics and Economics of Malnutrition
- Impact of malnutrition on productivity and national development

Unit IV: Approaches for Improving Nutrition and Health Status of the Community
- Health based interventions including immunization, provision of safe drinking water/sanitation, prevention and management of diarrhoeal diseases. Other health services such as antenatal care, de-worming, pharmaceutical supplements (IFA, VAS etc)
- Food based interventions including food fortification, dietary diversification, supplementary feeding and biotechnological approaches.
- Education based interventions including growth monitoring and promotion (GMP), health/nutrition related social and behaviour change communication.

Unit V: Food and Nutrition Security
- Concepts and definitions of food and nutrition security at national, regional, household and individual levels
- Impact of food production losses, distribution, access, availability, consumption on food and nutrition security - critical appraisal of the current scenario
- POSHAN Abhiyaan

Suggested Readings:

Teaching Plan
Week 1: Aim, scope and content of public health nutrition, Current concerns in public health nutrition: An overview
Week 2: Role of public health nutritionists in national development Health - definition, dimensions, determinants, indicator
Week 3: Community health care: Concept, levels of health care: primary, secondary, tertiary level care, Primary health care
Week 4: National Health Care Delivery System Demographic transition
Week 5: Population structure: Implications on quality of life Population Policy
Week 6: Health Economics and Economics of Malnutrition, Impact of malnutrition on productivity and national development
Week 7: Health based interventions including immunization, provision of safe drinking water/sanitation, prevention and management of diarrhoeal diseases
Week 8: Food based interventions including fortification, use of biotechnology, supplementary feeding
Week 9: Education based interventions including growth monitoring and promotion, communication for health and nutrition behaviour change
Week 10: Education based interventions including growth monitoring and promotion, communication for health and nutrition behaviour change
Week 11: Concepts and definitions of food and nutrition security at national, regional, household and individual levels
Week 12: Impact of food production losses, distribution, access, availability, consumption on food and nutrition security- critical appraisal of the current scenario

Facilitating the achievement of Course Learning Outcomes

<table>
<thead>
<tr>
<th>Unit No.</th>
<th>Course Learning Outcomes</th>
<th>Teaching and Learning Activity</th>
<th>Assessment Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Understand the concept and current concerns of Public Health Nutrition.</td>
<td>Presentations, Discussion</td>
<td>Test on the topic</td>
</tr>
<tr>
<td>II</td>
<td>Comprehend the National Health Care Delivery System.</td>
<td>Presentations, Discussion</td>
<td>Individual Assignments</td>
</tr>
<tr>
<td>III</td>
<td>Get exposed to population dynamics and economics of malnutrition and how it impacts national development</td>
<td>Presentations, Discussion</td>
<td>Group presentation</td>
</tr>
<tr>
<td>IV</td>
<td>Understand the causes and consequences of nutritional problems in the community.</td>
<td>Presentations, Discussion</td>
<td>Individual Assignments for different nutritional problems</td>
</tr>
<tr>
<td>V</td>
<td>Be familiar with the concept of food and nutrition security.</td>
<td>Presentations, Discussion</td>
<td>Test on knowledge domain, Individual Assignment</td>
</tr>
</tbody>
</table>
Course Objectives:
The aim of the course is to plan and prepare low cost nutritious dishes and cyclic menus for vulnerable groups, understand the national health care delivery system and identify type of nutritional problems and their determinants in different population groups.

Course Learning Outcomes:
The students will:
1. Develop low cost standardized recipes for different age groups and physiological states.
2. Prepare cyclic menus for feeding programmes and institutions.
3. Identify nutritional problems in the community and their determinants.

CONTENTS PERIODS

Unit I: Development of low cost recipes for infants, preschoolers, elementary school children, adolescents, pregnant and lactating mothers. Standardization and demonstration of any one recipe. 4

UNIT II: Planning and preparation of cyclic menu for a school feeding programme 3

Unit III: Field visit to Primary Health Centre/ANC / Ongoing nutrition and health programmes 1

Unit IV: Identification of the type of nutritional problems and their determinants in different population groups based on National/regional level Nutrition and Health Surveys- Secondary data analysis 4

Suggested Readings:
- IFCT (2017). *Indian Food Composition Tables*, NIN.

FNEC 32 B: PROGRAMME PLANNING IN PUBLIC HEALTH NUTRITION THEORY

Marks: 100 Duration: 3 hours

Course Objectives:
This course will make the students familiar with the process of planning and management of public health nutrition programmes. It will help them understand the concept of monitoring of programmes and nutritional surveillance. The students will also learn about nutrition in emergency and disaster situations.
Course Learning Outcomes:

The students will:

1. Become familiar with the process of planning and management of public health nutrition programmes.
2. Develop an understanding of the concept of nutrition monitoring and nutrition surveillance.
3. Get acquainted with the nutritional problems during emergencies/disasters and the strategies to tackle them.

CONTENTS

Unit I: Programme Planning and Management in Public Health Nutrition

- Introduction to Management Principles
- Basic principles and models of programme planning
- Planning process in public health nutrition - community needs assessment, setting goals and objectives, selecting indicators, selecting interventions, planning for programme implementation and resources, planning for programme monitoring and evaluation, planning for programme termination, stakeholder participation in programme management
- Planning at micro and macro level

14 PERIODS

Unit II: Programme Monitoring and Evaluation

- Definition, significance and purpose of monitoring food/nutrition programmes
- Identification and selection of indicators for monitoring, data collection and analysis system (e.g. MIS)
- Definition, significance and purpose of evaluation of food/nutrition programmes
- Principles of evaluation, types, models and steps of evaluation
- Identification and selection of indicators for evaluation
- Strategies for data collection - qualitative and quantitative

12 PERIODS

Unit III: Nutrition Surveillance

- Objectives, initial assessment indicators for use in nutrition surveillance
- Nutritional surveillance for programme planning: Triple A approach
- Current programme monitoring systems in India

10 PERIODS

Unit IV: Nutrition in Emergencies and Disasters

- Natural and manmade disasters resulting in emergency situations
- Nutritional problems in emergencies in vulnerable groups
- Macro/micronutrient deficiencies
- Infections
- Assessment and surveillance of affected population groups – clinical, anthropometric and dietary
- Nutritional relief and rehabilitation – assessment of food needs, food distribution strategies, mass/supplementary feeding, hygiene and sanitation, evaluation of feeding programmes
- Public nutrition approaches to tackle nutritional problems in emergencies

Suggested Readings:
• WHO. (2000). *The management of nutrition in major emergencies*.

**Teaching Plan**

**Week 1:** Concept of management, its importance. Introduction to Management Principles

**Week 2:** Basic principles and models of programme planning. Planning process in public health nutrition, community needs assessment, setting goals and objectives, selecting indicators

**Week 3:** Planning process in public health nutrition, selecting interventions, planning for programme implementation and resources, planning for programme monitoring and evaluation,

**Week 4:** Planning process in public health nutrition: planning for programme termination, stakeholder participation in programme management. Definition, significance and purpose of monitoring food/nutrition programmes. Identification and selection of indicators for monitoring, data collection and analysis system

**Week 5:** Definition, significance and purpose of evaluation of food/nutrition programmes
Principles of evaluation, types, models and steps of evaluation

**Week 6:** Identification and selection of indicators for evaluation. Strategies for data collection - qualitative and quantitative

**Week 7:** Strategies for data collection – quantitative objectives, initial assessment indicators for use in nutrition surveillance

**Week 8:** Nutritional surveillance for programme planning: Triple A approach

**Week 9:** Current programme monitoring systems in India

**Week 10:** Natural and manmade disasters resulting in emergency situations Nutritional problems in emergencies in vulnerable groups - Macro / micro Nutrient deficiencies, Infections

**Week 11:** Assessment and surveillance of affected population groups – clinical, anthropometric and dietary Nutritional relief and rehabilitation – assessment of food needs, food distribution strategies, mass/supplementary feeding, hygiene and sanitation, evaluation of feeding programmes

**Week 12:** Nutritional relief and rehabilitation – assessment of food needs, food distribution strategies, mass/supplementary feeding, hygiene and sanitation, evaluation of feeding programmes, Public nutrition approaches to tackle nutritional problems in emergencies
Facilitating the achievement of Course Learning Outcomes

<table>
<thead>
<tr>
<th>Unit No.</th>
<th>Course Learning Outcomes</th>
<th>Teaching and Learning Activity</th>
<th>Assessment Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Become familiar with the process of planning and management of public health nutrition programmes.</td>
<td>Lecture-cum-Discussion</td>
<td>Assignment/ Test</td>
</tr>
<tr>
<td>II &amp; III</td>
<td>Develop an understanding of the concept of nutrition monitoring and nutrition surveillance.</td>
<td>Lecture-cum-Discussion</td>
<td>Assignment/ Test</td>
</tr>
<tr>
<td>IV</td>
<td>Get acquainted with the nutritional problems during emergencies/disasters and the strategies to tackle them.</td>
<td>Lecture-cum-Discussion</td>
<td>Assignment/ Test/ Student Presentations</td>
</tr>
</tbody>
</table>

FNEC 32 B: PROGRAMME PLANNING IN PUBLIC HEALTH NUTRITION PRACTICAL

Maximum Marks: 50

Course Objectives:
The course aims to enable the students to understand methods of assessing the health and nutrition needs of the community and design action plans to address the nutrition problems.

Course Learning Outcomes:
The students will be able to:
1. Assess the health and nutrition needs of the community.
2. Acquire skills to design an action plan for addressing a public health nutrition problem in the community.

CONTENTS

<table>
<thead>
<tr>
<th>PERIODS</th>
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</thead>
</table>

Unit-I

- Assessment of needs of the public health nutrition problems in an identified community.

Unit-II

- Designing a suitable action plan for a public health nutrition programme for the identified community.

Suggested Readings:

**FNEC 31 C: PRINCIPLES OF FOOD PROCESSING**

**THEORY**

Maximum Marks: 100  
Duration: 3 hrs

**Course Objective:**
To acquaint with properties of foods and basic principle of Food Engineering and its processes, along with the unit operations.

**Course Learning outcome:**
Student will be able to
1. Understand the basic concepts of properties of foods and basic food engineering concepts
2. Acquire the knowledge of various unit operations in food processing.
3. Gain the knowledge of food packaging and its interaction with food products.

**Unit I: Properties of Foods and Processing**  
- Properties of liquid, solid and gases, material transfer, fluid flow, heat transfer, effect of processing on sensory characteristics of foods.

**Unit II: Unit operations in food processing**  
- Cleaning, sorting, grading, peeling, Size reduction, mixing and forming, Separation techniques, Process Plant design

**Unit III: Food Packaging**  
- Introduction, Types, printing, interaction between packaging and foods, environmental consideration.

**Suggested Readings:**

**Teaching Plan:**
- **Week 1-5:** Properties of Foods and Processing
- **Week 6-10:** Unit Operations on Food Processing
- **Week 11-12:** Food Packaging
Facilitating the achievement of Course Learning Outcomes

<table>
<thead>
<tr>
<th>Unit No.</th>
<th>Course Learning Outcomes</th>
<th>Teaching and Learning Activity</th>
<th>Assessment Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Understand the basic concepts of properties of foods and basic food engineering concepts</td>
<td>Lectures, discussions</td>
<td>• Practical and test</td>
</tr>
<tr>
<td>II</td>
<td>Acquire the knowledge of various unit operations in food processing.</td>
<td>Lectures, discussions based on industrial processing, Industrial Visits</td>
<td>• Presentation/quiz</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Visit report</td>
</tr>
<tr>
<td>III</td>
<td>Gain the knowledge of food packaging and its interaction with food products</td>
<td>Lectures, discussions,</td>
<td>• Presentation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Practicals on packaging material testing</td>
</tr>
</tbody>
</table>

FNEC 31 C: PRINCIPLES OF FOOD PROCESSING
PRACTICAL

Course Objective:
To impart the understanding of properties of foods, unit operations in food processing and plant design.

Course Learning Outcome:
Student will be able to
1. Understand the basic concepts of properties of foods and basic food engineering concepts
2. Acquire the knowledge of various unit operations in food processing.
3. Gain the knowledge of food plant design.

CONTENTS

Unit I
1. Viscosity measurement by viscometer
2. Density measurement of food
3. Dough rheology, amylase activity
4. Food plant design
5. Determination of thermal properties of foods such as thermal conductivity, thermal diffusivity, calorific value and specific heat

PERIODS

6

Unit II
1. Methods of grading and cleaning of raw materials (grains, spices, fruits and vegetables).
2. Calculation of freezing time for some typical foods

4

Unit III
1. Market survey of packaging equipment/ processing by heat/ processing by low temperature
2. Visit to bread and biscuit industry to observe mixing and forming operation and their equipment

2
Suggested Readings:

FNEC 32 C: FOOD PROCESSING TECHNOLOGY-I

Marks: 100 Duration: 3 Hrs.

Course Objectives: To gain in depth knowledge of technological aspects involved in processing of cereals, bakery products, meat, fish, poultry and eggs.

Course Learning Outcomes:
1. The course intends to provide knowledge of cereals and animal food processing.
2. Students will learn the processes and ingredients involved in breads, cakes and biscuit processing industry.
3. The course will train students to analyse all quality aspects of cereals and animal foods.
4. Students will gain knowledge of methods of preservation of meat, fish and poultry along with value added products from meat industry.

CONTENTS PERIODS
Unit I: Technology of Cereals, Legumes and oils 15
- Introduction to Wheat: Structure, types/varieties, harvesting, physical & chemical properties, composition and commercial value.
- Introduction to other cereals and millets: Rice, maize, oats, rye, corn, pearl millet; their nutritional importance and commercial value (Puffed rice, Rice flakes, parboiling of rice, extruded and fortified rice).
- Milling of wheat: Roller milling process, flour grade, flour treatments (bleaching, maturing), flour for various purposes, Products and By-products.

Unit II: Introduction to Baking technology: Types of bakery products, nutritional quality and safety of products, pertinent standards & regulations 15
- Bread, cakes, biscuits /crackers: Role of ingredients & processes, equipment used, product quality characteristics, scoring of quality parameters, faults and corrective measures.
- Breakfast cereals, macaroni products and malt. Production and quality of breakfast cereals and macaroni products.
Unit III: Technology of Meat, Fish, Poultry, Egg and Their Products

- **Meat**: Composition, variety, pre-slaughter handling, slaughtering and related practices, hygiene and sanitation practices of slaughter houses, grading, ageing, curing, smoking and tenderizing of meat, meat pigments and colour changes and methods of preservation for value addition and concerns of antibiotic residues.

- **Poultry**: Production considerations, Processing plant operations (slaughter, bleeding, scalding, defeathering, eviscerating, chilling and packaging), tenderness and storage.

- **Eggs**: Composition, quality factors, storage, bacterial infection and pasteurization, freezing, drying and egg substitutes.

- **Fish**: Composition, on-board handling & preservation, drying and dehydration, curing, smoking, marinades, fermented products, canning, Modified Atmosphere Packaging, and quality factors.

**Suggested Readings:**

- Pomeranz Yeshuraj, *Food Analysis: Theory and Practice*.

**Teaching Plan**

**Week 1**: technology of cereals, legumes and oilseeds- introduction to wheat: structure, types/varieties, harvesting, physical & chemical properties, composition and commercial value.

**Week 2**: Introduction to other cereals and millets: rice, maize, oats, rye, corn, pearl millet; their nutritional importance and commercial value.

**Week 3**: Milling of wheat: roller milling process, flour grade, flour treatments (bleaching, maturing), flour for various purposes, products and by-products.

**Week 4**: Legumes and oilseeds: composition, anti-nutritional factors, processing and storage; processing for production of edible oil, meal, flour.

**Week 5**: Introduction to baking technology: types of bakery products, nutritional quality and safety of products, pertinent standards & regulations.

**Week 6**: Bread: Role of ingredients & processes, equipment used, product quality characteristics, scoring of quality parameters, faults and corrective measures.

**Week 7**: Cakes: role of ingredients & processes, equipment used, product quality characteristics, scoring of quality parameters, faults and corrective measures.

**Week 8**: Biscuits /crackers: role of ingredients & processes, equipment used, product quality characteristics, scoring of quality parameters, faults and corrective measures.

**Week 9**: Breakfast cereals, macaroni products and malt (6 lectures). Production and quality of breakfast cereals and macaroni products.

**Week 10**: Technology of meat, fish, poultry, egg and their products- meat: composition,
variety, pre-slaughter handling,

**Week 11:** Slaughtering and related practices, hygiene and sanitation practices of slaughter houses, grading, ageing, curing smoking and tenderizing of meat, meat pigments and colour changes and methods of preservation for value addition and concerns of antibiotic residues.

**Week 12:** Poultry: production considerations, processing plant operations

**Week 13:** Poultry- slaughter, bleeding, scalding, defeathering, eviscerating, chilling and packaging), tenderness and storage.

**Week 14:** Eggs: composition, quality factors, storage, bacterial infection and pasteurization, freezing, drying and egg substitutes.

**Week 15:** Fish: composition, on-board handling & preservation, drying and dehydration, curing, smoking, marinades.

**Week 16:** Fermented products, canning, modified atmosphere packaging, and quality factors.

### Facilitating the achievement of Course Learning Outcomes

<table>
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<th>Teaching and Learning Activity</th>
<th>Assessment Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Imparting knowledge of processing, quality and technology of cereals, legumes and oilseeds</td>
<td>Lectures, discussions and visit to cereals processing industry</td>
<td>• Assessment of quality of cereals-practical based&lt;br&gt;• Visit report</td>
</tr>
<tr>
<td>II</td>
<td>Learning baking technology of breads, cakes and biscuits with focus on industrial production of these products.</td>
<td>Lectures, discussions based on industrial uses/industrial processing</td>
<td>• Presentation/quiz&lt;br&gt;• Practicals on quality aspects of baked products</td>
</tr>
<tr>
<td>III</td>
<td>Learning technological aspects of processing of meat, fish, poultry and eggs.</td>
<td>Lectures, discussions,</td>
<td>• Presentation&lt;br&gt;• Practicals on quality</td>
</tr>
</tbody>
</table>

### FNEC 32 C: FOOD PROCESSING TECHNOLOGY-I PRACTICAL

**Marks:** 50  
**Duration:** 3 Hrs.

**Course Objectives:** To gain in depth knowledge of processing aspects involved in processing of cereals, bakery products, meat, fish, poultry and eggs.

**Course Learning Outcomes:**

Student will be able to

1. Perform the quality testing of flour.
2. Learn the processes and ingredients involved in breads, cakes and biscuit processing industry.
3. Study the Study of Quality of meat, fish, poultry and eggs.
CONTENTS          PERIODS

Unit I Technology of Cereals and Cereal Products 6
• Quality testing of wheat flour: Gluten quality and quantity, moisture, ash, water Absorption Power (WAP), Pekar color test, maltose value, falling number, Dough Raising Capacity (DRC).

Unit II Introduction to Baking Technology 5
• Bread Processing: Straight dough method, sponge & dough method (delayed salt method) and use of improvers in bread, optimisation of brown bread process, preparation of sweet buns/pizza base/ Nan/French pao.
• Biscuits: Short and hard dough biscuits, their quality parameters packaging and shelf life study.
• Cakes: Sponge and cream cakes/ eggless cakes, their quality parameters, packaging and shelf life study.
• Others such as cookie, nan-khatai

Unit III Technology of Meat, Fish, Poultry, Egg and Their Products 1
• Study of Quality of meat, fish, poultry and eggs.

Suggested Readings:
• BIS standards of wheat, biscuits and cakes.
• Manuals of methods of analysis of various food products, FSSAI, 2016

FNOE31: COMMUNITY NUTRITION ASSESSMENT
THEORY

Marks: 100 Duration: 3 hrs

Course Objectives:
The purpose of this course is to enable the students to understand the concept and methods of nutritional status assessment of a community. This will help them to comprehend the nutrition concerns among communities, the correct screening criteria for malnutrition, along with strategies to combat and prevent them.

Course Learning Outcomes:
On completion of the course, students are expected to be able to –
1. Understand the concept and purpose of nutritional status assessment in community setting.
2. Explain nutritional concerns among vulnerable sections of the community and strategies to combat them.
3. Gain knowledge with regard to standard methods and techniques for assessing nutritional status.
4. Be familiar with the use of indices and indicators for screening and consequent identification of malnutrition in the community.
CONTENTS

**Unit I: Introduction to Nutritional Status Assessment**

- Definition of nutritional status
- Purpose of nutritional status assessment in community setting
- Significance of standardized methods and techniques for assessing nutritional status
- Major nutritional concerns among vulnerable sections of the community and National strategies to combat malnutrition.

**Unit II: Methods of Community Nutritional Assessment**

- Clinical examination, Anthropometry, Biochemical and Biophysical methods
- Measurement tool techniques and errors
- Standardization of methods
- Data recording, analysis and interpretation
- Use, plotting and interpretation of growth chart
- Rapid assessment procedures for community nutrition assessment and nutrition programme planning and evaluation
- Dietary methods: 24 hour recall, Food Frequency Questionnaire
- Ecological variables
- Vital health statistics: IMR, MMR, Under 5 Mortality rates
- National/regional nutrition and health surveys

**Unit III: Screening for Identification of Malnutrition in the Community**

- Indices, indicators and their interpretation

**Suggested Readings:**

**Teaching Plan:**
*Week 1-3:* Introduction to nutritional status assessment  
*Week 4-10:* Methods of community nutritional assessment  
*Week 11-12:* Methods of community nutritional assessment

### Facilitating the achievement of Course Learning Outcomes

<table>
<thead>
<tr>
<th>Unit No.</th>
<th>Course Learning Outcomes</th>
<th>Teaching and Learning Activity</th>
<th>Assessment Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Understand the concept and purpose of nutritional status assessment in community setting.</td>
<td>Classroom lectures, Presentations</td>
<td>Test</td>
</tr>
</tbody>
</table>
SEMESTER IV
FNCC 415: DISSERTATION II / EXPERIENTIAL LEARNING PROJECT

(External Board, Viva and Internal Evaluation)

Marks : 150

Course Objectives
The aim of dissertation is to develop skills in conducting a research study/ working in a project and learn the process of writing a dissertation/ project report

Course Learning Outcomes:
Student will be able to
1. Know the practical aspects of, collecting data/ project work
2. Evaluate, select and use appropriate strategies for reduction, analysis and presentation of data collected during research process/ project work
3. Suitably illustrate data/ insights using various graphical and other methods.
4. Prepare a dissertation document/ project report based on research process/ project work done.

Students will be given an option of doing either
A) Dissertation or B) Project work in a chosen area congruent to their discipline/ field of study.
The research will be an original work with plagiarism check and ethical clearance.

FNEC 41 A: ADVANCED CLINICAL NUTRITION THEORY

Marks: 100                                                                                                   Duration: 3 hours

Course Objectives:
To understand the etiology, physiological and metabolic anomalies and provide appropriate nutrition care for prevention and treatment of various disorders / diseases

Course Learning Outcome:
Students will be able to-
1. Develop a detailed understanding of the etiology, physiological and metabolic anomalies of various acute and chronic disorders / diseases
2. Demonstrate competency in nutrition assessment and diet history interview skills
3. Develop understanding and expertise on the effect of various disorders on nutritional status, nutritional and dietary requirements
4. Use critical thinking and clinical reasoning to develop nutritional care plan for prevention and treatment of various disorders / diseases
5. Apply the nutrition care process to the medical nutritional therapy of nutritionally vulnerable individuals using best evidence.

CONTENTS
UNIT I: Nutrition Care
• Nutrition Support – Parenteral Nutrition : International and National Guidelines

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UNIT II: Hepatobiliary and Pancreatic Disorders
• Etiopathophysiology, metabolic & clinical aberrations, diagnosis, complications and recent advances in prevention, treatment, MNT and dietary counselling in Nonalcoholic fatty liver disease (NAFLD), Cirrhosis, End stage liver disease (ESLD), Encephalopathy, Liver resection and transplant; Cholecystitis, Cholelithiasis, cholecystectomy, Pancreatitis.

Unit III: Diseases of Heart and Blood Vessels
• Etiopathophysiology, metabolic & clinical aberrations, diagnosis, complications and recent advances in prevention, treatment, MNT and dietary counselling in Myocardial Infarction, Coronary artery bypass graft (CABG), angioplasty, cerebrovascular and peripheral vascular disease, heart transplant

UNIT IV: Surgery and Critical Care
• Metabolic & clinical aberrations, diagnosis, complications, treatment, MNT and dietary Counselling in Metabolic Stress -Surgery, Burns, Sepsis and Trauma, Critical care

Unit V: Renal Disorders
• Etiopathophysiology, metabolic & clinical aberrations, diagnosis, complications and recent advances in prevention, treatment, MNT and dietary Counselling in Nephrotic Syndrome, Glomerulonephritis, Acute Renal Failure, Chronic Kidney Disease, End Stage Renal Disease (ESRD), Dialysis, Transplant, Renal Stones.

Unit VI: Neurological disorders
• Etiopathophysiology, metabolic & clinical aberrations, diagnosis, complications and recent advances in prevention, treatment, MNT and dietary Counselling in Alzheimer’s disease, Parkinson disease, Epilepsy

Suggested Readings:

Teaching Plan:
Week 1: Nutritional support- Parental nutrition
Week 2: Metabolic & clinical aberrations, diagnosis, complications, treatment, MNT and dietary Counselling in metabolic stress -surgery, burns, sepsis and trauma
Week 3: Medical nutrition therapy in Critical Care
Week 4: Etiopathophysiology, metabolic & clinical aberrations, diagnosis, Complications and recent advances in prevention, treatment, MNT and dietary Counselling in Nonalcoholic fatty liver disease (NAFLD), Cirrhosis
Week 5: Etiopathophysiology, metabolic & clinical aberrations, diagnosis Complications and recent advances in prevention, treatment, MNT and dietary Counselling in End stage liver disease (ESLD), Encephalopathy, Liver resection and transplant
Week 6: Etiopathophysiology, metabolic & clinical aberrations, diagnosis, Complications and recent advances in prevention, treatment, MNT and dietary Counselling in Cholecystitis, Cholelithiasis, cholecystectomy, Pancreatitis, Myocardial Infarction
Week 7: Etiopathophysiology, metabolic & clinical aberrations, diagnosis, Complications and recent advances in prevention, treatment, MNT and dietary Counselling in Coronary artery bypass graft (CABG), Angioplasty
Week 8: Etiopathophysiology, metabolic & clinical aberrations, diagnosis, Complications and recent advances in prevention, treatment, MNT and dietary Counselling in Cerebrovascular and peripheral vascular disease, heart transplant
Week 9: Etiopathophysiology, metabolic & clinical aberrations, diagnosis, Complications and recent advances in prevention, treatment, MNT and dietary Counselling in Nephrotic Syndrome, Glomerulonephritis
Week 10: Etiopathophysiology, metabolic & clinical aberrations, diagnosis, Complications and recent advances in prevention, treatment, MNT and dietary Counselling in Acute, Renal Failure, Chronic Kidney Disease
Week 11: Etiopathophysiology, metabolic & clinical aberrations, diagnosis, Complications and recent advances in prevention, treatment, MNT and dietary Counselling in Dialysis, Transplant, Renal Stones
Week 12: Etiopathophysiology, metabolic & clinical aberrations, diagnosis, complications and recent advances in prevention, treatment, MNT and dietary Counselling in Alzheimer’s disease, Parkinson disease, Epilepsy

Facilitating the achievement of Course Learning Outcomes

<table>
<thead>
<tr>
<th>Unit No.</th>
<th>Course Learning Outcomes</th>
<th>Teaching and Learning Activity</th>
<th>Assessment Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Develop a detailed understanding of the etiology, physiological and metabolic anomalies of various acute and chronic disorders / diseases</td>
<td>Discussion</td>
<td>Assignment on etiology, physiological and metabolic anomalies of various acute and chronic disorders / diseases</td>
</tr>
<tr>
<td>II</td>
<td>Demonstrate competency in nutrition assessment and diet history interview skills</td>
<td>Discussion</td>
<td>Assignment and practice interactive sessions in nutrition assessment and diet history interview skills</td>
</tr>
<tr>
<td>III</td>
<td>Develop understanding and expertise on the effect of various disorders on nutritional status, nutritional and dietary requirements</td>
<td>Discussion</td>
<td>Assignment on various disorders on nutritional status, nutritional and dietary requirements</td>
</tr>
</tbody>
</table>
### FNEC 41 A: ADVANCED CLINICAL NUTRITION PRACTICAL

**Marks:** 50  
**Duration:** 3 hours

#### Course Objectives:
To enable students to develop skill in nutritional diagnosis, planning and providing suitable preventive/therapeutic diets for various diseases / disorders

#### Course Learning Outcome:
Student will be able to:
1. Develop skill in nutritional diagnosis, planning and providing suitable preventive/therapeutic diets for various diseases / disorders
2. Provide effective dietary Counselling for these disorders
3. Awareness of various commercial nutritional therapeutic products available in the market

#### CONTENTS

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<th>PERIODS</th>
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</tbody>
</table>

#### UNIT II: Planning & preparation of diets for the following conditions: 10
- Post burn
- Liver Cirrhosis
- Hepatic Encephalopathy
- Pancreatitis
- Myocardial infarction
- Congestive heart failure
- Nephritis
- Acute Renal Failure
- Chronic renal failure
- Patients on dialysis

#### Suggested Readings:
FNEC 42 A: NUTRITION COMMUNICATION AND DIET COUNSELLING THEORY

Marks: 100
Duration: 3 Hrs.

Course Objectives:
To equip students to understand the influence of counselling on disease management and identify components of counselling skills and to provide skills of counselling for specific disease conditions

Course Learning Outcomes:
The students will be able to:
1. Gain knowledge on the basics of communication strategies and best suited methods of communicating with individuals to select appropriate strategies presented with dietary problems
2. Understand the importance of BCC in managing nutrition related problems
3. Draw out a complete Counselling plan for individuals based on their physiological conditions using the appropriate tools
4. Understand how best to maintain adherence to changed dietary practices for specific physiological conditions
5. Gain knowledge on traditional and alternate methods to manage disorders
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<tr>
<th>CONTENTS</th>
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<tr>
<td>- Communication methods</td>
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<tr>
<td>- Traditional, Current and Emerging methods/tools of communication</td>
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<tr>
<td>- Characteristics of effective communication, Skills and attributes of a communicator</td>
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<tr>
<td>- Approaches in communication</td>
<td></td>
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<tr>
<td>- Barriers to effective communication</td>
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<tr>
<td><strong>UNIT II: Nutrition Counselling</strong></td>
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<tr>
<td>- Concept and importance of Counselling in the nutrition care process</td>
<td></td>
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<tr>
<td>- Understanding dietary patterns and food choices and their impact on Counselling</td>
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<tr>
<td>- Behaviour Change Communication and Models for behaviour change</td>
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<tr>
<td>- Counselling strategies</td>
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<tr>
<td>- Factors to be considered for Counselling</td>
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<tr>
<td>- Conventional and non-conventional tools in Counselling</td>
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<tr>
<td><strong>UNIT III: Processes involved in Dietary Counselling</strong></td>
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<tr>
<td>- Managing resources of the communicator/counsellor</td>
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<tr>
<td>- Designing of Counselling plans – goals &amp; objectives, evaluation instruments.</td>
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<tr>
<td>- Implementation: facilitating self-management of disease condition</td>
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<tr>
<td>- Evaluation: evaluating adherence to dietary changes</td>
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<tr>
<td>- Counselling approaches after evaluation</td>
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<td><strong>UNIT IV: Dietary Counselling through the Life Span</strong></td>
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<td>Considerations for Counselling plans for:</td>
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<tr>
<td>- Antenatal and pregnant women</td>
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<tr>
<td>- Lactating women</td>
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<tr>
<td>- Childhood nutrition problems like</td>
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<tr>
<td>- SAM, weight management, vitamin and mineral deficiencies</td>
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<td>- School children, adolescents, young adults</td>
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<tr>
<td>- Fitness, weight management, eating disorders</td>
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<tr>
<td>Managing diet related chronic diseases in adults:</td>
<td></td>
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<tr>
<td>- Obesity</td>
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<td>- Diabetes</td>
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<td>- Dyslipidemia</td>
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<td>- Hypertension</td>
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<td>- Cancer risk prevention</td>
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<td>- Renal disease</td>
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<td>- Liver disorders</td>
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<tr>
<td>- Geriatric counselling</td>
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<tr>
<td><strong>UNIT V: Nutritional/medicinal Role of Traditional Foods</strong></td>
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</tr>
<tr>
<td>- Traditional food beliefs</td>
<td></td>
</tr>
</tbody>
</table>
Role of Ayurveda, Naturopathy, Yoga and other traditional medicines in disease management

Suggested Readings:
- Ravi M (2016) *Counselling what why and how*, New Delhi, Viva Books
- WHO 2016, Antenatal guidelines

Teaching Plan:
**Week 1**: Meaning of Communication, Forms of communication: Verbal and Non-verbal Communication, Communication methods: Intrapersonal, Interpersonal and Mass communication
**Week 2**: Traditional, Current and Emerging methods/tools of communication, Characteristics of effective communication, Skills and attributes of a communicator
**Week 3**: Approaches in communication: Informative, Educative, persuasive and prompting, Barriers to effective communication: physical, intellectual, emotional, environmental, and cultural
**Week 4**: Meaning and concept and importance of counselling in the nutrition care process, Understanding dietary patterns and food choices and their impact on counselling
**Week 5**: Counselling for behaviour change: Models for behaviour change- Health belief model, Social Cognitive Theory, Theory of Planned behaviour, Trans theoretical Model of Change
**Week 6**: Factors to be considered for counselling, managing resources of the facilitator/counsellor, designing of counselling plans – goals & objectives, planning client care and designing evaluation instruments.
**Week 7**: Implementation, Evaluation, Counselling approaches after assessment
**Week 8**: Considerations for counselling for Prenatal and pregnant women, Lactating women
**Week 9**: Considerations for counselling for Childhood nutrition problems and School children, adolescents, young adults
Week 10: Managing diet related chronic diseases in adults: Obesity, Diabetes, dyslipidemia, hypertension
Week 11: Considerations for counselling for Managing diet related chronic diseases in adults and geriatric counselling
Week 12: Nutritional/medicinal role of traditional foods: traditional food beliefs, role of Ayurveda, Naturopathy, Yoga and other traditional medicines in and disease management

Facilitating the achievement of Course Learning Outcomes

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<tr>
<td>I</td>
<td>To gain knowledge on the basics of communication strategies and best suited methods of communicating with individuals to select appropriate strategies presented with dietary problems</td>
<td>Discussion</td>
<td>Assignment on methods of communications</td>
</tr>
<tr>
<td>II</td>
<td>To understand the concept of BCC in nutrition</td>
<td>Discussion</td>
<td>Group discussions on theories of BCC</td>
</tr>
<tr>
<td>III</td>
<td>Draw out a complete Counselling plan for individuals based on their physiological conditions using the appropriate tools</td>
<td>Discussion on overall plan with case studies</td>
<td>Practical preparation of counselling plans for a hypothetical situation</td>
</tr>
<tr>
<td>IV</td>
<td>Understand how best to maintain adherence to changed dietary practices for specific physiological conditions</td>
<td>Discussion on case studies for each condition</td>
<td>Student presentations and assignments.</td>
</tr>
<tr>
<td>V</td>
<td>To gain knowledge on traditional and alternate methods to manage disorders</td>
<td>Discussion</td>
<td>Group discussions on various alternate methods of medicine in India</td>
</tr>
</tbody>
</table>

NUTRITION COMMUNICATION AND DIET COUNSELLING PRACTICAL

Marks: 50 Duration: 3 Hrs.

Course Objectives:
To gain practical knowledge in preparing Counselling sessions for selected conditions and to identify appropriate counselling strategies for different age groups and physiological conditions

Course learning Outcome:
The students will be able to-
1. Acquire knowledge in different methods of Counselling
2. Plan counselling sessions for different physiological conditions
UNIT I: Understanding the use of conventional and non-conventional methods of counselling

- Face to face counselling
- Use of a software for counselling e.g Dietcal
- Use of any one Diet App for counselling and assessing food intake

UNIT II: Planning Nutrition Counselling sessions and identifying ways to adhere to dietary changes for the following conditions

- IYCF, Lactation Counselling, SAM, Antenatal counselling
- Eating Disorders
- Overweight/Obesity in School children, adolescent and adults
- Metabolic Syndrome
- Diabetes: Type 1, Type 2 and Gestational Diabetes
- Renal Disease: CKD/ESRD/Post kidney Transplant
- Liver Disorders: NAFLD

Suggested Readings:

- WHO 2016, Antenatal guidelines

FNEC 43A: NUTRITION FOR FITNESS AND SPORTS

THEORY

Marks: 100

Course Objectives:

To learn the concepts of fitness, methods of assessing fitness, exercises for physical fitness and bioenergetics of exercise and role of macro- and micro-nutrients in sports performance and to gain knowledge & application skills with respect to nutrition for high performance sports, through the life-cycle and diet & nutritional care of special groups of athletes.
Course Learning Outcomes:
Students will be able to:
1. Understand concepts of fitness, its assessment and exercises for physical fitness training.
2. Function effectively as a sports dietitian, with knowledge and skills, to support recreational and competitive athletes
3. Exhibit knowledge of the metabolism and bioenergetics of exercise and continuum in various sports
4. Successfully plan, implement and monitor sport-specific diets for athletes through all age groups
5. Provide diet and nutritional care in terms of nutrition education, diet plans and counselling to special groups of athletes

CONTENT PERIODS
UNIT I: Introduction to Physical Fitness 6
- Definition of physical fitness
- Components of physical fitness
- Methods of assessing physical fitness
- Approaches to achieving physical fitness through the life cycle

UNIT II: Fundamentals of Sports Nutrition 14
- Integrated approach to care for athletes
- Assessment of Sports performance
- Bioenergetics and body metabolism of physical activity and sports
- Macro- and micro nutrients for sport performance
- Temperature regulation, fluid balance, fluid requirements of athletes and rehydration strategies for sports

UNIT III: Nutrition for High Performance Athletes 20
- Recommended allowances and nutritional guidelines for different categories of high performance sports
- Nutritional care during Training, weight management and day-to-day recovery
- Nutrition for the Pre-competition, Competition and post competition recovery phase
- Supplements in Sport: performance enhancing substances, drugs, ergogenic aids and herbs in sports performance

UNIT IV: Challenges in Sports Nutrition 8
- Nutritional care for children and adolescent athletes
- Athletes with special needs - Paralympics & special Olympics, vegetarian athletes,
- Athletes with eating disorders, athletes with diabetes and other medical conditions , management of Red-S.

Suggested Readings:
- Hickson JF and Wolinsky I. (1997) Nutrition for exercise and Sport. 2nd ed. CRC Press,
Teaching Plan:

Week 1: Definition of physical fitness, Components of physical fitness, Methods of assessing physical fitness

Week 2: Approaches to achieving physical fitness through the life cycle, Assessment of Sports performance

Week 3: Bioenergetics and body metabolism of physical activity and sports

Week 4: Macro- and micro nutrients for sport performance

Week 5: Temperature regulation, fluid balance, fluid requirements of athletes and rehydration strategies for sports

Week 6: Recommended allowances and nutritional guidelines for different categories of high performance sports

Week 7: Nutritional care during Training, and day-to-day recovery

Week 8: Nutrition for the Pre-competition, Competition and post competition recovery phase

Week 9: Weight management in athletes

Week 10: Supplements in Sport: performance enhancing substances, drugs, ergogenic aids and herbs in sports performance

Week 11: Nutritional care for children and adolescent athletes, Athletes with special needs- Paralympics & Special Olympics, vegetarian athletes,

Week 12: Managing athletes with eating disorders, and Red-S., Dietary care for athletes with diabetes and other medical conditions

Facilitating the achievement of Course Learning Outcomes

<table>
<thead>
<tr>
<th>Unit No.</th>
<th>Course Learning Outcomes</th>
<th>Teaching and Learning Activity</th>
<th>Assessment Tasks</th>
</tr>
</thead>
</table>
| I        | Develop concepts of physical fitness, its components, skills in assessment and exercises to improve physical fitness | Various fitness exercises and assessments in groups | • Assessment scores of partners’ physical fitness.  
• Test on the topic |
| II       | Exhibit knowledge of metabolism & nutritional care for athletes and demonstrate skills of assessing sports performance | Demonstration and discussion | • Test on knowledge domain  
• Assessment using skills learnt-case study |
| III      | Develop in-depth understanding and critically | Presentations, discussions and | Class assignments, scrap books, survey reports and diet plans |
evaluate and apply nutritional recommendations for different categories athletes, during various phases and a comprehensive view on supplements in Sport

IV
Understand comprehensively, needs of children, adolescents and special groups in sports training

Discussion

Diet plans for junior athletes and athletes with special needs

FNEC 43 A: NUTRITION FOR FITNESS AND SPORTS
PRACTICAL

Marks: 50         Duration: 3 hours

Course Objectives:
To apply knowledge of Sports nutrition to plan diets for sport-specific training, pre-competition, competition and recovery and to gain skills for counselling of individual athlete through various phases

Course Learning Outcomes:
Students will be able to-
1. Apply knowledge of Sports nutrition to plan diets for sport-specific training, pre-competition, competition and recovery.
2. Gain skills for counselling of individual athlete through various phases
3. Learn skills for care of special groups of athletes.

CONTENTS          PERIODS
UNIT I            1
• PARQ assessment and interpretation for fitness

UNIT II            1
• Planning a day’s diet for a fitness trainee who works out twice in a gymnasium

UNIT III            5
• Planning a training day’s diet for an individual high performance athlete(any one sport- (cover all categories of sports in groups)
• Planning a weight loss diet for a high performance athlete
• Planning a Counselling module for the training phase for a high performance athlete any one sport (cover all categories of sports in groups)
• Planning a diet for 1 week of carbohydrate loading for an ultra-endurance athlete
• Planning a pre-, and post-competition meal for ultra-endurance, endurance, strength events, team events and sports-drinks during and after an event

UNIT IV            5
• Planning a diet for multiple events like swimming competitions
• Survey of sports supplements
• Planning an education module for special groups of athletes: Diabetes, special
• Cooking

Suggested Readings:
• ILSI, NIN & SAI. (2017) *Nutritional recommendations for high performance athletes* 2nd ed.
• Bushman B. (2017) *ACSM's Complete Guide to Fitness & Health 2nd Edition*, Published by ACSM.

FNEC41B: PROBLEMS, POLICIES AND PROGRAMMES IN PUBLIC HEALTH NUTRITION THEORY

Marks: 100               Duration: 3 Hrs

Course Objectives:
This course will enable the students to become familiar with the prevalence and determinants of nutritional/health problems in the population. They will learn about the public health implications of various nutritional problems and the strategies to overcome the same. The students will also get acquainted with the various national/public sector policies and programmes for promotion of health and nutritional status in India.

Course Learning Outcomes:
The students will:
1. Become familiar with the prevalence and determinants of nutritional/health problems in the population.
2. Acquire knowledge about the public health implications of various nutritional problems and the strategies to overcome the same.
3. Get acquainted with national/public sector policies and programmes for promotion of health and nutritional status in India.

CONTENTS PERIODS

UNIT I: Public Health Aspects of Undernutrition 18
• Etiology, public health implications, preventive strategies and community based management of Protein Energy Malnutrition, Chronic Energy Deficiency, Severe Acute Malnutrition and major micronutrient deficiencies (Vitamin A Deficiency, Nutritional Anemias, Iodine Deficiency Disorders, Vitamin D Deficiency and Osteoporosis, Zinc Deficiency) and emerging nutrient deficiencies of public health significance
• Maternal Nutrition, Adolescent Nutrition and Anemia
Unit II: Public Health Aspects of Life Style Related Disorders
• Public health implications and preventive strategies for obesity, hypertension, coronary heart disease, diabetes, osteoporosis, cancer and dental caries

Unit III: National / Public Sector Policies for Promotion of Nutrition and Health Status of the Population
• National Nutrition Policy, Poshan Abhiyan, National Health Policy, National Food Security Act, National Water Policy, National Urban Sanitation Policy

Unit IV: National / Public Sector Programmes for Promotion of Nutrition and Health Status of the Population
• Nutrition sensitive and nutrition specific programmes
• Critical appraisal of ongoing public sector programmes and some success stories

Teaching Plan:
Week 1-4: Public Health Aspects of Undernutrition
Etiology, public health implications, prevention and community based management of Protein Energy Malnutrition, Chronic Energy Deficiency, Severe Acute Malnutrition and micronutrient deficiencies of public health significance

Week 5-6: Public Health Aspects of Life Style Related Disorders

Week 6-7: National / Public Sector Policies for Promotion of Nutrition and Health Status of the Population

Week 8-12: National / Public Sector Programmes for Promotion of Nutrition and Health Status of the Population

Facilitating the achievement of Course Learning Outcomes

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<tbody>
<tr>
<td>I</td>
<td>Public Health Aspects of Under-nutrition</td>
<td>Presentations, Discussion</td>
<td>Assignment on current nutrition concerns</td>
</tr>
<tr>
<td>II</td>
<td>Public Health Aspects of Life Style Related Disorders</td>
<td>Presentations, Discussion</td>
<td>Test on the topics</td>
</tr>
<tr>
<td>III</td>
<td>National / Public Sector Policies for Promotion of Nutrition and Health Status of the Population</td>
<td>Presentations, Discussion</td>
<td>Article review, current status of programmes and evaluation</td>
</tr>
<tr>
<td>IV</td>
<td>National / Public Sector Programmes for Promotion of Nutrition and Health Status of the Population</td>
<td>Presentations, Discussion</td>
<td>Critique of nutrition sensitive and specific programmes</td>
</tr>
</tbody>
</table>

FNEC41B: PROBLEMS, POLICIES AND PROGRAMMES IN PUBLIC HEALTH NUTRITION PRACTICAL

Marks : 50 Duration : 3 Hrs

Course Learning Outcomes:
The students will:
1. Acquire skills to do critical appraisal of public health nutrition programmes.
2. Become familiar with methods of preparation and implementation of plans/ tools for evaluation of public health nutrition programmes.

CONTENTS PERIODS

Unit I: Critical appraisal of ongoing national public health nutrition programmes. 4

Unit II: Preparation of evaluation, monitoring and surveillance plans for public health nutrition programmes/ and their components – preparation of evaluation tools and their implementation. 8

Suggested Readings:
- National Consensus Workshop on Management of SAM children through Medical Nutrition Therapy (2009)-Compendium of Scientific Publications Volume I and II. Jointly organized by AIIMS, Sitaram Bhartia Institute of Science and Research, IAP (Subspeciality chapter on Nutrition), New Delhi. Sponsoured by DBT.
- National Nutrition Policy, GoI. http://wcd.nic.in/sites/default/files/nnp_0.pdf

FNEC 44 B: NUTRITIONAL EPIDEMIOLOGY

Marks : 100 Duration : 3 hrs

Course Objectives:
The purpose of this course is to enable the students to understand the principles of disease causation with emphasis on modifiable environmental factors including dietary factors. This will also help students appreciate the effect of quality measures of nutritional exposure and nutrition related health outcomes on determination of diet-disease relationship. This will encourage the application of epidemiology to prevention of disease and promotion of health through nutrition.

Course Learning Outcomes:
On completion of the course, students are expected to be able to –
1. Describe major study designs in nutritional epidemiology and select an appropriate design for addressing a study question.
2. Explain implication of study design and methods of diet and nutritional status assessment in interpreting studies in nutritional epidemiology
3. Explain the role of epidemiological research in improving health and nutritional status
4. Demonstrate knowledge of epidemiological approach to defining and measuring occurrence of nutrition and health related states in population
5. Demonstrate the knowledge of epidemiological approach to causation

CONTENTS PERIODS
UNIT I: Basic Epidemiology Concepts and Methods

- Definition, scope and purpose of epidemiology
- Basic measurements in epidemiology
- Measurement of mortality, morbidity and disability – rates, ratios and proportions
- Comparison of disease occurrence- absolute and relative comparisons
- Epidemiologic study methods- observational and experimental studies
- Observational epidemiology- descriptive and analytical studies – ecological, cross sectional, care-control and cohort
- Experimental epidemiology- experimental and quasi experimental trials
- Randomized control trials, Field trials and community trials
- Population, sampling, sample size and power
- Introduction to nutritional epidemiology: Definition, scope and significance of nutritional epidemiology in public health nutrition.
- Design, steps in conducting the studies, data analysis and interpretation
- Association and causation in epidemiology
- Potential errors in epidemiologic studies
  - Measurement error and bias
  - Internal and external validity

UNIT II: Epidemiologic Approaches to Diet-Disease Relationships

- Measuring diet –disease associations- Type of measurement , time trends, correlation and regression, risk assessment
- Design of nutritional epidemiological studies
- Strengths and weaknesses of various designs in estimation of diet disease relationships, interpretation of epidemiologic research, multi variate relationship of diet and disease
- Genetics in nutritional epidemiology- genetic variation and epigenetics in nutritional epidemiology- Gene diet interactions.
- Ethical aspects of research in nutritional epidemiology

UNIT III: Measurements of Exposure and Outcomes in Nutritional Epidemiology

- Nutritional exposures- Relevant direct and indirect measures of nutrition and health assessment
- Critical review of diet assessment methods- assessment of food consumption at different levels, measurement errors, strengths and limitations, reproducibility and validity of methods measuring food consumption of individuals- 24 dietary recall, diet record and food frequency methods/Analysis of dietary patterns. Analysis and interpretation of dietary data.
- Nutritional status assessment: Critical review of anthropometric and various direct measures pf nutritional status- clinical , biochemical, biophysical and measures of body composition. Sources of errors, strengths and limitations of various measures. Relevance and use of various indices and indicators of nutritional status for risk assessment.
- Biomarkers in nutritional epidemiology: Uses and limitations of biomarkers as measures of nutritional status and in dietary validation studies.
- Physical activity assessment and interpretation: Strength and weaknesses of subjective and objective methods.
- Ecological assessment of nutritional status, socio-economic, demographic, cultural and political factors.
UNIT IV: Role of Epidemiological Research in Development of Nutrition Related Policies and their Evaluation

- Generating evidence for policy making, strengthening implementation of nutrition and health interventions and programmes, evaluation of the effectiveness of such interventions. Examples of use of epidemiological research data for improvement of nutrition and health interventions or national programmes.

Suggested Readings:
- Vir, S. (2011) Public health nutrition in developing countries, Woodhead Publishing India limited

Teaching Plan:
- **Week 1** Basic epidemiology concepts and methods
- **Week 2** Basic epidemiology concepts and methods
- **Week 3** Basic epidemiology concepts and methods
- **Week 4** Basic epidemiology concepts and methods
- **Week 5** Epidemiologic approaches to diet-disease relationships
- **Week 6** Epidemiologic approaches to diet-disease relationships
- **Week 7** Epidemiologic approaches to diet-disease relationships
- **Week 8** Measurements of exposure and outcomes in Nutritional epidemiology
- **Week 9** Measurements of exposure and outcomes in Nutritional epidemiology
- **Week 10** Measurements of exposure and outcomes in Nutritional epidemiology
- **Week 11** Role of Epidemiological research in development of nutrition related policies and their evaluation
- **Week 12** Role of Epidemiological research in development of nutrition related policies and their evaluation
### Facilitating the achievement of Course Learning Outcomes

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<th>Unit No.</th>
<th>Course Learning Outcomes</th>
<th>Teaching and Learning Activity</th>
<th>Assessment Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Understand major study designs in nutritional epidemiology and selection of an appropriate design for addressing a study question.</td>
<td>Presentations, Discussion</td>
<td>Test on the topic</td>
</tr>
<tr>
<td>II</td>
<td>Comprehend implication of study design and methods of diet and nutritional status assessment in interpreting studies in nutritional epidemiology</td>
<td>Presentations, Discussion</td>
<td>Review of related references</td>
</tr>
<tr>
<td>III</td>
<td>Explain the role of epidemiological research in improving health and nutritional status</td>
<td>Presentations, Discussion</td>
<td>Review and presentation of various examples</td>
</tr>
<tr>
<td>IV</td>
<td>Demonstrate knowledge of epidemiological approach to defining and measuring occurrence of nutrition and health related states in population</td>
<td>Presentations, Discussion</td>
<td>Test and Quiz</td>
</tr>
<tr>
<td>V</td>
<td>Demonstrate the knowledge of epidemiological approach to causation</td>
<td>Presentations, Discussion</td>
<td>Review of articles</td>
</tr>
</tbody>
</table>

### FNEC 44 B: NUTRITIONAL EPIDEMIOLOGY PRACTICAL

**Marks : 50**

**Duration : 3 Hrs**

**Course Objective:**
The course will enable students to critically review research articles specifically with emphasis on research design, sampling, analysis and interpretation of data. It will also enhance their skills to perform secondary data analysis as well as to interpret and estimate errors in anthropometric data.

**Course Learning Outcomes:**

1. To acquire skills in critically reviewing original research paper and be able to perform secondary data analysis for documenting change in nutrition and health problems
2. To be able to determine reliability and validity of an assessment tools
3. To interpret and estimate errors in anthropometric data
Unit I: Critically review original research on studies in the field of nutritional epidemiology and do the following:

- Identify research designs used, sampling, analyses and interpretation.
- Identify applications of research evidence in the field of public health nutrition

Unit II: Determine reliability and validity of an assessment tool

Unit III: Estimate measurement error in anthropometric data

Interpret anthropometric data available from national and regional surveys

Unit IV: Review and document the changes in nutrition and health problems in vulnerable groups of the population in the last decade using secondary data (Indicators of mortality, morbidity, disability and nutritional status).

Suggested Readings:
- Vir, S. (2011) Public health nutrition in developing countries, Woodhead Publishing India limited
The students will be able to:
1. Become Familiar with the concept of Dietary guidelines and their relevance.
2. Acquire skills to plan, implement and evaluate social and behaviour change communication for promotion of nutrition and health among the vulnerable groups.
3. Develop an understanding of the concept of nutrition advocacy.
4. Learn the ethics in nutrition and health communication.

CONTENTS

Unit I: Dietary guidelines for nutrition and health related concerns
National and international guidelines and their role in nutrition promotion. Critical appraisal of the current guidelines.

Unit II: Nutrition and behaviour inter-relationship
Food and health behaviour, models/ theories of health behaviour, food choices, strategies for intervention at the ecological and individual level

Unit III: Social and Behaviour Change Communication for Nutrition and Health Promotion
• Concept and objectives of communication for behaviour change
• Planning of communication strategies for social and behaviour change programme,
• Communication needs analysis, stakeholders in nutrition promotion, developing nutrition education plan, identifying communication strategies/ approaches for nutrition and health promotion (e.g. social marketing), designing nutrition and health messages, selecting communication channels, developing and field testing of communication materials, designing training strategies for trainers and their capacity building.
• Implementing social and behaviour change communication intervention: an overview
• Evaluation of social and behaviour change communication programmes

Unit IV: Nutrition Advocacy
• Meaning, types, tools and techniques and advocacy planning.
• Role of advocacy in nutrition policy formulation, preparation of policy briefs.

Unit V: Ethics in nutrition and health communication
• Significance of ethics in nutrition and health communication
• Ethical Principles and concerns

Suggested Readings:
Teaching Plan:

**Week 1:** National and international guidelines and their role in nutrition promotion.

**Week 2:** National and international guidelines and their role in nutrition promotion.

**Critical appraisal of the current guidelines**

**Week 3:** Critical appraisal of the current guidelines

Food and health behaviour, models/ theories of health behaviour, food choices,

**Week 4:** Food and health behaviour, models/ theories of health behaviour, food choices,

Strategies for intervention at the ecological and individual level

**Week 5:** Concept and objectives of communication for behaviour change

Planning of communication strategies for social and behaviour change programme,

**Week 6:** Communication needs analysis, stakeholders in nutrition promotion, developing nutrition education plan, identifying communication strategies/ approaches for nutrition and health promotion (e.g. social marketing),

**Week 7:** Communication needs analysis, stakeholders in nutrition promotion, developing nutrition education plan, identifying communication strategies/ approaches for nutrition and health promotion (e.g. social marketing),

**Week 8:** Designing nutrition and health messages, selecting communication channels, developing and field testing of communication materials, designing training strategies for trainers and their capacity building.

**Week 9:** Implementing social and behaviour change communication intervention: an overview

Evaluation of social and behaviour change communication programmes

**Week 10:** Meaning, types, tools and techniques, Advocacy planning.

**Week 11:** Role of advocacy in nutrition policy formulation, preparation of policy briefs

**Week 12:** Significance of ethics in nutrition and health communication, Ethical Principles and concerns

Facilitating the achievement of Course Learning Outcomes

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<tr>
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<th>Assessment Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Become Familiar with the concept of Dietary guidelines and their relevance.</td>
<td>Presentations, Discussion</td>
<td>Test on the topic</td>
</tr>
<tr>
<td>II</td>
<td>Acquire skills to plan, implement and evaluate behaviour change communication for promotion of nutrition and health among the vulnerable groups.</td>
<td>Presentations, Discussion</td>
<td>Review of related references</td>
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<tr>
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</tr>
<tr>
<td>III</td>
<td>Develop an understanding of the concept of nutrition advocacy.</td>
<td>Presentations, Discussion</td>
<td>Review and presentation of various examples</td>
</tr>
<tr>
<td>IV</td>
<td>Learn the ethics in nutrition and health communication.</td>
<td>Discussion</td>
<td>Assignments</td>
</tr>
</tbody>
</table>

**FNEC 45 C: NUTRITION COMMUNICATION FOR HEALTH PROMOTION PRACTICAL**

**Marks : 50**

**Duration : 3 hrs**

**Course Objective:**
The course aims to enable the students to understand communication strategies for addressing various public health nutrition problems in the community.

**Course Learning Outcomes:**
The students will be able to:
1. Comprehend communication strategies being used for public health and nutrition programmes in the community.
2. Design communication strategies for addressing a public health nutrition problem in the community.

**CONTENTS**

<table>
<thead>
<tr>
<th>Unit-I</th>
<th>PERIODS</th>
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</thead>
<tbody>
<tr>
<td>• Planning of communication strategies for public health nutrition problems among vulnerable groups in the community - field testing of messages, materials and methods.</td>
<td>10</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Unit-II</th>
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</thead>
<tbody>
<tr>
<td>• Review of communication strategies being used in any one public health nutrition programme in the community.</td>
</tr>
</tbody>
</table>

**Suggested Readings:**
**Course Objectives:**
The course aims to provide knowledge of principles and technical aspects of processing of milk and milk products and fruits and vegetable preservation.

**Course Learning Outcomes:**
Students will be able to:
1. Understand various aspects of processing and quality of milk and milk products.
2. Ingrain the understanding of post-harvest management of fruits and vegetables.
3. Gain in depth knowledge about processing and preservation techniques and quality aspects of fruits and vegetable.

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<thead>
<tr>
<th>CONTENTS</th>
<th>PERIODS</th>
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<tbody>
<tr>
<td><strong>Unit I: Milk and Milk Products</strong></td>
<td>23</td>
</tr>
<tr>
<td>• <strong>Introduction to market milk:</strong> Indian standards, Composition, factors affecting composition of milk, physico-chemical properties of milk and its constituents.</td>
<td></td>
</tr>
<tr>
<td>• <strong>Milk processing:</strong> Clean milk practices, buying and collection, platform tests, pre-heating, filtration, clarification, standardization, bactofugation, homogenization, pasteurization, cooling, packaging and storage. Cleaning and sanitization of dairy equipment including CIP and COP.</td>
<td></td>
</tr>
<tr>
<td>• <strong>Milk products (Cream, butter, ice cream, curd, cheese, khoa and ghee)</strong>-Introduction, definition, classification, methods of manufacture, quality aspects.</td>
<td></td>
</tr>
</tbody>
</table>

| Unit II: Introduction to Fruits and Vegetables | 10 |
| • **Classification** of fruits and vegetables, general composition, enzymatic browning and its prevention. | |
| • **Post-harvest changes and management of fruits and vegetables**- Climacteric rise, horticultural maturity, physiological maturity, maturity indices and process of ripening-physiological changes, physical and chemical changes. Causes of post-harvest losses, farm heat, measures to reduce post –harvest losses in F & V, Controlled atmosphere storage, | |
zero energy cool chambers.

Unit III: Preservation of Fruits and Vegetables

- **Canning:** Selection of fruits and vegetables, process of canning, factors affecting the process—time and temperature, containers of packing, lacquering, syrups and brines for canning, spoilage in canned foods.
- **Fruit Beverages:** Introduction, Processing of fruit juices (selection, juice extraction, deaeration, straining, filtration and clarification), preservation of fruit juices (pasteurization, chemically preserved with sugars, freezing, drying, tetra-packing, carbonation), processing of squashes.
- **Jams, jellies and marmalades:** Introduction, Jam: Constituents, selection of fruits, processing & technology, Jelly: Essential constituents (Role of pectin, ratio), Theory of jelly formation and defects in jelly.
- **Pickles, chutneys and sauces:** Processing, Types, role of ingredients, causes of spoilage in pickling.
- **Tomato products:** Selection of tomatoes, pulping & processing of tomato juice, tomato puree, paste, ketchup, sauce and soup.

Suggested Readings:

Teaching Plan:
- **Week 1:** Introduction to market milk—Indian standards, Composition, factors affecting composition of milk, Physico-chemical properties of milk and its constituents
- **Week 2:** Milk processing: Clean milk practices, buying and collection, platform tests, pre-heating, filtration, clarification, standardization
- **Week 3:** Bactofugation, homogenization, pasteurization, cooling, packaging and storage. Cleaning and sanitization of dairy equipment including CIP and COP
- **Week 4:** Milk products (Cream, butter, ice cream, curd)—Introduction, definition, classification, methods of manufacture, quality aspects.
- **Week 5:** Cheese, khoa and ghee—Introduction, definition, classification, methods of manufacture, quality aspects.
- **Week 6:** Classification of fruits and vegetables, general composition, enzymatic browning and its prevention
- **Week 7:** Post-harvest changes and management of fruits and vegetables—Climacteric rise, horticultural maturity, physiological maturity, maturity indices and process of ripening—physiological changes, physical and chemical changes.
- **Week 8:** Canning: Selection of fruits and vegetables, process of canning, factors affecting the process—time and temperature, containers of packing, lacquering, syrups and brines for canning, spoilage in canned foods.
- **Week 9:** Causes of post-harvest losses, farm heat, measures to reduce post—harvest losses in F & V, Controlled atmosphere storage, zero energy cool chambers.
Week 10: Fruit Beverages: Introduction, Processing of fruit juices (selection, juice extraction, deaeration, straining, filtration and clarification), preservation of fruit juices (pasteurization, chemically preserved with sugars, freezing, drying, tetra-packing, carbonation), processing of squashes.


Week 12: Pickles, chutneys and sauces: Processing, Types, role of ingredients, causes of spoilage. Tomato products: Selection of tomatoes, pulping & processing of tomato juice, Tomato puree, paste, ketchup, sauce and soup

Facilitating the achievement of Course Learning Outcomes

<table>
<thead>
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<th>Unit No.</th>
<th>Course Learning Outcomes</th>
<th>Teaching and Learning Activity</th>
<th>Assessment Tasks</th>
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<tbody>
<tr>
<td>I</td>
<td>Introduction to market milk and processing of milk products</td>
<td>Lectures, discussions and visit to milk industry</td>
<td>Assignment on milk</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Visit report</td>
</tr>
<tr>
<td>II</td>
<td>Introduction to fruits and vegetables and post-harvest management</td>
<td>Lectures, discussions based on industrial uses/processing of fruits and vegetables</td>
<td>Presentation/quiz on fruits and vegetables</td>
</tr>
<tr>
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<td></td>
<td>Practicals on quality aspects of fruits and vegetables.</td>
</tr>
<tr>
<td>III</td>
<td>Learning techniques of preservation of fruits and vegetables</td>
<td>Lectures, discussions</td>
<td>Presentation</td>
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<td>Practicals</td>
</tr>
</tbody>
</table>

FNEC 43 C: FOOD PROCESSING TECHNOLOGY -II
PRACTICAL

Marks: 50                                      Duration: 3 hours

Course objective:
The course aims at providing knowledge of processing and preservation principles and techniques pertaining to milk & milk products and fruits & vegetables.

Course learning outcomes:
Students will be able to-
1. Understand technologies used for processing and preservation of milk and milk products and preservation of fruits & vegetable products.
2. Gain practical knowledge of analysing adulterants in milk and quality aspects of milk, milk products and fruits and vegetables.

CONTENTS

PERIODS
Unit I: Milk and Milk Products
- Quality analysis of milk and determination of its components like fat, SNF, protein, TSS.
- Detection of preservatives in milk (e.g. boric acid and borate).
- Detection of adulterants in milk (like starch, sugar, soda, detergent, urea).
- Analysis of cream, cheese, paneer, khoa as per BIS standards.
- Visit to milk industry to understand process of pasteurization and homogenization.

Unit II: Fruits and Vegetable processing
- Experiment on control of enzyme activity, enzyme inactivation in fruits and vegetables.
- Estimation of acidity, total solids of different foods – Squashes, syrups and juices.
- Dehydration of fruits and vegetables and its effect on colour texture and rehydration ratio.
- New product development using principles of preservation of fruits and vegetables by low temperature/heat/salt and sugar.
- Processing of tomato products (ketchup and sauce).
- Processing of jams, jellies and marmalades.
- Processing of pickles and brines.

Suggested Readings:

FNEC 44 C: ADVANCED FOOD SCIENCE THEORY

Marks: 100 Duration: 3 hours

Course objective: The course aims to enable students to acquaint with fundamentals of food processing technology and its process and to understand concepts of various engineering principles and processing methods.

Course Learning Outcomes:
Students will be able to-
1. Gain knowledge of principles of Unit operations involved in food processing industry.
2. Learn fundamentals of food processing technology and its process.
3. Understand concepts of various engineering principles and processing and preservation methods and their application.
4. Understand various post processing operations important from industrial point of view.

CONTENTS PERIODS
UNIT I: Processing and preservation by heat 18 Principle, theory and effect of blanching, pasteurization, sterilization, UHT, canning, extrusion
cooking and frying on food.

UNIT II: Processing and preservation by low temperature 18
Principle, theory and effect of refrigeration, chilling, freezing, freeze-drying (lyophilization) and freeze-concentration on food.

UNIT III: Processing and preservation by non-thermal technologies 6
- Principle, theory and effect of irradiation, high pressure, pulsed electric field and other innovative technologies on food.

UNIT IV: Processing and preservation by other methods 6
- Principle, theory and effect on food of drying, osmotic dehydration, concentration, evaporation and distillation, Hurdle technology.

Suggested Readings:

Teaching Plan:
**Week 1:** Principle, theory and effect on food of blanching and pasteurization.
**Week 2:** Principle, theory and effect on food of sterilization, UHT and canning
**Week 3:** Principle, theory and effect on food of extrusion cooking and frying
**Week 4:** Principle, theory and effect on food of refrigeration and chilling
**Week 5:** Principle, theory and effect on food of freezing and freeze-drying (lyophilization)
**Week 6:** Principle, theory and effect on food of freeze-concentration
**Week 7:** Principle, theory and effect on food of irradiation and high pressure
**Week 8:** Principle, theory and effect on food of pulsed electric field and other innovative technologies.
**Week 9:** Principle, theory and effect on food of drying
**Week 10:** Principle, theory and effect on food of concentration and evaporation
**Week 11:** Revision
**Week 12:** Presentations

Facilitating the achievement of Course Learning Outcomes

<table>
<thead>
<tr>
<th>Unit No.</th>
<th>Course Learning Outcomes</th>
<th>Teaching and Learning Activity</th>
<th>Assessment Tasks</th>
</tr>
</thead>
</table>
| I        | The course intends to provide knowledge of principles of Unit operations involved in | Lectures, discussions and visit | • Assignment  
• Visit report  |
<table>
<thead>
<tr>
<th>UNIT</th>
<th>PERIODS</th>
<th>CONTENTS</th>
</tr>
</thead>
</table>
| UNIT I | 4       | - To conduct dehydration and rehydration of fruits and vegetables.  
- To study the steps of can making process.  
- Estimation of ascorbic acid and effect of heat treatment on it.  
- Determination of drying characteristics |
| UNIT II | 4       | - Visit to food processing industry to learn about heat exchangers, freezers, freeze drying and freeze concentration.  
- Freezing time calculations.  
- Estimation of total acidity, volatile acidity, fixed acidity and esters in alcoholic beverages. |
| UNIT III | 4      | - Analysis of water for its potability. Estimation of Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) of industry wastewater  
- Estimation of toxins and pesticide residue in foods. |
Suggested Readings:

FNEC 45 C: APPLIED FOOD MICROBIOLOGY
THEORY

Marks: 100 Duration: 3 hrs

Course Objective:
The course aims to provide knowledge of the microbial flora associated with food, role of microorganisms, microbiological safety of food, food borne pathogens and their toxins.

Course Learning Outcomes:
Students will be able to-
1. Understand the microbial flora associated with food and acquire knowledge on beneficial role of microorganism and relevance of microbiological safety of food.
2. Understand the conventional and rapid methods for detection of food borne pathogens and their toxins.

CONTENTS PERIODS
UNIT I: Microorganisms associated with Foods 2
• Bacteria, Fungi, Yeasts and Viruses.

UNIT II: Useful Microorganisms 10
• Food Cultures, Fermentation, Fermented products and role of microorganisms.
• Cultivation of microorganisms:
  Fermenter design and various types of fermentation systems (submerged, surface and solid state); Fermentation substrates, Principles and production of enzymes, Baker’s yeast, vinegar.

UNIT II: Food microbiological quality and safety 18
• Estimating number of microorganisms.
• ICMSF criteria for microbiological safety of food-Microbiological standards, Microbiological guidelines, Microbiological specifications. Microbiological criteria for various food products.
ICMSF sampling plan: Two class plan, Three class plan.
Repair and detection of microorganisms
Colony counting methods
Indicators of food quality and food safety—Coliforms, Enterococci, Bifidobacteria, coliphages.
Predictive microbiology

UNIT III: Techniques for detection of pathogens associated with food
Analysis of food for detection of Salmonella and E.coli.
Rapid methods for detection of food borne pathogens and their toxins:
  ATP Photometry, Direct epifluorescent filter technique, Immunological Methods (Immunodiffusion, ELISA), Molecular method (PCR based).

UNIT IV: Waste disposal and Effluent treatment
Identification of waste, Utilization and disposal of industrial wastes.
Different methods of waste disposal.
Contemporary technologies for management of waste

Suggested Readings:

Teaching Plan:
Week 1: Microorganisms associated with Foods, Useful Microorganisms.
Week 2: Useful Microorganisms
Week 3: Useful Microorganisms
Week 4: Food microbiological quality and safety
Week 5: Food microbiological quality and safety
Week 6: Food microbiological quality and safety
Week 7: Food microbiological quality and safety
Week 8: Food microbiological quality and safety
Week 9: Techniques for detection of pathogens associated with food
Week 10: Techniques for detection of pathogens associated with food
Week 11: Techniques for detection of pathogens associated with food
Week 12: Waste disposal and Effluent treatment
Facilitating the achievement of Course Learning Outcomes

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<th>Course Learning Outcomes</th>
<th>Teaching and Learning Activity</th>
<th>Assessment Tasks</th>
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</thead>
<tbody>
<tr>
<td>I</td>
<td>Understand the microbial flora associated with food.</td>
<td>Lectures, discussions</td>
<td>• Assignment</td>
</tr>
<tr>
<td>II</td>
<td>Acquire knowledge on beneficial role of microorganism.</td>
<td>Lectures, discussions</td>
<td>• Presentation/quiz</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Practicals</td>
</tr>
<tr>
<td>III</td>
<td>Understand the relevance of microbiological safety of food.</td>
<td>Lectures, discussions</td>
<td>• Presentation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Practicals</td>
</tr>
<tr>
<td>IV</td>
<td>Understand the conventional and rapid methods for detection of food borne pathogens and their toxins</td>
<td>Lectures, discussions</td>
<td>• Presentation</td>
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<tr>
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<td></td>
<td>• Practicals</td>
</tr>
<tr>
<td>V</td>
<td>Understand the role of microbes in waste water treatment</td>
<td>Lectures, discussions and visit</td>
<td>• Presentation</td>
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<td>• Practicals</td>
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<td>• Visit report</td>
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</tbody>
</table>

FNEC 45 C: APPLIED FOOD MICROBIOLOGY
PRACTICAL

Marks: 50        Duration: 3 hours

Course Objectives:
The course aims at providing practical understanding of cultivation of microorganisms and study of microorganisms commonly associated with foods and environmental monitoring of a food manufacturing unit.

Course Learning Outcomes:
Students will be able to-
1. Learn techniques of detection of microorganisms from food samples.
2. Understand the method of enumeration of microorganisms and to study different types of microorganisms.

CONTENTS

UNIT I: Microbial Growth
• Bacterial growth by Turbidometric method.
• Effect of pH and temperature on bacterial growth.
• Grow Brewer’s Yeast and its Application in alcohol production.

UNIT II: Detection and Enumeration of Microorganisms associated with Food Samples

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• Psychrotrophic, Thermoduric, Lipolytic, Proteolytic, Halophilic, Osmophilic, Pectinolytic, Acid producing microorganisms from different food samples.

UNIT III: Environmental Monitoring and Personnel Hygiene (College canteen/Any manufacturing unit)
• Use of swabs, Contact plate, Dip slide, Exposure plate and Phenol co-efficient determination.

Suggested Readings: