

**SU/BOS/Science/497**

**Date: 10/07/2023**

**To,**

The Principal, All Concerned Affiliated Colleges/Institutions Shivaji University, Kolhapur	The Head/Co-ordinator/Director All Concerned Department (Science) Shivaji University, Kolhapur.
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**Subject:** Regarding syllabi of M.Sc. Part-II (Sem. III & IV) as per NEP-2020 degree programme under the Faculty of Science and Technology.

**Sir/Madam,**

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, nature of question paper and equivalence of M.Sc. Part-II (Sem. III & IV) as per NEP-2020 degree programme under the Faculty of Science and Technology.

<b>M.Sc.Part-II (Sem. III &amp; IV) as per NEP-2020</b>			
1.	Microbiology (HM)	8.	Food Science & Nutrition
2.	Pharmaceutical Microbiology (HM)	9.	Food Science & Technology
3.	Microbiology	10.	Biochemistry
4.	Computer Science	11.	Biotechnology
5.	Computer Science (Online Mode)	12.	Medical Information Management
6.	Data Science	13.	Environmental Science
7.	Information Technology (Entire)	14.	Physics

This syllabus, nature of question and equivalence shall be implemented from the academic year 2023-2024 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website [www.unishivaji.ac.in](http://www.unishivaji.ac.in)

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2023 & March/April 2024. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

  
**Dy Registrar**  
**Dr. S. M. Kubal**

**Copy to:**

1	The Dean, Faculty of Science & Technology	8	P.G. Admission/Seminar Section
2	Director, Board of Examinations and Evaluation	9	Computer Centre/ Eligibility Section
3	The Chairman, Respective Board of Studies	10	Affiliation Section (U.G.) (P.G.)
4	B.Sc. Exam/ Appointment Section	11	Centre for Distance Education

# **SHIVAJI UNIVERSITY, KOLHAPUR.**



**Accredited By NAAC with 'A' Grade**

**National Education Policy 2020**

**Syllabus For**

**M.Sc. (Food Science & Nutrition)**

**Part I & II**

**(Syllabus as per NEP to be implemented from June, 2022 onwards.)**

**Shivaji University, Kolhapur**  
**College of Non- Conventional Courses for Women, Kolhapur**  
**Department of Food Technology**

**Syllabus and Scheme of examinations for Two year (Four Semesters)**

**M. Sc. Degree Program in Food Science and Nutrition**

**Guidelines and Regulations shall be as per M. Sc. CBCS Program**

**Preamble:**

The Master's programme of Food Science and Nutrition provides professional education for those who wish to develop a carrier in Food industry, New product Development, Clinical Nutrition, Public health Nutrition and Research. It focuses on the interface between food science and human nutrition and area of increasing importance to educators, health departments, consumers, government and food industry. It builds on major concepts of nutritional biochemistry, nutrition and food science to discuss the roles of all nutrients, nutritional contents of food and diet in health and disease. The programme includes all the units of study to ensure the students to reach competence including public health, clinical nutrition, communication, research and evaluation. Shivaji University Kolhapur, Faculty of Science and Technology is offering M.Sc. degree in Food Science and Nutrition since inception with modifications in scheme and syllabus from time to time as needed to keep abreast with largest knowledge in the field. Since the subject has grown tremendously, there is a need to specialize within the subject and train students specifically for the job market.

The proposed M.Sc. Programme under CBCS scheme has a total of 96 credits consisting of CC, CCS, DSE.

**Eligibility Criteria:**

Minimum percentage is 55% or equivalent grade who have the following degrees- B.Sc. Food Technology and Management, Bachelor of Food technology and Management, B.Sc. Food Technology, B.Sc. Food Science and Quality Control, B.Sc. Food Processing and

Packaging, B.Sc. Foods and Nutrition, B.Sc. Food Science and Nutrition, B.Sc. Clinical Nutrition and Dietetics/ Nutrition and Dietetics, B.Sc. Public Health and Nutrition, B.Sc. Applied Nutrition, B.Sc. Home Science, B. Voc. Food Processing and Management (with 12<sup>th</sup> Science), B. Sc. Life Sciences/ Biochemistry/ Biotechnology / Microbiology/ Zoology/ Molecular Biology/ Botany/ Chemistry or equivalent.

**Intake Capacity:** 30

**PROGRAM OUTCOMES (POS), PROGRAM SPECIFIC OUTCOMES (PSO)**

<p><b>PROGRAM OUTCOMES (POS)</b></p>	<ol style="list-style-type: none"> <li>1. Utilize knowledge from the physical and biological sciences as a basis for understanding the role of food and nutrients in health and disease processes. Students will be able to prepare and deliver effective presentations of technical information to food science and nutrition professionals and to the general public.</li> <li>2. Students/ learners will gain a broad knowledge of food science focusing on chemistry, biochemistry, whilst giving them the necessary understanding of food processing, preservation techniques, quality, safety and new product development to excel in the field.</li> <li>3. Students/ learners will develop an in-depth understanding of the principles that underpin the relationships between diet, human health and wellbeing.</li> <li>4. Ability development of Students/ learners to critically appraise the effects of food processing on the nutritional quality of foods and the role of processed foods in the diet.</li> </ol>
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<p><b>PROGRAM SPECIFIC OUTCOMES (PSO)</b></p>	<ol style="list-style-type: none"> <li>1. Able to provide nutrition counselling and education to individuals, groups, and communities throughout the lifespan using a variety of communication strategies.</li> <li>2. Able to apply technical skills, knowledge of health behaviour, clinical judgment, and decision-making skills when assessing and evaluating the nutritional status of individuals and communities and their response to nutrition intervention.</li> <li>3. Students can implement strategies for food access, procurement, preparation, and safety for individuals, families, and communities. Apply food science knowledge to describe functions of ingredients in food.</li> <li>4. Students/ learners will develop the ability to apply fundamental specific concepts to understand the complex characteristics of foods.</li> <li>5. The programme will allow the students to challenge current issues in food production and issues arising from food safety.</li> <li>6. The programme will encourage students to evaluate current issues and developments related to the food science &amp; nutrition discipline.</li> </ol>
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**Choice Based Credit System with Multiple Entry and Multiple Exit Option (NEP-2020)**  
**M. Sc. (Food Science and Nutrition) Programme Structure**  
**M.Sc. Part I (Level 8)**

<b>Semester I (Duration Six Months)</b>												
<b>TYPE</b>	<b>SR. NO</b>	<b>COURSE CODE</b>	<b>TITLE OF THE PAPER</b>	<b>TEACHING SCHEME</b>			<b>EXAMINATION SCHEME</b>					
				<b>Theory and Practical</b>			<b>External Assessment (EA)</b>			<b>Internal Assessment (IA)</b>		
				<b>LECTURES (per week)</b>	<b>HOURS (per week)</b>	<b>CREDITS</b>	<b>Max. Marks</b>	<b>Min. Marks</b>	<b>Exam. Hours</b>	<b>Max. Marks</b>	<b>Min. Marks</b>	<b>Exam. Hours</b>
CGPA	1	CC-101	Human Physiology	4	4	4	80	32	3	20	8	1
	2	CC-102	Food Preservation Techniques	4	4	4	80	32	3	20	8	1
	3	CC-103	Advances in Food Chemistry	4	4	4	80	32	3	20	8	1
	4	CC-104	Nutrition Through Life Cycle	4	4	4	80	32	3	20	8	1
	5	CCPR-105	Laboratory Course I	16	16	8	200	80	---	---	---	*
<b>Total(A)</b>				---	---	<b>24</b>	<b>520</b>	---	---	<b>80</b>	---	---
Non-CGPA	1	AEC-106	Communication English I	2	2	2	---	---	---	50	20	2
<b>Semester II (Duration Six Months)</b>												
CGPA	1	CC-201	Advances in Food Microbiology	4	4	4	80	32	3	20	8	1
	2	CC-202	Processing of Cereal, Legumes and Oilseeds	4	4	4	80	32	3	20	8	1
	3	CC-203	Processing of Fruits and Vegetables	4	4	4	80	32	3	20	8	1
	4	CC-204	Nutritional Biochemistry	4	4	4	80	32	3	20	8	1
	5	CCPR-205	Laboratory Course II	16	16	8	200	80	---	---	---	*
<b>Total (B)</b>				---	---	<b>24</b>	<b>520</b>	---	---	<b>80</b>	---	---
Non-CGPA	1	SEC-206	Fundamentals of Information Technology I	2	2	2	---	---	---	50	20	2
<b>Total (A+B)</b>						<b>48</b>	<b>1040</b>	---	---	<b>160</b>	---	---

<ul style="list-style-type: none"> <li>• Student contact hours per week: <b>32</b> Hours (Min.)</li> </ul>	<ul style="list-style-type: none"> <li>• Total Marks for M.Sc.-I: <b>1200</b></li> </ul>
<ul style="list-style-type: none"> <li>• Theory and Practical Lectures: <b>60</b> Minutes Each</li> </ul>	<ul style="list-style-type: none"> <li>• Total Credits for M. Sc.-I (Semester I &amp; II): <b>48</b></li> </ul>
<ul style="list-style-type: none"> <li>• CC-Core Course</li> <li>• CCPR-Core Course Practical</li> <li>• AEC-Mandatory Non-CGPA compulsory Ability Enhancement Course</li> <li>• SEC- Mandatory Non-CGPA compulsory Skill Enhancement Course</li> </ul>	<ul style="list-style-type: none"> <li>• Practical Examination is annual.</li> <li>• Examination for CCPR-105 shall be based on Semester I Practicals.</li> <li>• Examination for CCPR-205 shall be based on Semester II Practicals.</li> <li>• *Duration of Practical Examination as per respective BOS guidelines</li> <li>• <i>Separate passing is mandatory for Theory, Internal and Practical Examination</i></li> </ul>
<ul style="list-style-type: none"> <li>• <b>Requirement for Entry at Level 8:</b>  <b>Completed all requirements of the relevant Bachelor's degree (Level 7) with principal / major subjects.....</b> </li> </ul>	
<ul style="list-style-type: none"> <li>• <b>Exit Option at Level 8:</b> Students can exit after Level 8 with <b>Post Graduate Diploma in .....</b> if he/she completes the courses equivalent to minimum of 48 credits.</li> </ul>	

**Choice Based Credit System with Multiple Entry and Multiple Exit Option (NEP-2020)**  
**M. Sc. (Food Science and Nutrition) Programme Structure**  
**M.Sc. Part II (Level 9)**

Semester III (Duration Six Months)												
TYPE	SR. NO	COURSE CODE	TITLE OF THE PAPER	TEACHING SCHEME			EXAMINATION SCHEME					
				Theory and Practical			External Assessment (EA)			Internal Assessment (IA)		
				LECTURES (per week)	HOURS (per week)	CREDITS	Max. Marks	Min. Marks	Exam. Hours	Max. Marks	Min. Marks	Exam. Hours
CGPA	1	CC-301	Research Methodology & Biostatistics	4	4	4	80	32	3	20	8	1
	2	CCS-302	Processing of Milk and Milk Products	4	4	4	80	32	3	20	8	1
	3	CCS-303	Food Additives, Contaminants & Toxicology	4	4	4	80	32	3	20	8	1
	4	DSE-304	Clinical Nutrition	4	4	4	80	32	3	20	8	1
	5	CCPR-305	A) Laboratory Course III + B) Project Phase I	8 8	8 8	4 4	100 100	40 40	--- ---	--- ---	--- ---	* ---
Total (C)				---	---	24	520	--	---	80	---	---
Non-CGPA	1	AEC-306	Communication English II	2	2	2	---	---	---	50	20	2
	2	EC	SWAYAM/MOOC/Online	Number of Lectures & Credits will be specified on SWAYAM/MOOC/Online Courses								
Semester IV (Duration Six Months)												
CGPA	1	CC-401	Food Product Development & Packaging	4	4	4	80	32	3	20	8	1
	2	CCS-402	Processing of Animal Foods	4	4	4	80	32	3	20	8	1
	3	CCS-403	Functional Foods and Nutraceuticals	4	4	4	80	32	3	20	8	1
	4	DSE-404	Public Health Nutrition	4	4	4	80	32	3	20	8	1
	5	CCPR-405	A) Laboratory Course IV + B) Project Phase II	8 8	8 8	4 4	100 100	80	---	---	---	* ---
Total (D)				---	---	24	520	---	---	80	---	---
Non-CGPA	1	SEC-406	Fundamentals of Information Technology II	2	2	2	---	---	---	50	20	2
	2	GE-407	Food Analysis and Quality Control	2	2	2	---	---	---	50	20	2
Total (C+D)						48	1040	---	---	160	---	---



<ul style="list-style-type: none"> <li>• Student contact hours per week: <b>32 Hours (Min.)</b></li> </ul>	<ul style="list-style-type: none"> <li>• Total Marks for M.Sc.-II: <b>1200</b></li> </ul>
<ul style="list-style-type: none"> <li>• Theory and Practical Lectures: <b>60 Minutes Each</b></li> </ul>	<ul style="list-style-type: none"> <li>• Total Credits for M.Sc.-II (Semester III &amp; IV): <b>48</b></li> </ul>
<ul style="list-style-type: none"> <li>• CC-Core Course</li> <li>• CCS- Core Course Specialization</li> <li>• CCPR-Core Course Practical and Project</li> <li>• DSE-Discipline Specific Elective</li> <li>• AEC-Mandatory Non-CGPA compulsory Ability Enhancement Course</li> <li>• SEC- Mandatory Non-CGPA compulsory Skill Enhancement Course</li> <li>• EC (SWM MOOC) - Non-CGPA Elective Course</li> <li>• GE- Multidisciplinary Generic Elective</li> </ul>	<ul style="list-style-type: none"> <li>• Practical Examination is annual.</li> <li>• Examination for CCPR-305 shall be based on Semester III Practicals.</li> <li>• Examination for CCPR-405 shall be based on Semester IV Practicals.</li> <li>• *Duration of Practical Examination as per respective BOS guidelines</li> <li>• <b><i>Separate passing is mandatory for Theory, Internal and Practical Examination</i></b></li> </ul>
<ul style="list-style-type: none"> <li>• <b>Requirement for Entry at Level 9:</b>  <b>Completed all requirements of the relevant Post Graduate Diploma (Level 8) in .....</b> </li> </ul>	
<ul style="list-style-type: none"> <li>• <b>Exit at Level 9:</b> Students will exit after Level 9 with <b>Master's Degree in .....</b> if he/she completes the courses equivalent to minimum of 96 credits.</li> </ul>	

	<b>M.Sc.-I</b>	<b>M.Sc.-II</b>	<b>Total</b>
<b>Marks</b>	<b>1200</b>	<b>1200</b>	<b>2400</b>
<b>Credits</b>	<b>48</b>	<b>48</b>	<b>96</b>

**I. CGPA course:**

1. There shall be 14 Core Courses (CC) per programme.
2. There shall be 04 Core Course Specialization (CCS) of 16 credits per programme.
3. There shall be 02 Discipline Specific Elective (DSE) courses of 08 credits per programme
4. Total credits for CGPA courses shall be of 96 credits per programme

**II. Mandatory Non-CGPA Courses:**

1. There shall be 02 Mandatory Non-CGPA compulsory Ability Enhancement Courses (AEC) of 02 credits each per programme.
2. There shall be 01 Mandatory Non-CGPA compulsory Skill Enhancement Course (SEC) of 02 credits per programme.
3. There shall be one Elective Course (EC) (SWAYAM MOOC). The credits of this course shall be as specified on SWAYAM MOOC.
4. There shall be one Generic Elective (GE) course of 02 credits per programme. Each student has to take generic elective from the department other than parent department.
5. The total credits for Non-CGPA course shall be of 08 credits + 2-4 credits of EC as per availability.
6. The credits assigned to the course and the programme are to be earned by the students and shall not have any relevance with the work load of the teacher.

## **CC-101: HUMAN PHYSIOLOGY**

**(4 Credits, 60 lectures)**

### **Course Outcome**

- Students will understand structure and function of cell, tissues and organs of the body
- Students will come to know about different systems of the body and their functions
- Students will learn the role of body systems in maintaining Homeostasis

### **Unit I**

**(1 Credit, 15 lectures)**

General principles of Human Physiology- The Cell and the tissues, structure of cell and tissues, various types and functions of tissues, Transport through the cell membrane, action potential, Introduction to various systems, skeletal system, cavities of the body, Blood and Immune System- Blood composition, plasma and plasma proteins; Red Blood Cells and Anemias, White Blood Cells and Immune System; Platelets Homeostasis and Blood Coagulation; Blood Groups and Blood Transfusion

### **Unit II**

**(1 Credit, 15 lectures)**

Cardiovascular System- Anatomy of Cardiovascular System, The Heart and Blood Vessels, Physiological Activities of the Heart, Physiology of Circulation, Cardiovascular Regulation and Adjustments During Health and Disease, Lymphatic System; Respiratory System- Anatomy, Organization and Functions of Respiratory System, Physiology of Respiration, Respiration: Clinically Applied Aspects; Excretory System- Anatomy of Excretory System, Physiology of Excretory System, Physiology of Acid Base Balance

### **Unit III**

**(1 Credit, 15 lectures)**

Digestive System- Organisation and general characteristics of Digestive System, Anatomy and Physiology of Mouth, Pharynx and Oesophagus, The Stomach, Pancreas, Liver and Gall Bladder, The Small Intestine, The Large Intestine, Digestion and Absorption; Reproductive System- Sexual Growth and Development, Male Reproductive System, Female Reproductive System, Physiology of Contraception

### **Unit IV**

**(1 Credit, 15 lectures)**

Endocrine System- Organisation and general principles of Endocrine System, Hypothalamus and Pituitary Gland, Thyroid Gland, Parathyroid Glands and Thymus, Adrenal Glands, Pancreatic and Gastrointestinal Hormones and Local Hormones; Nervous System and Special Senses- Organisation of Nervous System and Nerve Physiology, Central Nervous System, Peripheral Nervous System, Autonomic Nervous System, Somatosensory System,

Somatomotor System and Reflexes, Meninges, Cerebrospinal Fluid, Blood-Brain Barrier and Cerebral Blood Flow, Special Senses

**Suggested Readings:**

1. L Antony, C.A (1963), 'Text Book of Anatomy and Physiology', the C.V. Mosby Co., Saint Louis
2. Bell G.H., Davidson, J.N., and Scarborough H. (1972) 'Textbook of Physiology and Biochemistry' London E.S. Livingston Ltd.
3. Best. C.H., and Taylor, R.B. (1965) 'The Living Body', London Chapman and Hall Ltd.
4. Gyotons, A.C. (1966), Textbook of Medical Physiology, London, W.B. Saunders & Co.
5. Rogers, T.S. Elementary (1961), 'Human Physiology', New York, John Wiley and Sons, Inc.
6. Green, H. (1972), 'An Introduction to Human Physiology', London, Oxford University Press
7. K Sembulingam, PremSembulingam (2001), Essentials of Medical Physiology, CBS Publishers and Distributors, New Delhi
8. InduKhurana, Arushi; Text book of Anatomy and Physiology for Nurses, (2009), CBS Publishers and Distributors, New Delhi

## **CC-102 FOOD PRESERVATION TECHNIQUES (4 Credits, 60 lectures)**

### **Course Outcome:**

1. Student will be able to understand different processing and preservation techniques.
2. The students will be able to utilize the various preservative methods for food in industrial settings.
3. The students will comprehend the processing techniques utilized in food industries.

### **Unit – I**

**(1 Credit, 15 lectures)**

Definition and scope of food Science and Technology, historical development of food processing and preservation, general principles of food preservation, Water Activity and its significance in food preservation, fermentation methods for preservation, and chemical preservations of foods.

### **Unit – II**

**(1 Credit, 15 lectures)**

Food preservation by low-temp: Cold Storage, Chilling and super chilling, Refrigeration, Freezing and Freeze-drying. Cryogenic preservation. Advantages and disadvantages of low temperature preservation techniques

### **Unit – III**

**(1 Credit, 15 lectures)**

Food preservation by heating: Drying, Dehydration, Osmotic Dehydration, Blanching, Cooking, Canning, Pasteurization, Sterilization, Baking and Extrusion cooking

### **Unit – IV**

**(1 Credit, 15 lectures)**

Preservation by non-thermal methods: Hydrostatic pressure, Dielectric heating, Ohmic Heating, Radiofrequency heating, Microwave processing, Irradiation, Membrane technology and Hurdle technology.

### **Suggested Readings:**

1. Srivastava, R. P. 1994 Fruit & Vegetable Preservation Principles, CBS publication
2. McWilliams, M. 1984, Modern Food Preservation Surjeet Publication
3. Desrosier, Norman W. 1987, Technology of Food Preservation, fourth edition, CBS Publishers and distributors
4. Agnihotri, Atul 2018 Food Preservation Techniques, Crescent publication
5. N. P. Singh 2000: Fruit & vegetable Preservation, Oxford Food Company
6. Kalia, Manoranjan 1986: Food Preservation & Processing, Sarup & Sons, New Delhi
7. Shirley J Vangarde, Margy Woodburn : Food preservation & safety, Surabhi Publications, Jaipur
8. S.N Mahindru: Food preservation & Irradiation, APH Publishing Corporation
9. Morris, T.N. 2004 Principles of Fruit Preservation, Agrobios India
10. H. A Modi, 2017: food preservation, Aivishkar Publishers, Distributors, Jaipur

11. Subbulakshmi, G. 2001; Food Processing & Preservation, New age International publishers
12. Khetarpaul, Neelam 2005: Food Processing and Preservation, Daya Publication House

## **CC-103 ADVANCES IN FOOD CHEMISTRY ((4 Credits, 60 lectures)**

### **Course Outcome**

1. Students will be able to learn the chemistry of food to control a chemical and biochemical reaction that influence food quality.
2. Students will also learn about the principles behind analytical techniques associated with food components and related problems.
3. Student will understand the role of food nutrients.
4. Students will be able to know the basic nutrients and their requirements for human nutrition.
5. Students will be able to evaluate new product development.

### **Unit I**

**(1 Credit, 15 lectures)**

Carbohydrates: Introduction Occurrence, Structure and Classification of Carbohydrates, Physicochemical Properties of Carbohydrates, Absorption of Water Solubility, Mutarotation, Inversion of Sugar, Taste, Crystallization. Effect of Heat, Effect of Food Processing on Carbohydrates -Effect on Starch, Effect on Dietary Fibre Application of Carbohydrates in Foods -Use of Sugars in Food, Food Applications of Starch Polysaccharides Food Applications of Non-starch Polysaccharides

### **Unit II**

**(1 Credit, 15 lectures)**

Lipids Introduction, Occurrence and Sources, Classification of Lipids -Simple Lipids, Complex Lipids, Derived Lipids, Structure of Lipids -Fatty Acids, Acylglycerols, Properties of Lipids -Physical Characteristics, Chemical Reaction and Fat Constants, Deteriorative Changes in Fats and Oils and their Prevention - Auto-oxidation, Lipolysis and Thermal Decomposition, Antioxidants, Applications in Foods and Nutrition, Adulteration of Fats and Oils.

### **Unit III**

**(1 Credit, 15 lectures)**

Proteins and Enzymes. Introduction, Occurrence of Proteins, - Plant Sources, Animals Sources, Microbial sources, Classification of Proteins -On the Basis of Shape and Size, Products of hydrolysis, biological functions, Structure of Proteins - Amino Acids, Peptides Structural Organization of Proteins Properties of Proteins -Physico-chemical properties of Proteins, Food Applications of Protein Concentrates, Isolates and

Hydrolysates. Enzymes-Nomenclature and Classification of Enzymes, Enzyme Utilization in Food Industry, Immobilized Enzymes, Enzymatic Browning.

#### **Unit IV**

**(1 Credit, 15 lectures)**

Vitamins Definition, fat soluble Vitamins-Vitamin A, D, E and K, Water soluble vitamins – B Complex Vitamins and Vitamin C Sources, deficiency, excess, and effect of food processing on vitamins, optimization and retention of vitamins.

Minerals - Definition, classification, macro-minerals, micro-minerals Sources, excess, deficiency, RDA and effect of processing on minerals, optimization and retention of minerals

#### **Suggested Readings**

1. John M.deMan,John W. Finley,W Jeffrey Hurst.Chang Yong Lee (2019) Principles of Food Chemistry(4<sup>th</sup> edition) Springer
2. Meyer Lillian Hoagland (2008),Food chemistry (6<sup>th</sup> edition) Reinhold Publishing Corporation
3. H.D.Belitz,W.Grosch,P.Schieberle(2008)Food chemistry (4<sup>th</sup> edition)Springer
4. Alex.V.Ramani(2015)Food Chemistry(1<sup>st</sup> edition)MJP publishers
5. J.L.Jain(2009)Fundamenntals of Biochemistry (Multicolour edition) S .Chand and Company,New Delhi
6. N. ShakuntalaManay,MShadaksharswamy(2020)Food Facts and Principles(4<sup>th</sup> edition)New Age International
7. H.K.Chopra,P.S.Panesar(2015) Food chemistry(1<sup>st</sup> edition) Narosa Publishing House



## **CC-104: NUTRITION THROUGH LIFE-CYCLE (4 Credits, 60 lectures)**

### **Course Outcome:**

1. Students will understand the functions and sources of nutrients, role of nutrients in maintenance of good health. Able to identify what foods are good sources for what nutrients.
2. Students will be familiar with factors affecting for the absorption of nutrients.
3. Students will gain knowledge about food pyramid, vegetarian diet, menu planning and nutritional needs during infancy to adolescents.
4. Students will come to know about the nutritional requirement of adults, nutritional needs during pregnancy and lactation, physiological changes and hormones involved during pregnancy and lactation, effects of ageing and life expectancy.

### **Unit I**

**(1 credit, 15 lectures)**

Food, Nutrition and Health- Food Definition, Functions of Food, Nutrients and definition of Nutrition, Classification of Nutrients; Basic Concepts- Recommended Dietary Allowances and Dietary Guidelines; The Food Group System, The Food Guide for Indians, Use of Food Composition tables, Daily Value, Food Exchanges, Serving Size, Energy Metabolism, Energy Balance and Body Weight; Water, Electrolyte and Acid Base Balance

### **Unit II**

**(1 Credit, 15 lectures)**

Nutrition in Pregnancy- Physiological changes, Preconceptual Nutrition, Nutritional Requirements, Food Requirements, General Dietary Problems, Complications, Exercise/Physical activity, Indian Pregnant Woman; Nutrition in Lactation- Role of Hormones in Milk Production, Nutritional Requirements, Food Requirements, Indian Nursing Mothers; Postpartum Nutrition and Nutritional Status, Nutrition in Infancy- Growth and Development during infancy, Nutritional and Food requirements, Artificial Feeding, Low Birth Weight, Preterm Baby, Weaning

### **Unit III**

**(1 Credit, 15 lectures)**

Nutrition in pre-school children (1 to 6 years)- Nutritional Requirement, Food Requirements, Nutrition Related Problems, Feeding Programmes; Nutrition in School-going Children (7 to 12 years)- Nutritional Requirements, Food Requirements, Diet Related Problems, Packed Lunches, School Lunch Programmes ; Nutrition in Adolescents- Nutritional Requirements,

Food Requirements, Nutritional Problems, Physical Activity; Adult Nutrition- Nutritional Requirements, Food Requirements, Low cost balanced diets, Vegetarian Diets

#### **Unit IV**

**(1 Credit, 15 lectures)**

Nutrition of Ageing and Elderly- Process of Ageing, Nutritional Requirements, Food Requirements, Nutrition related problems of old age, Degenerative Diseases, Physical Activity, Drug and Supplements; Nutrition for special population- Nutritional Anaemias- Prevalence, causes, types, Iron Deficiency Anemias, Megaloblastic Anemias, Haemolytic Anemias, Differentiating Anemias, Prevention; Food Sensitivity- Types of reactions, Food involved sensitivity, symptoms, diagnosis, treatment, Food Intolerance; Inborn Errors of Metabolism- Phenylketonuria, Galactosemia, Fructosuria, Fructose-1,6-Biphosphatase Deficiency, Menkes' Disease, Wilson's Disease.

#### **Suggested Reading:**

1. Judith E. Brown, (2010), Nutrition through the life cycle (5<sup>th</sup> edition), Cenage Learning, USA
2. B. Shrilakshmi, (2016), Dietetics (8<sup>th</sup> edition), New Age International Publication, New Delhi.
3. Shubhangini Joshi (2000), Nutrition and Dietetics (4<sup>th</sup> edition), McGraw Hill Publication, New Delhi
4. B. Shrilakshmi, (2016), Human Nutrition for B.Sc. Nursing Students (4<sup>th</sup> edition), New Age International Publication, New Delhi.
5. M. Raheena Begum, (2005), Textbook of Food, Nutrition and Dietetics (3<sup>rd</sup> edition), Sterling Publishers, New Delhi
6. Joan Webster-Gandy, Angela Madden, Michelle Holdsworth; (2003), Nutrition and Dietetics (2<sup>nd</sup> edition), Oxford Publication, UK
7. Nix, Staci (2017), William's Basic Nutrition and Diet Therapy (15<sup>th</sup> edition), Elsevier, USA
8. Anjana Agarwal, Shibha Udupi, (2009), Text book of Human Nutrition (3<sup>rd</sup> edition), Jaypee Brothers Medical Publishers, New Delhi

## **CCPR- 105: LABORATORY COURSE I (8 Credits 120 hours)**

**(Based on CC 101, CC 102, CC 103, CC 104)**

### **Group A**

Anthropometric Assessment of Body  
Determination of energy value of food  
Determination of BMR  
Determination of Hemoglobin  
Determination of Blood group  
Determination of Daily energy requirement of body  
Study of Hematology Analyzer  
Study of Blood Biochemistry Analyzer  
Study of Balanced Diet Plan

### **Group B**

Brining of Baby corn  
Canning of pineapple  
Freeze drying of fruits  
Tray drying of Garlic and Ginger  
Chilling of Fish or meat products

### **Group C**

Study of Laboratory instruments/equipments  
Determination of moisture content of given food sample  
Determination of fat content by soxhlet method  
Determination of protein by kjeldahl's method  
Determination of ash content from given food sample  
Determination of crude fibre  
Isolation and characterization of starch  
Isolation and characterization of casein

### **Group D**

Standardization of Recipes  
Planning of Calorie-Protein rich recipe  
Planning of Iron rich Recipe  
Planning of Calcium rich Recipe  
Planning of Vitamin, A rich Recipe

Planning of Vitamin B1 rich Recipe

Planning of Vitamin B2 rich Recipe

Planning of Vitamin B3 rich Recipe

Planning of Vitamin D rich Recipe

Planning of Vitamin C rich Recipe

**Seminars on Group A, B, C and D**

**AEC-106: COMMUNICATION ENGLISH-I (2 Credits, 30 Hours)**

## **CC-201: ADVANCES IN FOOD MICROBIOLOGY (4 Credits, 60 Lectures)**

### **Course Outcome:**

1. Students will understand the important pathogens and spoilage microorganisms in foods, the most likely sources of these organisms, and the conditions under which they grow, the role of beneficial microorganisms in foods and their use in fermentation processes.
2. Students will be able to use appropriate laboratory techniques to enumerate, isolate, and identify microorganisms in foods.

### **UNIT I**

**(1 Credit, Lectures 15)**

Growth and survival of microorganisms in foods; Temperature effects on microbial growth and survival; thermal destruction, Cell injury; Effect of atmosphere on microbial growth; water activity as growth/survival parameters; Spoilage organisms of milk, fruits, vegetables, grains and oilseeds, meat and poultry; Physical and Chemical methods to control microorganisms.

### **UNIT II**

**(1 Credit, Lectures 15)**

Biochemical changes caused by microorganisms; Microbes in food fermentation, putrefaction, lipolysis; Antagonism and synergism in microorganisms; Food poisoning and food borne infections; Microbial toxins; Pathogenesis: Virulence mechanisms of food-borne pathogens; toxin structure/function (with emphasis on enterotoxins); classical approaches for control of food-borne pathogens; New directions in pathogen detection

### **UNIT III**

**(1 Credit, Lectures 15)**

Food borne illness: (*Clostridium botulinum*, *Escherichia coli*, *Brucella*, *Bacillus*, *Salmonella*, *Staphylococcus*); Non-bacterial agent & food borne illness, (Helminths & Nematodes, protozoa, toxic algae, fungi & food borne viruses; Introduction to the epidemiology of food-borne disease.

### **UNIT IV**

**(1 Credit, Lectures 15)**

Food Fermentations; Probiotics and Prebiotics; Fermented foods based on milk, meat and vegetables; Fermented beverages; Genetic engineering for food fermentations. Cell immobilization and applications

### **Suggested Readings**

1. Burton E. Pierce and Michael J. Leboffe, Microbiology, Laboratory theory and Application (3rd Edition), Morton Publishing company
2. Powar CB and Dagainawala HF (2005), General Microbiology Vol. I and II 8th Edition, Himalaya Publishing House, Mumbai.

- 3.** James M. Jay, Martin J. Loessner, David A. Golden • 2005, Modern Food Microbiology 6th Edition, Springer, US.
- 4.** Bibek Ray, ArunBhunia • 2013, Fundamental Food Microbiology, 5th Edition, Taylor and Francis.
- 5.** NeelimaGarg, K. L. Garg, K. G. Mukerji • 2010, Laboratory Manual of Food Microbiology, I. K. International Publishing house Pvt. Ltd.
- 6.** Frazier, W. C, Food Microbiology, fifth edition 2014, McGraw Hill Education Pvt. Ltd.
- 7.** Industrial Microbiology Casida, L. E.
- 8.** M. R. Adams, M. O. Moss, Food Microbiology, 1995, New Age International (P) Limited, Publishers.
- 9.** George J. Banwart, Basic Food Microbiology, First edition 1998, CBS Publishers and Distributors.
- 10.** K. R. Aneja, Modern Food Microbiology, 2018, Vinod Kumar Jain, Scientific International Pvt. Ltd.
- 11.** S. P. Narang, Food Microbiology; Methods of enumeration, 2016, A. P. H. Publishing House.
- 12.** Dr. H. A. Modi, Food Microorganisms, 2008, Aavishkar Publishers and Distributors.

## **CC – 202 PROCESSING OF CEREALS, LEGUMES AND OILSEEDS**

**(4 Credits 60 Lectures)**

### **Course Outcome:**

1. Students will be able to understand importance of cereal, legumes and oilseeds and also technology used in different milling industries.
2. Students will be able to understand technical knowledge of refining of oil.
3. Students will understand technology of cereals, legumes and oilseeds and their processed products and associated nutritional values.

### **UNIT I**

**(1 Credit 15 Lectures)**

General introduction and production and utilization trends; Structure and composition of common cereals, pulses and oilseeds.

### **UNIT II**

**(1 Credit, 15 Lectures)**

Wheat: Types and physicochemical characteristics; wheat milling -products and by-products; factors affecting quality parameters; physical, chemical and rheological tests on wheat flour; additives used in bakery products; flour improvers and bleaching agents; manufacture of bakery products, pasta products and various processed cereal-based foods; manufacture of whole wheat atta, blended flour and fortified flour.

### **UNIT III**

**(1 Credit, 15 Lectures)**

Rice: Classification, physicochemical characteristics; cooking quality; rice milling technology; by- products of rice milling and their utilization; Parboiling of rice- technology and effect on quality characteristics; aging of rice - quality changes; processed products based on rice. Corn: Types and nutritive value; dry and wet milling, manufacture of value-added products; processing of barley, oats, sorghum and millets.

### **UNIT IV**

**(1 Credit, 15 Lectures)**

Legumes and oilseeds: composition, anti-nutritional factors, processing and storage; processing for production of edible oil, meal, flour, protein concentrates and isolates; extrusion cooking technology; snack foods.

### **Suggested Readings**

1. Patil, R.T., Processing Technology for Food Legumes 2013, International Publishing house, New Delhi.
2. Chakrabarty MM. 2003. Chemistry and Technology of Oils and Fats. Prentice Hall.
3. Dendy DAV & Dobraszczyk BJ. 2001. Cereal and Cereal Products. Aspen.
4. Hamilton RJ & Bhati A. 1980. Fats and Oils - Chemistry and Technology. Sci. Publ.
5. Hosney RS. 1994. Principles of Cereal Science and Technology. 2nd Ed. AACC.
6. Kay DE. 1979. Food Legumes. Tropical Products Institute.
7. Kent NL. 1983. Technology of Cereals. 4th Ed. Pergamon Press.
8. Kulp K & Ponte GJ. 2000. Handbook of Cereal Science and Technology. 2nd Ed. Marcel Dekker.
9. Lorenz KL. 1991. Handbook of Cereal Science and Technology. Marcel Dekker.
10. Marshall WE & Wadsworth JJ. 1994. Rice Science and Technology, Marcel Dekker.
11. Mathews RH. 1989. Legumes Chemistry, Technology and Human Nutrition. Marcel Dekker.
12. Matz SA. 1969. Cereal Science. AVI Publ.
13. Paquot C. 1979. Standard Methods of Analysis of Oils, Fats and Derivatives. Pergamon Press.
14. Pomeranz Y. 1987. Modern Cereal Science & Technology. VCH Publ.
15. Salunkhe DK. 1992. World Oilseeds: Chemistry, Technology and Utilization. VNR.
16. Swern D. 1964. Bailey's Industrial Oil and Fat Products. InterSci. Publ.



## **CC-203: PROCESSING OF FRUITS & VEGETABLES**

**(4Credits, 60 Lectures)**

### **Course outcomes:**

1. Students will be able to know the application of food processing and preservation principles and technologies in the processing.
2. Students will be able to know preservation, extension of shelf life and value addition of fruit and vegetable products.
3. Students will gain knowledge and understanding of the basic post-harvest biological, chemical, physiological and metabolic processes and changes in fruits and vegetables.

### **UNIT I**

**(1 Credit, Lectures 15)**

Indian and global scenario on production and processing of fruits and vegetable; Quality requirements of raw materials for processing; sourcing and receiving at processing plants; primary processing: grading, sorting, cleaning, washing, peeling, slicing and blanching; minimal processing.

### **UNIT II**

**(1 Credit, Lectures 15)**

Processing for pulp, puree and concentrates, especially from mango, tomato, guava, papaya, apple, pineapple, pomegranate, grapes etc. using aseptic packaging, canning, IQF and frozen fruits and vegetables for peas, mango pulps etc. Potato processing, Mushroom Processing.

### **UNIT III**

**(1 Credit, Lectures 15)**

Technology for processed products like pickles, chutneys, sauces particularly from raw mango, lime and other regional fruits and vegetables of importance. Fruit and Vegetable Juices, Fruit Syrups, Cordials and Nectars. Fruit preserve, Candies, Crystallized fruits and vegetables. Jams, Jellies, Marmalades, Pickles, Chutney, Sauces and Ketchup.

### **UNIT IV**

**(1 Credit, Lectures 15)**

Processing of fruits for candies, bars, toffees, jams and jellies, squashes and syrups using locally available fruits like papaya, mango, aonla and other under-utilized fruits. Dehydration of fruits and vegetables using various drying technologies like sun drying, solar drying (natural and forced convection), osmotic, tunnel drying, fluidized bed drying, freeze drying, convectional and adiabatic drying; applications to raisins, dried figs, vegetables, intermediate moisture fruits and vegetables. Fruit powders using spray drying

**Suggested Readings:**

- 1) Salunkhe, D.K. and Kadam, S.S. Ed. 1995. Handbook of Fruit Science and Technology: Production, Composition and Processing. Marcel Dekker, New York.
- 2) Salunkhe, D.K. and Kadam, S.S. Ed. 1995. Handbook of Vegetable Science and Technology. Production, Composition, Storage and processing Marcel Dekker, New York.
- 3) Srivastava, R.P. and Kumar, S. (1998), Fruit and Vegetable Preservation: Principles and Practices (3<sup>rd</sup> Edition) Published by Satish Kumar Jain. CBS Publishers & Distributors Pvt. Ltd.
- 4) Verma LR & Joshi VK (2000), Postharvest Technology of Fruits and Vegetables: General concepts and principles. Vol I and II. Indus Publishing Company, New Delhi., Post - Harvest Technology of Fruits and Vegetables. Indus Publications.
- 5) Lal G., Siddappa G. and Tondon G. L. (1986), Preservation of Fruits and Vegetables, Indian Council of Agri. Research, New Delhi.
- 6) Rathore N. S, Mathur G. K and Chasta S. S. (2012), Post-Harvest Management and Processing of Fruits and Vegetables. Energy and Resources Institute. Indian Council of Agricultural Research, New Delhi.
- 7) W. V. Crusee. (2009). Commercial Fruit and Vegetable Products. Agrobios, India.
- 8) S. Rajarathnam and R. S. Ramteke. 2011. Advances in Preservation and Processing Technologies of Fruits and Vegetables. NIPA, New Delhi.
- 9) NIIR Board of Consultants & Engineers, (2019), The Complete Technology Book on Processing, Dehydration, Canning, Preservation of Fruits & Vegetables. NIIR Project Consultancy Services.
- 10) Loesecke H.W.V. (2005), Drying & Dehydration of Foods. Agrobios India.
- 11) Singh N. P. (2007), Fruit and Vegetable Preservation. Oxford Book Company.
- 12) Narang R. K. (2017), Fruit and Vegetable Preservation Techniques. A P H Publishing Corporation, New Delhi.

## **CC-204 NUTRITIONAL BIOCHEMISTRY**

**(4 Credits,60 lectures)**

### **Course Outcome**

1. Students will gain understanding in physiological and metabolic functions of nutrients
2. Students will be able to know the significance of biochemical pathways in nutrient metabolism.
3. Students will be able to understand the regulatory mechanisms of macronutrient metabolism
4. Students will learn the nutrition-related disorders.

### **Unit I**

**(1 Credit 15 lectures)**

#### **Introduction to Carbohydrate Metabolism**

Glycolytic pathway, Fate of Pyruvate, Energy production in glycolysis, Oxidation of pyruvate to acetyl CoA, Krebs's cycle-functions of Krebs's cycle, Reactions of Krebs's cycle, Energetics of Krebs's cycle, Gluconeogenesis-Functions of gluconeogenesis, Substrates for gluconeogenesis, Gluconeogenesis pathway, Metabolism of Glycogen- Glycogenesis and Glycogenolysis, HMP Pathway-Metabolic reactions in HMP pathway, Significance of HMP pathway, Entry of other fructose and galactose in glycolytic pathway, Regulation of Blood sugar level, Electron Transport Chain, Components of Electron Transport Chain, Inborn errors of Carbohydrate metabolism.

### **Unit II**

**(1 Credit 15 lectures)**

#### **Lipid Metabolism**

Introduction to Lipid Metabolism, Oxidation of Fatty Acids, Oxidation of Mono and Polyunsaturated fatty acids, Metabolism of Triacylglycerols, Metabolism of Cholesterol, Lipoprotein Metabolism, Hyperlipoproteinemia, Ketosis, Inborn errors of lipid metabolism.

### **Unit III**

**(1 Credit 15 lectures)**

#### **Amino Acid and Nucleotide Metabolism**

Introduction Transamination Reaction, Deamination Reaction, Urea Cycle, Metabolism of Carbon Skeletons of Amino Acids, Inborn errors of protein metabolism, Nucleotide Metabolism Degradation of Purine and pyrimidines Nucleotides, Gout

## **Unit IV**

**(1 Credit 15 lectures)**

Hormones: Introduction Endocrine System Mechanism of Hormone Action Classification of Hormones Biochemical Role of Hormones of Hypothalamus, Pituitary gland, Pancreas, Thyroid gland, Parathyroid gland, Adrenal Medulla Adrenal Cortex, Sex hormones and GIT hormones.

### **Suggested Readings**

1. U.Satyanarayana, U.Chakrapani (2019) Biochemistry(5<sup>th</sup> edition)Elsevier India
2. A.C.Deb (2001) Fundamentals of Biochemistry,7<sup>th</sup> edition New Central Book agency
3. David l. Nelson Michael.M.Cox (2021) Lehninger Principles of Biochemistry(8<sup>th</sup> edition)W.H.Freeman and company
4. Jeremy M. Berg Lubert Stryer , John L. Tymoczko(2015) ,Biochemistry (8<sup>th</sup> edition)
5. .P .Agarwal(2014) Text book of Biochemistry, KrishanPrakashan
6. Ramkrishnan.S(1995),Nutritional Biochemistry,TR Publications
7. Dr.A.V.S.Srama Rao (2010) Textbook of Biochemistry(11<sup>th</sup> edition) cbs Publishers Distributors Ltd
8. Patricia Trueman (2019) Nutritional Biochemistry(1st edition) MJP publishers
9. D.C.Sharma(2020)Nutritional Biochemistry (1st edition) CBS publishers

**CCPR 205 LABORATORY COURSE II**  
**(Based on CC 201, CC 202, CC 203, CC 204)**

**(8 Credits 120 hours)**

**Group A**

Introduction to laboratory instruments /equipments  
Study of differential staining method (Gram staining)  
Isolation of pure culture streak plate and spread plate technique  
Identification of food pathogen from water and milk sample  
Isolation of halophilic bacteria from food sample  
Study of IMViC Test  
Isolation of antibiotic producers  
Isolation of microorganisms from food sample

**Group B**

Physical test on wheat and rice  
Physio-chemical and rheological properties of cereals  
Determination of Gluten content in Wheat flour  
Parboiling of Rice  
Malting of Barley  
Puffing and popping of grains  
Preparation of peanut butter  
Preparation of soy spread

**Group C**

Preparation and Analysis of Fruit juice and RTS  
Preparation and analysis of Nectar, squash and cordial  
Preparation and analysis of Jam, Jelly and Marmalade  
Canning of vegetables  
Preparation of tutti fruity  
Preparation and Analysis of Tomato sauce  
Preparation of Hard-boiled candy  
Preparation of Potato chips

**Group D**

Estimation of Reducing sugars by fehling's method

Estimation of non-Reducing sugars by fehling's method

Estimation of Starch by Anthrone method

Estimation of protein by Biuret method

Determination of Saponification number of fats

Determination of iodine number of fats

Estimation of Vitamin C by DCPIP method

Estimation of Calcium content in given sample

Estimation of iron content in given sample

**Seminar on Group A, B, C and D****SEC-206: FUNDAMENTALS OF INFORMATION TECHNOLOGY-I**

**(2 Credits, 30 Hours)**

**CC-301: Research Methodology and Biostatistics****(4 credits, 60 lectures)****Course Outcome:**

1. Students will be able to identify the overall process of designing a research study from the inception to its report making.
2. Students will learn the characteristics of qualitative and quantitative research and will be able to identify a research problem stated in a study.
3. Students will understand advanced concepts of statistics and develop basic skills of data analysis.

**Unit I****(1 Credit, 15 lectures)**

Introduction to Research, Objectives and types of Research, Research Approach, Significance of Research, Research Methods versus Methodology, Research Process, Research Problem Selection, Necessity to define problem, Research Formulation, Research Design and Methods, Defining the Research Problem, Research Design, Need and Features of Good Design, Important concepts- Dependent and Independent variables, Extraneous Variables, Control, Confounded Relationship, Research Hypothesis, Experimental and Non experimental Hypothesis, Experimental and Control Groups, Treatments, Experiments, Experimental Unit; Different Research Designs, Basic principles of experimental designs, Important Experimental Designs.

**Unit II****(1 Credit, 15 lectures)**

Design of Sample Surveys- Introduction, Sample design, Sampling and Non Sampling Errors, Sample Survey Vs. Census Survey, Types of Sample Design, Non probability sampling, Probability Sampling, Complex Random Sampling Designs; Measurement and Scaling- Quantitative and Qualitative Data, Classification of Measurement Scales, Sources of error in Measurement, Techniques of developing measurement tools, Scaling, Scaling Techniques, Multidimensional Scale, Deciding the scale; Data Collection- Experiments and Surveys, Collection of Primary and secondary data, Data Preparation; Descriptive Statistics- Measures of Central Tendency- Mean, Median, Mode, Other Average, Measures of Description- Range, Mean Deviation, Standard Deviation, Measures of Skewness, Kurtosis, Measures of Relationship

### **Unit III**

**(1 Credit, 15 lectures)**

Sampling and Statistical Inference- Parameter and Statistic, Sampling and Non Sampling Errors, Sampling Distribution; Degree of freedom, Standard Error, Central Limit Theorem; Testing of Hypothesis; Chi Square Tests, Analysis of Variance- ANOVA, Other Non Parametric Methods- Sign Tests, Wilcoxon Signed Rank Sum Test, Mann Whitney U test, Run Test, Kruskal Wallis Test, Spearman's Rank Correlation; Linear Regression Analysis; Multiple Linear Regression Model; Using SPSS

### **Unit IV**

**(1 Credit, 15 lectures)**

Factor Analysis- Centroid Method, Principal Components Method, Maximum likelihood Method, Rotation in Factor Analysis, R-Type and Q-type Factor Analysis, Merits and Demerits of Factor Analysis; Cluster analysis; Interpretation and Report Writing- Meaning of Interpretation, Techniques of Interpretation, Precautions in Interpretation, Significance of Report Writing, Different Steps in Report Writing, Layout of Research Report, Types of Report, Oral Presentation, Mechanics of writing a Research Paper.

### **Suggested Reading,**

1. Kothari C.R, Garg G.,(2014), Research Methodology; New Age International Publication, New Delhi
2. Zina O'Leary, (2004), The essential Guide to doing research; SAGE Publication
3. Rao S., Richard J., (2002), Introduction to Biostatistics and Research Methods, Eastern economy edition.
4. Dr. Mishra S., Dr. Alok S., (2017), Handbook of Research Methodology, Educreation Publication.
5. Singh Y.K., (2010), Fundamentals of Research Methodology and Statistics, New Age International Publishers.
6. Dr. Achari P., (2012), Research Methodology, Horizon Books Publication.
7. Singh R., Research Methodology, (2012), R.T. Publication



## **CCS- 302 Processing of Milk and Milk Products**

**(4 Credits, 60 lectures)**

### **Course outcome**

1. Students will be able to understand the technology behind the production of various dairy products.
2. Students impart skills in the application of biological, chemical, biochemical, physical and engineering sciences in processing and preservation of milk and milk products.
3. Students will get acquainted with techniques and technologies of testing and processing of milk by products.

### **Unit-I**

**(1 Credit, 15 Lectures)**

Status of Dairy Industry, MMPO, Milk cooperative system, NDDB, Definition, Sources, Composition, Nutritive Value, and Procurement of Milk Collection, chilling, transportation, cream separation, standardization, pasteurization, sterilization, UHT, homogenization, packaging, storage and distribution of fluid milk.

### **Unit-II**

**(1 Credit, 15 lectures)**

Principles and practices of manufacture, packaging, storage and marketing of Cheese, processed cheese, Dahi, yoghurt, Shrikhand, etc. Sanitary aspects: sanitation of dairy plant building, equipment and their maintenance. Effluent treatment plant.

### **Unit-III**

**(1 Credit, 15 lectures)**

Classification, manufacture, packaging, storage and marketing of ice cream, ices, sherbets etc. Defects of frozen products and their control. Technology of indigenous milk products: Principles and practices of manufacture, packaging, storage and marketing of butter, ghee, khoa, Paneer, channa and milk based foods.

### **Unit-IV**

**(1 Credit, 15 lectures)**

Manufacture of evaporated milks and milk powders. Packaging storage, defects and their control. Technology of Dairy by-products: Utilization of skim milk, buttermilk and way for the manufacture of casein, lactose etc.

### **Suggested Readings:**

1. Sukumar De (1997), Outline of Dairy Technology, oxford University press
2. Cogan, T. M. (1995), Dairy Starter Cultures, VCH publishers
3. Gangasagare, Pandurang (2018), Textbook of Traditional Dairy Products, Oxford Book Company.
4. Mishra, Birendra (2016), Dairy and Food Product Technology, Biotech Books.
5. Kango Mangala (2006), Milk & Milk Products , RBSA publishers.
6. Robinson, R. K. Modern Dairy Technology Vol. I: Advances in Milk, Springer Science Business Media.
7. Robinson, R. K. Modern Dairy Technology Vol. II: Advances in Milk, Springer Science Business Media.
8. Patange, D. D.(2005), Textbook on Milk and Milk Products, Jaya publishing house.
9. Singh S. K. (2016), Analysis of Milk Chemistry, Oxford Book Company, Jaipur.
10. Johnson, Webb (1987), Fundamentals of Dairy Chemistry, CBS Publishers & Distributors, New Delhi.
11. Clearence Henry Eckles, Willes Barnes Combs , (1997): Milk & Milk Products , Tata McGraw Hill Publishing Company
12. Gangasagare Pandurang (2016), Processing of Milk, Agrotech Press, Jaipur

## **CCS- 303 Food Additives, Contaminants and Toxicology (4Credits 60 lectures)**

### **Course outcome**

1. Students will be able to understand that additives are relevant to processed food industry for shelf-life extension, processing aids and sensory appeal.
2. Students will get acquainted to develop an understanding of isolation of various biopolymers from food resources and their relevant application.
3. After completing the course students, a known – how on food additive legislation & understands the chemical & technological properties of the most relevant food additives used as food improvement agents.

### **UNIT-I**

**(1 Credit, 15 lectures)**

Food additives- definitions, classification and functions, Preservatives, antioxidants, colors and flavors (synthetic and natural), emulsifiers, sequestrants, humectants, hydrocolloids, sweeteners, acidulants, buffering salts, anticaking agents, etc. - chemistry, food uses and functions in formulations; indirect food additives; toxicological evaluation of food additives.

### **UNIT – II**

**(1 Credit, 15 lectures)**

Proteins, starches and lipids as functional ingredient; isolation, modification, specifications, functional properties and applications in foods and as nutraceuticals.

### **UNIT – III**

**(1 Credit, 15 lectures)**

Definition scope and general principles of food toxicology; manifestation of toxic effects; classification of food toxicants; factors affecting toxicity of compounds; methods used in safety evaluation-risk assessments.

### **UNIT – IV**

**(1 Credit, 15 lectures)**

Food contaminants, physical, chemical, microbial and other contaminants; food toxicants. Derived Food toxicants- Processing & Packaging; Toxicants generated during food

processing such as nitrosamines, acrylamide, benzene, dioxins and furans; persistent organic pollutants.

**Suggested Readings:**

1. Shakuntala Manay, Foods Facts and Principles (3<sup>rd</sup> Edition), New Age International Publishers.
2. S N Mahindru, (2017), Food Additives-Characteristics, Detection and Estimation, APH Publishing Corporation.
3. Branen AL, Davidson PM & Salminen S, (2001) Food Additives. (2nd Edition).
4. Madhavi DL, Deshpande SS & Salunkhe DK. 1996. Food Antioxidants: Technological, Toxicological and Health Perspective. Marcel Dekker.
5. P. V. Patil, Food Contamination, (2013), Aavishkar Publishers, Distributors.
6. Gerorge AB (1996), Encyclopedia of Food and Color Additives, Vol. III. CRC Press.
7. Gerorge AB. 2004. Fenaroli's Handbook of Flavor Ingredients. 5th Ed. CRC Press.
8. Vanisha Nambiar, (2004), A textbook on Food Contamination and Safety, Anmol Publications PVT. LTD. New Delhi.
9. Stephen AM. (Ed.). 2006. Food Polysaccharides and Their Applications.
10. Hathcock JN. (Ed.). 1982. Nutritional Toxicology. Vol. I. Academic Press.
11. S N Mahindru, (2017), Food Contaminants-Origin, Propagation & Analysis, APH Publishing Corporation.

**DSE-304: Clinical Nutrition****(4 Credits, 60 lectures)****Course Outcome:**

1. Students will be able to understand principles of diet therapy, modification of normal diet for therapeutic purposes and the role of dietitian.
2. Students will be able to demonstrate counselling techniques to facilitate behaviour change.
3. Students can identify and describe the roles of others with whom the registered dietitian collaborates in the delivery of food and nutrition services.

**Unit -1****(1 Credit, 15 lectures)**

Introduction to Diet Therapy, Nutrition Care Process, Menu Planning, Adjuncts to Diet Therapy, Therapeutic Nutrition- Definition of Therapeutic diet, Routine Hospital Diets, Route of administration- Enteral, Parenteral and Total Parenteral Nutrition, Difference between Enteral and Parenteral Nutrition, Advantages and Disadvantages of Therapeutic Nutrition, Role of a dietitian in Hospital, Patient care and Counselling, Eating Disorders- Anorexia Nervosa, Bulimia Nervosa, Binge Eating Disorder- Definition, prevalence, causative factors, sign and symptoms, medical treatment, nutritional management; Adverse Food Reactions- Food Allergy and Intolerances; Food and Drug Interactions

**Unit -2****(1 Credit, 15 lectures)**

Diet in Infections and Fever: Typhoid, Malaria, Influenza, Tuberculosis, Dengue Fever, COVID-19, Swine flu- Definition, prevalence, Pathophysiology, aetiological factors, sign and symptoms, medical treatment, nutritional management.

Diet in Weight Imbalance- Obesity and Underweight: Definition, prevalence, Pathophysiology, aetiological factors, sign and symptoms, medical treatment, nutritional management and Dietary Guidelines, Diet in Cardiovascular Diseases: Atherosclerosis, Role of fat in Atherosclerosis, Coronary Heart Diseases- Definition, prevalence, Pathophysiology, aetiological factors, sign and symptoms, medical treatment, nutritional management Dietary Guidelines, Myocardial Infarction, Hypertension- Definition, prevalence, Pathophysiology, aetiological factors, sign and symptoms, medical treatment, nutritional management, DASH Diet.

Diet in Gastrointestinal Diseases- Indigestion, GERD, Peptic Ulcer, Diverticular Disease, Constipation, Diarrhoea, Inflammatory Bowel Disease, Dumping Syndrome: Definition, prevalence, Pathophysiology, aetiological factors, sign and symptoms, medical treatment, nutritional management, Dietary Guidelines

### **Unit -3**

**(1 Credit, 15 lectures)**

Diet in Diseases of Liver and Pancreas- Jaundice, Infective Hepatitis, Liver Cirrhosis, Hepatic Coma, Cholecystitis, Cholelithiasis, Pancreatitis: Definition, prevalence, Pathophysiology, aetiological factors, sign and symptoms, medical treatment, nutritional management, Diet in Gout, Diabetes Mellitus type 1 and 2, Gestational Diabetes: Definition, prevalence, Pathophysiology, aetiological factors, sign and symptoms, medical treatment, nutritional management, dietary guidelines.

Diet in Diseases of Kidneys- Functions of Kidney, Glomerulonephritis, Nephrotic Syndrome, Acute Renal Failure, Chronic Renal Failure, Dialysis and Renal Transplant, Kidney Stones- Definition, prevalence, Pathophysiology, aetiological factors, sign and symptoms, medical treatment, nutritional management.

### **Unit -4**

**(1 Credit, 15 lectures)**

Diet in Cancer- Definition, prevalence, Pathophysiology, aetiological factors, sign and symptoms, medical treatment and surgical management, nutritional management, Immunonutrients in Cancer.

Diet in Thyroid Disorders- Hyperthyroidism and Hypothyroidism: Definition, prevalence, Pathophysiology, aetiological factors, sign and symptoms, medical treatment, nutritional management.

Diet in PCOS- Definition, prevalence, Pathophysiology, aetiological factors, sign and symptoms, medical treatment, nutritional management.

Diet in Critical Care- Definition, prevalence, Pathophysiology, aetiological factors, sign and symptoms, medical treatment, nutritional management.

Diet in Neurological Disorders- Epilepsy, Alzheimers Disease, Multiple Sclerosis, Parkinsons Disease, Head Trauma, Bipolar Disorder, Migrain: Definition, prevalence, Pathophysiology, aetiological factors, sign and symptoms, medical treatment, nutritional management.

**Suggested Reading,**

1. Krause and Mahan, (2015), Food and Nutrition Care Process, 14<sup>th</sup> edition; Elsevier, New York.
2. Shrilaxmi B, (2019), Dietetics, New Age International Publishers, New Delhi, India
3. Joshi S., (2015), Nutrition and Dietetics, Mc Graw Hill Education, India
4. Agarwal S., Udupi S., (2014), Human Nutrition, Jaypee Publication, New Delhi, India
5. Gandy G., (2010), Oxford Handbook of Nutrition and Dietetics; Oxford Publication, UK
6. Width M, Reinhard T, (2012), The Essential Pocket Guide for Clinical Nutrition, Oxford, UK
7. Shrilakshmi B, (2019), Nutrition Science, New Age International Publishers, New Delhi, India.

## **CCPR 305 LABORATORY COURSE III**

**(4 Credits 60 hours)**

### **Group A**

Platform tests in milk

Estimation of fat and SNF from milk

Preparation and evaluation of flavoured milk

Preparation and evaluation of lassi

Preparation and evaluation of paneer and Channa

Preparation and evaluation of khoa and gulabjamun

Preparation and evaluation of chakka and Shrikhand

Determination of titrable acidity and specific gravity of milk

### **Group B**

Estimation of preservatives from food

Estimation of sweeteners from food

Estimation of colors from food sample

Estimation of fibers from food sample

Estimation of flavor enhancer

Estimation of Antioxidants

Extraction of essential oil and oleoresins

Applications of additives and ingredients in foods

### **Group C**

Therapeutic Diets

Diet in Typhoid

Diet in Tuberculosis

Diet in Dengue Fever

Diet in Obesity

Diet in Underweight

Diet in Myocardial Infarction

Diet in Hypertension



Diet in Hepatitis

Diet in Gall Bladder Disease

**Seminars based on above groups**

**AEC-306: Communication English-II**

**(2 Credits, 30 Hours)**

**EC: SWAYAM/MOOC/ONLINE**

**Number of Lectures and Credits will be specified by Course**

## **CC 401: Food Product Development & Packaging (4 credits, 15 lectures)**

### **Course outcome**

1. Student will be able to understand the need for packaging food, understand the various functions of food packages as influenced by their characteristics, understand the health implications of food-package interactions.
2. Students will be able to understand different functions performed by packaging material.
3. Students will be able to understand health implications of food-package interactions.
4. Students learn about packaging requirement for fresh and processed food for local and international markets.

### **UNIT I**

**(1 credit, 15 lecture)**

Definition & need for product development, classes & characteristics of New food products, ethics in food product development, stages/ phases of new product development- idea generation, screening, feasibility studies, consumer research, financial review, product design & formulation, process development- recipe development & scale up, consumer trials, market testing, quality assessment of new developed products- sensory evaluation, shelf life testing, costing/ pricing & economic evaluation of the product

### **UNIT II**

**(1 credit, 15 lectures)**

Functions & objectives of packaging, forms of packaging- rigid, semi- rigid, flexible, packaging closures & sealing systems, packaging requirements & selection of packaging materials, Types of packaging materials: Paper: pulping, fibrillation and beating, types of papers and their testing methods; Glass: composition, properties, types of closures, methods of bottle making; Metals: Tinplate containers, tinning process, components of tinplate, tin free steel (TFS), types of cans, aluminum containers, lacquers; Plastics: types of plastic films, laminated plastic materials, co-extrusion, edible films, biodegradable plastics.

### **UNIT III**

**(1 credit, 15 lectures)**

Properties of materials such as tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength, tear strength, their methods of testing and evaluation; Barrier properties of packaging materials: Theory of permeability, factors affecting permeability, permeability coefficient, gas transmission rate (GTR) and its measurement, water vapour transmission rate (WVTR) and its measurement, prediction of shelf life of foods, selection and design of packaging material for different foods.

### **UNIT IV**

**(1 credit, 15 Lectures)**

Packaging equipment and machinery: Vacuum, CA and MA packaging machine; gas packaging machine; seal and shrink packaging machine; form and fill sealing machine; aseptic packaging systems; bottling machines; carton making machines.

### **Suggested Readings**

1. Avantina Sharma (2018), Food Product Development, CBS Publishers and Distributors.
2. Fuller G W (1994), New Food Product Development : From Concept to Market place  
CRC Press, New York
3. Man C M D, Jones A A (1994), Shelf life Evaluation of Foods. Blackie Academic and Professional, London
4. Olickle, J K (1990), New Product Development and value added. Food Development Division, Agriculture, Canada
5. Graf E and Saguy I S (1991), Food Product Development : From concept to the Market Place, Van Nostrand Reinhold New York
6. Jacqueline H. Beckley, M. Michele Foley Elizabeth J. Topp & J. C. Huang Witoon Prinyawiwatkul (2007), Accelerating New Food Product Design and Development. Blackwell Publishing Company. IFT Press. USA
7. Howard R. Moskowitz, I. Sam Saguy & Tim Straus (2009), An Integrated Approach to New Food Product Development, Taylor and Francis Group, LLC.USA

## **CCS 402: Processing of Animal Foods**

**(4 credits, 15 lectures)**

### **Course outcome**

1. Student will be able to understand the importance of meat, preservation and processing into different products.
2. Students provide insight into the functions and areas of responsibility of meat inspection.
3. Students will get acquainted with an understanding of the technology for handling, processing, preservation and bi-product utilization of meat, poultry and fish products processing.
4. Combination of theoretical & practical sessions consisting of the analysis of case studies, laboratory work, use of computer software & technical visits.

### **Unit-I**

**(1 credit, 15 lectures)**

Slaughter and census of meat animals. Components of carcass viz. muscles, postmortem glycolysis. Conversion of muscle of meat, pre and post slaughter factors affecting quality of meat, color, texture, WHC, organoleptic characteristics, PSE and DFD conditions. Preservation of meat and meat products, Meat analogue and their processing. Effect of processing parameters on product constituents, viz. lipid, protein, carbohydrates and flavor, sensory evaluation, guidelines, different tests, hedonic testing etc.

### **Unit-II**

**(1 Credit, 15 lectures)**

Status of poultry industry in India and abroad. Pre slaughter care, ante mortem examination slaughter, dressing and postmortem. Composition and chemistry of chicken muscle, pre and post slaughter factors affecting poultry meat quality, Chilling and freezing of poultry meat; packaging and grading of poultry meat. Preparation of poultry products: cured, smoked, canned, barbecue and curried poultry.

### **Unit–III**

**(1 credit, 15 lectures)**

Structure, composition and nutritive value of egg, egg proteins and functional properties of eggwhite and yolk. Factor affecting egg quality and their measurements. Industrial uses of eggs. Collection, grading, cleaning, washing, packaging and transportation of eggs, preparation of egg products. Preservation of shell egg. Microbial spoilage of egg and egg products. Preparation of poultry products.

### **Unit –IV**

**(1 credit, 15 lectures)**

Muscle structure, composition, nutritive value, processing operations, Post-mortem chemistry of marine foods, Microbiology & safety of marine foods, grading of marine foods, Storage & preservation techniques, Marine food products, By-product utilization

### **Suggested Readings:**

1. P. Sinha (2018), Fish processing & preservation, APH Publishing Corporation.
2. Mandal Pratibhat Kumar, (2018), Handbook of Meat Science, stadium press India Pvt Ltd.
3. A.L. Winton, K.B. Winton, (1993), The structure & composition of animal products, Agro botanical Publishers.
4. Norman N. Potter and Joseph H. Hotchkiss (1986), Food Science, Fifth Edition New York.
5. Manay, N. Shakuntala (2000), Foods Facts & Principles, New Age International Publishers
6. Herbart W. Ockerman, Conly L. Hansen (2000), Animal By-Product Processing & Utilization, CRC press, Delhi.
7. Forrest J C. (1975), Principles of Meat Science. Freeman
8. Kerry J. et al. (2002). Meat Processing. Woodhead Publication. CRC Press. Delhi.
9. Norman N Potter, Joseph Hotchkiss (1996), Food Science, CBS Publishers & distributors

## **CCS 403 Functional Foods and Nutraceuticals (4 Credits: 60 Lectures)**

### **Course Outcome-**

1. Student will gain the knowledge about Functional Foods and Nutraceuticals
2. Students will understand relationship between Disease, Maintenance of Health and Functional Food.
3. Students will be able to study application of Functional Foods and Nutraceuticals.

### **UNIT I**

**(1 Credit: 15 Lectures)**

Functional Food and Nutraceuticals- Definition, history, types and classification. Perceived effect of diet on disease prevention, Understanding benefits of functional foods and nutraceuticals, Polyphenols: Flavonols, Catechins, Isoflavons, Tannins; Phytoestrogens, Phytosterols, Glucosinolates

### **UNIT II**

**(1 Credit: 15 Lectures)**

Introduction to Probiotics, Prebiotics and Symbiotics. Probiotics: Taxonomy and Important Features of Probiotic Microorganisms, Health effects of Probiotic Microorganisms, Probiotics in various foods, Quality Assurance of Probiotics and Safety, Probiotics: Non digestible Carbohydrates/ Oligosaccharides, Prebiotics: Dietary Fibres, Resistant Starch, Gums

### **UNIT III**

**(1 Credit: 15 Lectures)**

Pigments: Carotenoids, Lycopene, Curcumin; Organosulphur Compound, Introduction to Antinutritional Factors, Phytates; Enzymes, Protease inhibitors, Amylase Inhibitors, Proteins and Peptides, Vitamins and Minerals, Non Nutrient Effect of Specific Nutrients: Conjugated Linoleic Acid, Omega 3 fatty acids

## **UNIT IV**

**(1 Credit: 15 Lectures)**

Saponins, Haemagglutinins, An introduction to Active Biodynamic Principles in Spices, Condiments and in Plant extracts; Resveratrol, Kaempferol, Quercetin, Cinnamaldehyde, Crocin, Lutoline, Capsaicin, Piperine, Gingerol, Eugenol, Rosmarinic acid, Apigenin, Thymoquinone, Fenugreek and Diosgenin

### **Suggested Readings:**

1. Wildman, R.E. (2016). Handbook of Nutraceuticals and Functional foods. CRC Press
2. Gibson, G.R and Williams, M.C. (2001). Functional Foods Concept to Product. CRC Press
3. Vatter, D.A and Maitin V. (2016). Functional foods, Nutraceuticals and Natural Products, Concept and Applications. DEStech Publications, Inc.
4. Gupta R.C. (2016), Nutraceuticals: Efficacy, Safety and toxicity. Academic Press
5. Egbuna C. and Tupas G., (2001), Functional Foods and Nutraceuticals Bioactive Components, Formulations and Innovations, Springer
6. Swaroop A., Bagchi D., Preuss H., (2015), Nutraceuticals and Functional Foods in Human Health and Disease Prevention, CRC Press, New York
7. Shi J., (2006), Functional Food Ingredients and Nutraceuticals: Processing Technologies, CRC Press, New York.
8. Konishi T., Bagchi D., Ghosh D., (2014), Clinical Aspects of Functional Foods and Nutraceuticals, CRC Press, New York

**DSE--404: Public Health Nutrition****(4 Credits, 60 lectures)****Course Outcome:**

- 1.Students will focus on promotion of good health through nutrition and the primary prevention of nutrition related problems.
- 2.Students will deal with nutritional epidemiology and also will understand public policies relevant to nutrition.

**Unit I****(1 Credit, 15 lectures)**

Principles of epidemiology and epidemiologic methods, Nutrition Epidemiology in developing countries, Under-nutrition in children

**Unit II****(1 Credit, 15 lectures)**

Dual nutrition burden in women: causes, consequences and control measures, Measuring under-nutrition and over-nutrition in children

**Unit III****(1 Credit, 15 lectures)**

Essential new-born care and child survival, Integrating breastfeeding in public health programming, complementary feeding of infants and young children, Prevention and Management of Protein Energy Malnutrition

**Unit IV****(1 Credit, 15 lectures)**

Nutritional Deficiency Disorders Control Programmes in India, Food and Nutrition Security in India, Monitoring and evaluation of Public health nutrition programmes, Nutrition-Health education, Integrated Child Development Services Scheme (ICDS), National Rural Health Mission



**Suggested Readings:**

1. Vir S., (2012), Public Health Nutrition in Developing Countries Part 1 and 2; Woodhead Publishing India Pvt. Ltd, New Delhi, India
2. K Park, (2015), Preventive and Social Medicine, 26<sup>th</sup> Edition; Bhanot Publication, India
3. Eldelstein S, (2012), Nutrition in Public Health; Jones and Bartlett Publishers, United States
4. Swaminthan (1995), Food and Nutrition Volume I and II, The Bangalore Press, India.
5. Buttriss J, Welch A., Kearney J., (2017), Public Health Nutrition, John Willey Publisher, London
6. Sabarwal B, (2018), Public Health and Nutritional Care, Arjun Publishing House, India
7. Schneider M., (2013), Introduction to Public Health, Jones and Bartlett Publisher, United States

**CCPR 405 LABORATORY COURSE IV****(4 Credits 60 hours)****Group A**

Identification and testing of Packaging materials

Determination of wax from wax paper

Testing of Lacquered tin plate sheets

Measurement of Tin coating by Clark's method

Determination of water vapor transmission rate of Packaging material

To perform vacuum packaging of Food sample and carry out its storage study

Testing of Compression strength of Boxes

Packaging of food material in seal and shrink-packaging machine and study its shelf life

**Group B**

Inspection and grading of eggs

Development and preparation of Meat products

Development and preparation of poultry food products

Development and preparation of Fresh water and marine food products

Preparation of preserved meat, poultry and marine food products

**Group C**

Diet in Hepatic Coma

Diet in Pancreatitis

Diet in Type 1 Diabetes Mellitus

Diet in Type 2 Diabetes Mellitus

Diet in Gout

Diet in Acute Renal Failure

Diet in Chronic Renal Failure

Diet in Cancer

Diet in Hypothyroidism

Diet in Hyperthyroidism

**Seminar on above groups****SEC-406: Fundamentals of Information Technology – II****(2 Credits, 30 Hours)****GE-407: Food Analysis and Quality Control****(2 Credits, 30 Hours)**