SYLLABUS OF FOOD SCIENCE& QUALITY CONTROL AT UG LEVEL

Semester-wise Titles of the Papers in B.Sc. Food Science & Quality Control.

Year	Sem.	Course Code	Paper Title	Theory/Practical	Credits
Certificate in Basic Nutrition & Hygiene					
1	I	B058101T	Basic Nutrition, Sanitation & Hygiene	Theory	4
		B058102P	Practical	Practical	2
	II	B058201T	Food Chemistry & Food Commodities	Theory	4
		B058202P	Biochemical Analysis	Practical	2
Diploma in Food Preservation & Microbiological Studies					
2	III	B058301T	Food Process Technology & Food Microbiology	Theory	4
		B058302P	Practical	Practical	2
	IV	B058401T	Sensory Evaluation & Post Harvest Technology of Food	Theory	4
		B058402P	Practical	Practical	2
Degree in Bachelor of Science in Food Science &Quality Control					
3	V	B058501T	Food Analysis	Theory	4
		B058502T	Food Manufacturing & Packaging	Theory	4
		B058503P	Qualitative Analysis	Practical	2
		B058504R	Research Project/ Internship	Project	3
	VI	B058601T	Food Toxicology	Theory	4
		B058602T	Food Adulteration & Testing & Analytical Instrumentation	Theory	4
		B058603P	Analytical Methods	Practical	2
		B058604R	Research Project/ Internship	Project	3

Purpose of the Program

The purpose of the undergraduate Food Science program at the university and college level is to provide the key knowledgebaseandlaboratoryresourcestopreparestudentsforcareersasprofessionalsinvariousindustriesand researchinstitutions.

Program's Outcomes

1. Studentswillhaveafirmfoundationinthefundamentalsandapplicationofcurrentchemicalandscientific theories including those in Basic Nutrition, Food Preservation, Food microbiology, Sensory evaluation, and Food manufacturing and packaging, Food Analysis., and food toxicology.
2. Students will be able to design and carry out scientific experiments as well as accurately record and analyze the results of suchexperiments.

3. Students will be skilled in food adulteration testing and analytical instrumentation.

4. Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientificproblems.
5. Students will be able to explore new areas of research in bothand allied fields of food science and technology.
6. Students will appreciate the central role of Food science & quality control in our society and use this as a basis for ethical behavior in issues facing adulteration in food including an understanding of safe handling of chemicals, environmental issues and key issues facing our society in energy &health.

7. Students will be able to function as a member of an interdisciplinary problem solvingteam.

PROGRAM SPECIFIC OUTCOMES (PSOS)	
CERTIFICATE IN BASIC NUTRITION & HYGIENE	
First Year	Certificate in Basic Nutrition & Hygiene will give the student a basic knowledge of all the fundamental principles of food including food chemistry, nutrition, sanitation &hygiene, study of different food product. Student will be able to do to qualitative and bio chemical analysis of the compounds in the laboratory. This certificate course is definitely going to prepare the students for various fields of Nutrition and will give an insight into all the branches of food &Nutrition and enable our students to join the knowledge and available opportunities related to chemistry in the government and private sector services particularly in the field of food safety, health inspector, pharmacist etc.
Second Year	**DIPLOMA IN FOOD PRESERVATION & MICROBIOLOGICAL STUDIES**
	Diploma in Food Preservation & Microbiological Studieswillprovidethetheoreticalaswellaspractical knowledge of handling different food product & how to preserve different food product by using different preservatives & technique in order to avoid the contamination & spoilage of food. The diploma will also provide the complete knowledge of food microbiology.The microbiological studies will make the students skilled to work in food industries& laboratories. The diploma will enable to the student to study the characteristic properties of food &Post Harvest technology of different food product.
Third Year	**DEGREE IN BACHELOR OF SCIENCE IN FOOD SCIENCE & QUALITY CONTROL**
	Degree in Bachelor of Science in Food Science & Quality Control programme aims to introduce very important aspects of modern day course curriculum, food analysis, food manufacturing and food packaging material & food toxicology, and food adulteration & testing and analytical instrumentation. It will enable the students to understand the importance of the food toxicology including drug toxicology, trace element, carcinogens, micro, macro element &pesticide, antioxidant and it will enable the student to be aware regarding different adulterant in food like milk & milk product & spices and their negative impact on health. The study of food analysis will make the student skilled to work as food analyst in food industries like FSSAI.

COURSE		SUBJECT: FOOD SCIENCE & QUALITYCONTROL					Total Credits of the subject
Year	Sem.	Paper Title		Prerequisite for paper	Elective For Major Subject	Hours per Semester	
Certificate in Basic nutrition and Hygiene	I	Theory-1	Basic Nutrition & Sanitation & Hygiene	Chemistry in 12th	Yes Open to all	60	4
		Practical-1	Quantitative Analysis	Chemistry in 12th	Yes Open to all	**60**	2
	II	Theoty-1	Food Chemistry & Food Commodities	PassedSem.-I, Theorypaper-1	**Yes** Zoo/Bot./Physics/Math/Comp Sci.	60	4
		Pracical-2	BiochemicalAnalysis	OptedSem.-II, TheoryPpaer-1	Yes Zoo/Bot./Physics/Math/Comp Sci.	**60**	2
Diploma in Food Preservation & Microbiological Studies	III	Theoty-1	Food Process Technology & Food Microbiology	Chemistry in 12th	Yes Zoo/Bot./Physics/Math/Comp Sci.	60	4
		Pracical-2	Physical Analysis	OptedSem.-III, TheoryPpaer-1	Yes Zoo/Bot./Physics/Math/Comp Sci.	**60**	2
	IV	Theoty-1	Sensory Evaluation & Post Harvest Technology of Food	Chemistry in 12th	Yes Zoo/Bot./Physics/Math/Comp Sci.	60	4
		Practical-2	Instrumental Analysis	Chemistry in 12th	Yes Zoo/Bot./Physics/Math/Comp Sci.	**60**	2
Degree in Bachelor of Science in Food Science & Quality Control.	V	Theory-1	Food Analysis	PassedSem.-I, Theorypaper-	Yes Zoo/Bot./Physics/Math/Comp Sci.	60	4
		Theory-2	Food Manufacturing & Packaging	PassedSem.-I, Theorypaper-	Yes Zoo/Bot./Physics/Math/Comp Sci.	60	4
		Practical- 3	Qualitative analysis	Opted Sem.-V Theory Paper-1 &2	Yes Zoo/Bot./Physics/Math.	60	2
		Research Project /Internship	……	……..	……	45	3
	VI	Theory-1	Food Toxicology	PassedSem.-V Theorypaper-1	Yes Zoo/Bot./Physics/Math	60	4
		Theory-2	Food Adulteration & Testing & Analytical Instrumentation	Chemistry in 12th	Yes Zoo/Bot./Physics/Math/Comp Sci.	60	4
		Practical-3	Analytical Methods	Chemistry in 12th	Yes Zoo/Bot./Physics/Math/Comp Sci.	60	2

		Research Project/ Internship	……	……	……	45	3

Year	Sem.	Course Code	Paper Title	Theory/Practical	Credits
Certificate in Basic Nutrition & Hygiene					
1	**I**		Basic Nutrition, Sanitation & Hygiene	Theory	4
			Quantitative Analysis	Practical	2
1	**II**		Food Chemistry & Food Commodities	Theory	4
			Biochemical Analysis	Practical	2

Semester-1,
Paper-1 (Theory)
Course Title: Basic Nutrition, Sanitation& Hygiene

Programme/Class: Certificate in Basic Nutrition & Hygiene	Year: First	Semester: First
Paper-1 Theory		Subject: **Food Science**
Course Code:	**Course Title:** Basic Nutrition & Sanitation& Hygiene	

Course outcomes: The students at completion will be able to

- understand the concepts of basic nutrition , how to use food guide , pyramid , optimum nutrition , mal nutrition , sign of good health , metabolism of carbohydrate , protein & fats .
- recognize Food borne illness , control of pest , solid & liquid waste disposal
- be aware of Cleaning procedure in catering, structure & layout of food remises maintaining clean environment.
- Exhibit potential to manage the quality and safety, storage of food.

Credits: 4	Compulsory
Max. Marks: 25+75	Min. Passing Marks- as per rule

Total No. of Lectures = 60

Unit	Topics	No. of Lectures
I	Historical developments in Food Science and Technology-Indian perspective **Introduction to nutrition** -Food as a source of nutrients, Function of foods, Definition of nutrition, Nutrients, Adequate optimum and good nutrition, Malnutrition. Inter-relationship between nutrition and health, Visible symptoms of good health	10
II	**Food guide** – Basic five food groups -how to use food guide Use of food in body – digestion, absorption, transport, utilization of nutrients in body. Water as a nutrients, function, sources, requirement, water balance-effect of deficiency.	10
III	**Energy**-Unit of energy, Food as a source of energy, Energy value of food, The body's need for energy, B.M.R activity for utilization of food to fat energy requirement. Acid-base balance.	05
IV	**Minerals** – Function, Sources, Bio availability and deficiency of following minerals - Calcium, Iron, Iodine, Fluorine, Sodium, Potassium **Vitamins** - Classification, Units of measurement, Sources, Function, Deficiency about water and fat soluble vitamins.	05
V	**Food contamination** – Sources and transmissions by water, air, sewage and soil as reservoir of infection and type of spread. Importance of personal Hygiene of Food handler – Habits – Clothes, Illness ,Education of food handler in handling and serving food.	10

VI	**Safety in food procurement**, storage, handling and preparation control of spoilage – safety of left over foods. Cleaning Methods – Sterilization and disinfection – products and methods – use of Detergents, heat, chemicals, test for sanitizer strength.	10
VII	**Sanitation** – Kitchen design equipment and systems.Structure and layout of food premises maintaining clean environment.Selecting and installing equipment cleaning equipment. Waste product handling – Planning for waste disposal, Solid wastes and liquid wastes.	05
VIII	**Control of Infestation** – Rodent control Rats, Mice- Rodent, destruction.Vector control – Use of pesticides.Food Sanitation, Control and Inspection – planning and Implementation Of training programmes for health personal.	05

Suggested Readings:

1. S. Roday 2005 Food Hygiene and Sanitation in Food Industry 7th Edition Published byTata McGraw Hill Publishing Company New Delhi .
2. Shubhangini A.Joshi.2015 Nutrition and Dietetics 4th Edition Published by McGraw Hill Education (India)Private Limited..

Note: For the promotion of Hindi language, course books published in Hindi may be prescribed by the University.

This course is compulsory for the students of following subjects: Chemistry in 12th Class	
Suggested Continuous Evaluation Methods: Students can be evaluated on the basis of score obtained in a mid-term exam, together with the performance of other activities which can include short exams, in-class or on-line tests, home assignments, group discussions or oral presentations, among others . **Or**	
Assessment and presentation of Assignment/ Research Orientation assignment	(10 marks)
04 tests (Objective): Max marks of each test = 10 (average of all 04 tests)	(10 marks)
Overall performance throughout the semester, Discipline, participation in different activities)	**(**05 marks)
Course prerequisites: To study this course, a student must have had the chemistry in class 12 th	
Suggested equivalent online courses: ……..	
Further Suggestions: ……..	

Semester-I, Paper-2 (Practical)

Course Title: Quantitative Analysis

Programme: Certificate in Basic Nutrition & Hygiene	Year: First	Semester: I
Practical paper-2		**Subject: Food Science**
Course Code:	**Course Title: Quantitative Analysis**	

Course outcomes:

Uponcompletionofthiscoursethestudentswillhavetheknowledgeandskillsto:

- Understandthelaboratorymethods and tests related to estimation of caloric value and calculation of BMR in percentage.
- Making a diet plan for working women .
- Calculation of in BMR percentage.
- Estimation of caloric value in food samples

Credits: 2	Elective
Max. Marks: 25+75 = 100	Min. Passing Marks:

Practical **60h**

Unit	Topics	No of Lectures
I	**Estimation of calorific value** of food samples (fruits, bakery products, eggs, nuts, sweets, junk food etc. by Bomb Calorimeter	**12**
II	**Water testing** Determination of pH and Electrical Conductivity of water Determination of Alkalinity Determination of Hardness (Total, Permanent & Temporary) Determination of Calcium Determination of Magnesium Determination of Carbonates & Bi-carbonates Determination of Chemical Oxygen demand (C.O.D.) Determination of Biochemical Oxygen Demand (B.O.D.)	**14**
III	**Microbiological Testing** Determination of pH and Electrical Conductivity of soil Determination of Total and differential count of microorganisms Microscopic identification of nematodes and Protozoans from selected vegetables	**12**
IV	**Nutritional case studies** Determination of Basal Metabolic Rate and Energy –case study Study of Deficiency disease of vitamins & minerals- case study	**12**
V	Preparation of diet plan –case study(working men/women, professionls, students etc.)	**10**

	Balanced Diet/Immunity Booster Diet for – patient/senior citizen/ pregnant woman with reference to Giloy, Tulsi ,Ginger	

Suggested Readings:

1. Standard Methods for Examination of Water & waste water APHA-AWWAWPCF
2. Manual of Water & waste water analysis, NEERI, Nagpur
3. Text book of water and waste water engineering by H.K. Hussen
4. Water supply & sanitary engineering by Birdie
5. Practical methods in ecology & Environmental science by R.K. Trivedi, P.K. Goel, C.L. Trisa
6. Manual of Nutrition &Dietetics by Monika Arora.
7. Text book of soil chemical analysis by Murray Heses P.R.
8. Chemistry of soil by Firman E. Bear
9. A text book of analysis by T.C. Barua
10.. Analytical agricultural chemistry by J.S. Kanwar, S.L. chopra

Note: For the promotion of Hindi language, course books published in Hindi may be prescribed by the University.

This course can be opted as an elective by the students of following subjects: Chemistry in 12 th Class

Suggested Continuous Evaluation Methods:

Viva voce	(10 marks)
Mock test	(10 marks)
Overall performance	(05marks)

Course prerequisites: To study this course, a student must have had the chemistry in 12th Class

Suggested equivalent online courses:
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Further Suggestions:
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Semester-II Paper-1

Course Title: Food Chemistry& Food Commodities

Programme: Certificate in Basic Nutrition & Hygiene	**Year: 1**	**Semester: II**
Paper-1	**Elective**	**Subject: Food Science**
Course Code:	**Course Title: Food Chemistry & Food Commodities**	

Course outcomes: Student would be able to define, demonstrate and formulate -

- Functions of carbohydrate , proteins & fats
- Understand denaturation , Rancidity ,browning reactions
- composition and nutritive value of food
- Storage of different food commodities.

Credits: 4	**Elective**
Max. Marks: 25+75	**Min. Passing Marks:……**

Total No. of Lectures = 60

Unit	Topics	No. of Lectures
I	**Introduction to Food chemistry** -Water and Ice., Moisture in Foods, Hydrogen Bonding, Bound water, Water activity and food stability	5
II	**Carbohydrate**s: Classes, Structure, reactions, functions of mono, oligo and Polysaccharide in foods. Other sweetening agents. Changes on cooking and processing **Proteins**- Peptides and proteins, Physico Chemical Properties,Denaturation Modification of Food Product, through processing and storage. .	10
III	**Lipids:** Nomenclature classification, Physical aspects, Chemical aspects Emulsions and Emulisifers. Chemistry of Fats and Oil processing Role of foods lipids in flavor. **Digestive Enzymes:** Nomenclature, Definition, Specificity, Catalysis regulation of enzyme, Kinetics, Factors influencing enzyme activity, controlling enzyme action, Enzymes added to food during processing, Modification of food by endogenous enzyme, Enzyme inhibitors in foods.	10

IV	**General courses for loss in foods**. Antioxidant rich foods, Fortification, enrichment, restoration. Pigments indigenous to food, structure, chemical and physical properties, processing and storage. Flavors- Vegetables. fruit and spice flavors, from Ferments Meal and sea foods.	10
V	**Cereals & pulses:-** Cereals and Millets - breakfast cereals, cereal products, fast food, structure, processing, using variety of preparation, selection, variety storage, nutrition aspects and cost. Pulses and legumes -production (in brief) selection and variety, storage,processing, using variety of preparation,nutrition aspects and cost. **Milk and Milk Products:-** Composition, classification, quality, processing, storage,uses, cost, nutritional aspects of milk., curds, buttermilk, paneer, khoa, cheese ice cream, kulfi and various kind of processed milk. **Eggs:-** Production, grade, quality, selection, storage,uses, cost and nutritional aspects.	05
VI	**Fish, Poultry and Meat:-** Selection, purchase, storage, uses, cost and nutritional aspects, Blue Foods. **Vegetable and Fruits:-** Variety, selection, purchase, storage, availability, cost, uses and nutritional aspects of raw and processed vegetable and fruits. **Sugar and Sugar Products:-** Different forms of sugar (Sugar, Jaggery, honey syrup) manufacture, selection, storage and use preserves, White sugar as white poison	10
VII	**Fats and Oils:-** Types and source of fats and oils (animal and vegetable) processing, uses, storage, cost and nutritional aspects. **Raising agent:-** Types,constituents,uses in cookery and bakery, preservation methods. **Food Adjucts:-** Spices, condiments, herbs, extracts, concentrates, essences, food colors, origin, classification, description ,uses, specification, procurement and storage.	05
VIII	**Salt**- Types, uses in the diet. **Beverage**s: Tea(types of tea, green tea , Fermented Tea) coffee, chocolate, and cocoa powder Growth, cultivation, processing, cost and nutritional aspects.	05

Suggested Readings:

1. ShakuntalaManay2008 Food Facts & Principle Second Edition Published by New Age International (P)Ltd..
2. Sukumar De 2018 Outlines of Dairy Technology 44th Published in India by Oxford University Press

Note: For the promotion of Hindi language, course books published in Hindi may be prescribed by the University

This course can be opted as an elective by the students of following subjects: Chemistry in 12 th Class

Suggested Continuous Evaluation Methods:

Assessment and presentation of Assignment/ Research Orientation assignment	(10 marks)
04 Unit tests (Objective): Max marks of each unit test = 10 (average of all 04 unit tests)	(10 marks)
Overall performance throughout the semester (Discipline, participation in different activities)	**(**05 marks)
Course prerequisites: To study this course, a student must have Passed Sem-I, Theory paper-1	

Semester-II , Paper-2 (Practical)
Course Title: Biochemical Analysis

Programme: Certificate in Basic Nutrition & Hygiene	Year: 1	Semester: II
Subject: Food Science		
Course Code:	Course Title: **Biochemical Analysis**	

Course outcomes:

This course will provide basic qualitative experimental knowledge of biomolecules such as carbohydrates, amino acids. Upon successful completion of this course students may get job opportunities in food, beverage and pharmaceutical industries.

Credits: 2	Elective
Max. Marks: 25+75 = 100	Min. Passing Marks:

Practical **60-h**

Unit	Topics	No of Lectures
I	Qualitative and quantitative analysis of Carbohydrates: Tests of different carbohydrates (monosaccharides, oligo, polysaccharides).	**15**
II	Qualitative and quantitative analysis of Proteins(Estimation of protein in egg albumen)	**15**
III	Qualitative and quantitative analysis of Fats using Soxhlet'sappratus	**18**
IV	To determine the solubility and antioxidant activity of different amino acids in different mediums.	**12**

Suggested Readings:

Biochemistry lab manual by Sardar Hussain & Komal Kp

Note: For the promotion of Hindi language, course books published in Hindi may be prescribed by the University

This course can be opted as an elective by the students of following subjects: Chemistry in 12 th Class

Suggested Continuous Evaluation Methods:

Viva voce	(10 marks)
Mock test	(10 marks)
Overall performance	(05marks)

Course prerequisites: To study this course, a student must have Opted Sem.-II, Theory Ppaer-1**.**

Year	Sem.	Course Code	Paper Title	Theory/Practical	Credits
Diploma in Food Preservation & Microbiological Studies					
2	III		Food Process Technology & Food Microbiology	Theory	4
			Practical	Practical	2
	IV		Sensory Evaluation & Post Harvest Technology of Food	Theory	4
			Practical	Practical	2

Semester III, Paper-1 (Theory)

Course Title:

Programme: Diploma in Food process technology & Microbiological Studies	**Year: Two**	**Semester: III**
Paper-1 Theory		Subject: **Food Science**
Course Code:	**Course Title: Food Process Technology and Food Microbiology**	

Course outcomes: principle of food preservation , preservation by use of high temperature ,preservation by use of low temperature , preservation of different food by using different method.contamination& spoilage of different food products by different type of micro organism.

Credits: 4	**Elective**
Max. Marks: 25+75	Min. Passing Marks:……

Total No. of Lectures = 60

Unit	**Topics**	**No. of Lectures**
I	**Principles of Food Process Technology**, Methods of Food Preservation, Asepsis, Removal of Microorganisms, Maintenance of Anaerobic Conditions. Preservation by Use of High Temperature – Factors affecting Heat Resistance, Heat Resistance of Microorganisms and their Spores. Determination of Heat Resistance, TDT Curves (Thermal Death Time Curves), 12D concept, Heat Preservation, Determination of Thermal Processing, Heat Treatments employed in Processing Foods, Canning.	5
II	**Preservation by Low Temperatures** – Growth of Microorganisms at Low Temperatures, Preparation of Food for Freezing, Temperature employed in Low Temperature Storage, Freezing of Food & Freezing Effects, Effect of Subfreezing and Freezing Temperatures on Microorganisms. Preservation by Food Additives – The Ideal Antimicrobial Preservatives, Added Preservatives, Developed Preservatives.	5

III	**Food Processing of regional and seasonal Fruits** Cereals & Cereal Products, Cereal grains & Meal ,Flours, Bread, Cakes and other Bakery Products-Macaroni and Tapioca Sugar & Sugar Products-Sucrose, Maple Sap & Syrup, Honey, Candy iii. Vegetable and Fruits-Fruits and Fruit Products like Apple, Apricot, Banana Black Berries, Cherries, Fig, Grapes, Guava, Greengage, Jack-fruit, Litchi, Loquat, Mango, Orange, Papaya, Peach, Pear, miscellaneous Minor Fruits, Processing Minor and Lesser known fruit, Fruit Juices, Squashes & Cordials, Fruit Beverages, Fermented Beverages, Jams, Jellies and Marmalades.	10
IV	**Food Processing of regional and seasonal Fruits** Vegetables, Asparagus, Beans, Beetroots, Cabbage, Carrot, Cauliflower, Gram, Mushroom, Okra (Lady Finger), Peas, Potato, Tomato, Turnip, Tomato Product etc. Preservation of Meat & Meat Products, Fish and Other Sea Foods, Blue foods Eggs and Poultry, Milk and Milk Products Miscellaneous foods- example: Fatty Foods, Essential Oils, Bottled Beverages etc. Preservation by Carbonation, Filtration & Improved Equipment for manufacture of Preserves, Some important Preserves e.g.: Aamla, Apples, Bael, Ber (Indian Jujube), Carrot, Cherry, Candied Citrus Peels, Ginger Candy, Karounda, Mango, Pear, Petha (Pumpkin), Pineapple, Strawberry.	5
V	**Food Processing by dry vaccum:** – Methods of Drying, Factors in the Control Drying, Treatment of Foods before Drying, Procedures after Drying, Microbiology of Dried Food, Intermediate Moisture Food. Food Preservation by Use of Radiation – Radiations of Interest in Food Preservation, Principles of Destruction of Microorganisms by Radiations, Processing of Food for Irradiation, Application of Radiation, Radappertization, Radicidation, Radurization of food, Effect of Irradiation on Food Constituents, Storage stability of Irradiated Foods.	15
VI	. **Food Microbiology** & its relevance to everyday life – General morphology of microorganism – General characteristics of bacteria, fungi, virus, protozoa, algae. Control of microorganisms – Growth curve – Effect of environmental factors on growth of micro organisms – pH, water activity – oxygen availability, temp. & others.	5
VII	**Microbial Spoilage and contamination** – sources, types, affects on the following: Cereals& cereals products .Sugar &Sugar products. Vegetables & Fruit, Meat and meat products, Fish & other sea foods ,Eggs & poultry. Milk & milk products , Canned foods	10
VIII	**Microbes as food-** Probiotics, Prebiotics ,Symbiotics & Neutraceuticals). Relevance of Microbiological standards for foods & safey.	5

Suggested Readings:

1. William C. Frazier 2014 Food microbiology Published by McGraw Hill Education (India)Pvt. Ltd.
2. Prescott's Microbiology 10th Edition. By Joanne Willey and Linda Sherwood and Christopher J. Woolverton
3. Microbiology: An Introduction, Global Edition. Edited by Gerard J. Tortora
4.

Note: For the promotion of Hindi language, course books published in Hindi may be prescribed by the University

This course can be opted as an elective by the students of following subjects: Chemistry in 12 th Class

Suggested Continuous Evaluation Methods: Students can be evaluated on the basis of score obtained in a mid-term exam, together with the performance of other activities which can include short exams, in-class or on-line tests, home assignments, group discussions or oral presentations, among others .

Or

Assessment and presentation of Assignment/ Research Orientation assignment	(10 marks)
04 Unit tests (Objective): Max marks of each unit test = 10 (average of all 04 unit tests)	(10 marks)
Overall performance throughout the semester (Discipline, participation in different activities)	**(**05 marks)

Course prerequisites: To study this course, a student must have had the chemistry in class 12 th , Physics in Class 12th

Suggested equivalent online courses:

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Further Suggestions:

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Semester III, Paper (Practical)
Course Title: Practical

Programme: Diploma in Food Preservation & Microbiological Studies	Year: Two	Semester: III
Practical paper-2		**Subject:Food Science**
Course Code:	**Course Title: Practical**	

Course Outcomes:

Student will have a detailed insightful knowledge and expertise in-

- Isolation & identification of Lactic acid bacteria ,
- Isolation of Fungi from food
- Various techniques of food preservation
- preparation of tomato ketch up , apple chutney , lemon squash ,preparation of jam

Credits: 4	Elective
Max. Marks: 25 +75	Min. Passing Marks:
Practical	**60h**

Unit	Topics	No of Lectures
I	Isolation and identification of microorganism of spoiled food, fungi and bacteria.	20
II	Inhibitory effect of low temperature on microbial growth Isolation of Lactic Acid Bacteriafrom curd.	06
III	Preparation of Tomato ketchup Preparation of Apple chutney. Preparation of lemon Squash Preparation of Jam.	14

Suggested Readings:

Practical microbiology – A laboratory manual by D.K Maheswari

Note: For the promotion of Hindi language, course books published in Hindi may be prescribed by the University

This course can be opted as an elective by the students of following subjects: Chemistry in 12th Class

Suggested Continuous Evaluation Methods:

Viva voce	(10 marks)
Mock test	(10 marks)
Overall performance	(05marks)

Course prerequisites: To study this course, a student must have Opted Sem-III, Theory Ppaer-1

Suggested equivalent online courses:

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Further Suggestions:

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Semester IV Paper-1 (Theory)
Course Title: Sensory Evaluation & Post Harvest Food Technology

Programme: Diploma in Chemical Dynamics and Analytical Techniques	Year: **Two**	Semester: **IV**
Paper-1	Elective	Subject: **Food Science**
Course Code:	**Course Title: Sensory Evaluation & Post Harvest Food Technology**	

Course Outcomes: This paper will give a broad outline of –

- factors affecting food acceptance ,
- sensory assessment of food quality, type of panelist ,
- sensory testing of food ,
- processing technology of food product like milk & milk product , cereal & cereal product.

Credits: 4	Elective
Max. Marks: 25+75	Min. Passing Marks:
Total No. of Lectures- = 60	

Unit	Topics	No. of Lectures
I	Factors affecting Food Acceptance-Sensory. Psychosocial and Physiological Sensory Assessment of Food Quality:-Appearance of Food - Visual perception, Color of Foods, Odour & Smell, Flavor, Texture, Taste	**5**
II	Types of Panelist – Trained & Untrained Panelist Data Analysis.	**5**
III	Sensory Testing of Foods:-Threshold Test, Difference Test,Ranking Test,Scoring Test Hedonic Test, Acceptance and Preference Test Consideration for Testing Sensory Evaluation-Testing Area,Testing Setup,Lighting Testing Schedule,Preparation of Sample,Cooling & Order of Presentation,Choosing & Training of Panelist	**10**
IV	Processing Technology of Cereals and Legumes losses, Storage, Handling andProcessing. Processing Technology of Oil Seeds.	**5**
V	Processing Technology of Fruits and Vegetables, Fresh and Other Types. Processing Technology of Milk and Milk Products. Processing Technology of Meat, Fish, Poultry and Eggs.	**15**
	Fermentation Technology, Enrichment and Fortification Technology, High Protein Food	**5**

VI	Technology Quality Control in Food Industry- Methods of Evaluation and Control of the various aspects of quality of raw material manufacturing process, Testing of Finished Products	
VII	Physical Principles underlying Food Processing Operations including Thermal Processing. Ionizing Radiations, Refrigeration, Freezing, Dehydration etc. Chemical Principles in Food Processing, Chemical changes in Food that effectthe Texture, Color, Flavor, Odour. Stability and Nutritive Quality during Processing and Storage.	**10**
VIII	Extruded Foods Processing Technology of spices.	**5**

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Suggested Readings:

1. ShakuntalaManay2008 Food Facts & Principle Second Edition Published by New Age International (P)Ltd.
2. Norman N. Potter & Joseph H. Hotchkiss Food science Published by Dennis R. Heldman University of Missouri 5th Edition.

This course can be opted as an elective by the students of following subjects: Chemistry in 12th Class

Suggested Continuous Evaluation Methods: Students can be evaluated on the basis of score obtained in a mid-term exam, together with the performance of other activities which can include short exams, in-class or on-line tests, home assignments, group discussions or oral presentations, among others .
Or

Assessment and presentation of Assignment/ Research Orientation assignment	(10 marks)
04 Unit tests (Objective): Max marks of each unit test = 10 (average of all 04 unit tests)	(10 marks)
Overall performance throughout the semester (Discipline, participation in different activities)	**(**05 marks)

Course prerequisites: To study this course, a student must have had the chemistry in class 12 th

Suggested equivalent online courses:
……..

Further Suggestions:
……..

Semester IV, Paper-2 (Practical)
Course Title: Practical

Programme: Diploma in Food Preservation & Microbiological Studies	Year: Two	Semester: V
Practical paper-3		Subject:Food Science
Course Code:	**Course Title: Practical**	

Course outcomes:

Student will be able to have in hands practice on-

- Determination of pH& acidity
- Sensory Evaluation of milk products
- Evaluation of Basic Taste
- Determination of specific gravity , fats & total solids

Credits: 2	Elective
Max. Marks: 25 + 75	Min. Passing Marks:

Practical **60h**

Unit	Topics	No. of Lectures
I	Determination of pH & Acidity of fruit & vegetable, Milk. Dehydration of Vegetables – Tomato	**10**
II	Sensory evaluation of Bakery product – Bread Sensory evaluation of milk & milk products	**20**
III	Evaluation of Basic tastes – Threshold test. Determination of (a) Specific Gravity (b) Fat% (c) Total Solids.	**10**
IV	Effect of processing technology on different foods, Fruits & Veg.	**20**

Suggested Readings:

1. Sensory evaluation of food : principles & practices by Lawlell H. T, Springer

This course can be opted as an elective by the students of following subjects: Chemistry in 12th Class

Suggested Continuous Evaluation Methods:

Viva voce	(10 marks)
Mock test	(10 marks)
Overall performance	(05marks)

Year	Sem.	Course Code	Paper Title	Theory/Practical	Credits
Degree in Bachelor of Science in Food Science & Q.C					
3	V		Food Analysis	Theory 1	4
			Food Manufacturing and Enterpreneurship	Theory 2	4
			Practical	Practical	2
			Research Project/winter internship	Project	3
	VI		Food Toxicology	Theory 1	4
			Food Adulteration & Testing and Analytical Instrumentation	Theory 2	4
			Practical	Practical	2
			Research Project/summer internship	Project	3

Semester-V Paper-1
Course Title: Food Analysis

Programme**:** Degree in Bachelor of Science in Food Science & Q.C	Year: Three	Semester: **V**
Paper-2 Theory	**Compulsory**	Subject: Food Science
Course Code:	Course Title: Food Analysis	

Course outcomes:

Student will have an overview of-

- Food composition and factors affecting food composition,
- General physical methods of food analysis
- Total Protein Nitrogen, Non Protein Nitrogen and Specific Protein in foods.
- Crude Fibre and Dietary Fibre, Total Carbohydrate, Starch, Gums, Monosaccharide & Disaccharide

Credits: 4	Elective
Max. Marks: 25+75	Min. Passing Marks:

Total No. of Lectures- = 60

Unit	Topics	No. of Lectures
I	Food composition and factors affecting food composition Sampling Techniques. Preparation of samples.	**8**
II	General physical methods of food analysis- Lactometric determination, Refractometry Polarimetry and Polarography, Food Rheology,Viscosity,Surface Tension, Freezing Point	**12**
III	Total Protein Nitrogen, Non Protein Nitrogen and Specific Protein in foods.	**06**
IV	General chemical methods of food analysis:Proximate principles,Moisture, Specific Gravity,Ash and types	**10**
V	Total Fat and different types of Lipids.	**8**
VI	Total Carbohydrate, Starch, Gums, Monosaccharide & Disaccharide	**06**
VII	Crude Fibre and Dietary Fibre	**05**
VIII	Macro Nutrients-Sodium, Potassium, Phosphorus, Calcium, Magnesium, Iron, Zinc Vitamins Trace Elements	**05**

Suggested Readings:

1. S. Ranganna 1977 Handbook of Analysis and Quality Control for Fruit and vegetable Products Tata McGraw Hill Publishing Company Ltd New Delhi.
2. Prevention of Food Adulteration Act, 1985
3. Pearson's Chemical Analysis of Foods- Egan, Kiv and Sawyer
4. Methods in Food Analysis - Joslyn
5. Chemical methods of Food Analysis-Jacob
6. Standard methods for examination of Dairy Products-E.M.Master

Note: For the promotion of Hindi language, course books published in Hindi may be prescribed by the University.

This course is compulsory for the students of following subjects: Chemistry in 12th Class

Suggested Continuous Evaluation Methods:

Students can be evaluated on the basis of score obtained in a mid-term exam, together with the performance of other activities which can include short exams, in-class or on-line tests, home assignments, group discussions or oral presentations, among others .

Or

Assessment and presentation of Assignment	(10 marks)
04 Unit tests (Objective): Max marks of each unit test = 10 (average of all 04 unit tests)	(10 marks)
Overall performance throughout the semester (Discipline, participation in different activities)	**(**05 marks)

Course prerequisites: To study this course, a student must have Passed Sem-I, Theory paper

Suggested equivalent online courses:

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Further Suggestions:

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Semester-V Paper-2
Course Title: Food Manufacturing and Enterpreneurship

Programme: Degree in Bachelor of Science in Food Science & Q.C	Year: Three	Semester: V
Paper-2 Theory	Elective	Subject: Food Science
Course Code:	Course Title: Food Manufacturing and Enterpreneurship	

Course outcomes: Student will be able to study about-

- Market & consumer research , product development , Type of Product,
- Chemical & Physical of food ,
- Transportation ,
- Food Laws & Equipment Advertising & marketing
- Evaluation of Food Packaging , Packaging method & performance & specification .

Credits: 4	Elective
Max. Marks: 25+75	Min. Passing Marks:
Total No. of Lectures- = 60	

Unit	Topics	No. of Lectures
I	Market and Consumer Research. Needs and types of food consumption and trends.Economic, Physiological, Anthropological and Sociological Dimensions of food consumption pattern. Traditional foods-Status and need for revival in the context of determined non-traditional foods, urbanization and such factors.	6
II	Product development: Primary Processing, Secondary Processing. Types of products e.g. Quick cooking, Fast foods, fabricated foods and Convenience foods. Chemical and Physical properties of food, Shelf life studies and shelf life prediction, Sanitization and waste disposal.	8
III	Transportation, Types/Modes, Optimization of Transportation taking into account, Type of product, Distance, Storage facilities etc. Food Laws Equipment and Space. Costing of product. Advertising and Marketing	10

IV	. Project work to be submitted at the end of the course. For each topic student will be taken to different types of food manufacturing industries and food service establishments.	**6**
V	Evaluation of Food Packaging Importance of Packaging	**4**
VI	Packaging Criteria, Appearance, Protection, Function, Cost, Material and Forms of Packaging Packaging methods & Performances	**4**
VII	Packaging Specification & Control of Packaging Quality Food & Food Packaging Interaction Food Packaging and Law	**6**
VIII	Packaging evaluation Package Life Theory & Testing Packaging Materials Shelf Life Testing	**6**

Suggested Readings:

1. Norman N. Potter & Joseph H. Hotchkiss Food science Published by Dennis R. Heldman University of Missouri 5th Edition.
2. Food Packaging & Material by Mahadeviam Gowramma

This course can be opted as an elective by the students of following subjects: Chemistry in 12 th Class

Suggested Continuous Evaluation Methods:

Students can be evaluated on the basis of score obtained in a mid-term exam, together with the performance of other activities which can include short exams, in-class or on-line tests, home assignments, group discussions or oral presentations, among others .

Or

Assessment and presentation of Assignment	(10 marks)
04 Unit tests (Objective): Max marks of each unit test = 10 (average of all 04 unit tests)	(10 marks)
Overall performance throughout the semester (Discipline, participation in different activities)	**(**05 marks)

Course prerequisites: To study this course, a student must have Passed Sem-I, Theory paper

Suggested equivalent online courses:

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Further Suggestions:

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Semester V, Paper-3 (Practical)
Course Title: Qualitative Analysis

Programme: Degree in Bachelor of Science in Food Science & Q.C	Year: Three	Semester: V
Practical paper-3		**Subject: Food Science**
Course Code	**Course Title: Practical**	

Course outcomes:

Upon completion of this course, the students will have the knowledge and skills to:

- Understand the laboratory methods and tests related to Food Analysis.
- Determination of Peroxide value.
- Estimation of Ash content
- Estimation of Moisture content

Credits: 2	Elective
Max. Marks: 25+75	Min. Passing Marks:
Practical	**60h**

Unit	Topics	No of lectures
I	**Food Analysis** Estimation of Crude fibre/Dietary fibre in food:	**8**
II	**Titration :** 1.Determination of peroxide value of oil 2. Calculation of Acid value in oil.	**14**
III	**Minerals :**Estimation of Ash content in food like Besan , Wheat Flour	**14**
IV	**Moisture :**Estimation of moisture content in food samples like Biscuit , Butter	**12**
V	**Study of Instruments in analysis** -pH meter, Conductivity meter, Flame photometer, Spectrophotometer, Atomic absorption spectrophotometer, Kjeldahl's apparatus, Soxhlet apparatus, Muffle furnace, Hot air oven, Bacteriological incubator, BOD incubator, Centrifuge, Autoclave.	**12**

Suggested Readings:

1. Methods in Food Analysis – Joslyn
2. Chemical methods of Food Analysis-Jacob

This course can be opted as an elective by the students of following subjects: Chemistry in 12 th Class

Suggested Continuous Evaluation Methods:	
Viva voce	(10 marks)
Mock test	(10 marks)
Overall performance	(05marks)

Course prerequisites: To study this course, a student must have Opted Sem-V Theory Ppaer-1 &2

Suggested equivalent online courses:
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Further Suggestions:
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Semester-VI Paper-1
Course Title: Food Toxicology

Programme**:** Degree in Bachelor of Science in Food Science & Q.C	Year: Three	Semester: VI
Paper-1 Theory	**Compulsory**	Subject: Food Science
Course Code:	**Course Title: Food Toxicology**	

Course outcomes:this paper aims at imparting a broad picture of-

- Genetically engineered food ,pests and their safety.
- Carcinogens
- Importance of Toxicology. Physical treatment of food and health hazards
- Substances intentionally added to foods. Choice of technology, plant and equipment. Creativity and innovation

Credits: 4	Elective
Max. Marks: 25+75	Min. Passing Marks:
Total No. of Lectures- = 60	

Unit	Topics	No. of Lectures
I	Genetically engineered food , pests and their safety. Introduction to Food Engineering	**6**
II	Carcinogens	**4**
III	Importance of Toxicology. Naturally occurring toxins in various foods.	**10**
IV	Microbial and Parasitic: i. Food poisoning and food infections or food borne illness. ii. Mycotoxins- aflatoxin iii. Bacterial toxin	**8**

V	Physical treatment of food and health hazards: Irradiation - heat treatment	**5**
VI	Residual chemicals utilized in food production and processing:- Chemical preservation.,Pesticides, Heavy metals, Hormones in food. **Food toxins**– water, air, soil & sewage. Microbial intoxication & Infections – Sources of contamination of foods, toxin, production and physiological action, sources of infection of foods by pathogenic organisms – Symptoms & method of control.	**10**
VII	Substances intentionally added to foods. (Food Additives) Antioxidants, Color, Stabilizers & Heavy Metal	**10**
VIII	Choice of technology, plant and equipment Creativity and innovation Problem solving approach Strength Weakness Opportunity and Threat (SWOT) Techniques.	**7**

Suggested Readings:

Food safety & Toxicity by De .Vries

This course compulsory for the students of following subjects: Chemistry in 12th Class

Suggested Continuous Evaluation Methods:

Students can be evaluated on the basis of score obtained in a mid-term exam, together with the performance of other activities which can include short exams, in-class or on-line tests, home assignments, group discussions or oral presentations, among others .

Or

Assessment and presentation of Assignment	(10 marks)
04 Unit tests (Objective): Max marks of each unit test = 10 (average of all 04 unit tests)	(10 marks)
Overall performance throughout the semester (Discipline,	**(**05 marks)
participation in different activities)	

Course prerequisites: To study this course, a student must have Passed Sem-V Theory paper-1

Suggested equivalent online courses:

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Further Suggestions:

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Semester-VI Paper-2

Course Title: Food Adulteration & Testing and Analytical Instrumentation

Programme**:** Degree in Bachelor of Science in Food Science & Q.C	Year: Three	Semester: VI
Paper-2 Theory	**Elective**	Subject: Food Science
Course Code:	**Course Title: Food Adulteration & Testing and Analytical Instrumentation**	

Course outcomes: Food Laws , food Adulteration , Composition & quality of food products, analytical techniques like TLC , paper Chromatography, atomic absorbtion , flourimetry

Credits: 4	Elective
Max. Marks: 25+75	Min. Passing Marks:

Total No. of Lectures- = 60

Unit	Topics	No. of Lectures
I	Food laws:Voluntary,Mandatory- National and International Role of Voluntary Agencies and Legal aspects of Consumer Protection	**8**
II	Food Standards,Food Adulteration	**10**
III	Composition and Quality criteria for the following:- Milk and Milk Products, Oil and Fats,Spices and Condiments, Food grain, Flours, Canned foodsFruits and Vegetable products,Flesh food, Sugar and Preserves, Beverages- Alcoholic and Non Alcoholic	**8**
IV	Radioactive Tracer Techniques, Radioactive Counter Gas and Liquid Scintillation Fluorimetry- Thiamin& Riboflavin	**10**
V	Spectrophotometry- Phosphorus & Ascorbic Acid	**04**
VI	Principles and Techniques of Separation Methods- Chromatography (TLC, GLC,HPLC). Electrophoresis-Paper, Moving boundary, Agar, β-Carotene.	**6**
VII	Atomic Absorption- Iron, Calcium/ Any Trace element .	**07**
VIII	Measurement of Enzyme Activity- Principles of any enzyme to be estimated	**07**

Suggested Readings:

Domestic test of food adulteration by Chrihtian.

This course can be opted as an elective by the students of following subjects: Chemistry in 12 th Class

Suggested Continuous Evaluation Methods:
Students can be evaluated on the basis of score obtained in a mid-term exam, together with the performance of other activities which can include short exams, in-class or on-line tests, home assignments, group discussions or oral presentations, among others .
Or

Assessment and presentation of Assignment	(10 marks)
04 Unit tests (Objective): Max marks of each unit test = 10 (average of all 04 unit tests)	(10 marks)
Overall performance throughout the semester (Discipline, participation in different activities)	**(**05 marks)

Course prerequisites: To study this course, a student must have had the chemistry in class 12th , Physics in 12th

Suggested equivalent online courses:
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Further Suggestions:
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Semester VI, Paper-3 (Practical)
Course Title: Analytical Methods

Programme: Degree in Bachelor of Science in Food Science & Q.C	Year: Three	Semester: IV
Practical paper-3		Subject: Chemistry
Course Code:	Course Title: Practical	

Course Outcomes: Adulteration & testing of food like milk & milk products , spices . titrable acidity , pigment separation by paper chromatography.

Credits: 2	Elective
Max. Marks: 25+75	Min. Passing Marks:

Practical **60h**

Unit	Topics	No of Lectures
I	**Adulteration & testing of foods:** 1.milk & milk products 2. spices 3. pulses 4.fats & oils 5. Sedimentation value of Maida 6. Specific gravity of milk .	**30**
II	**Titrable Acidity of Milk & Lemon**	**8**
III	**Chromatography:** 1.Paper chromatography 2.TLC Determination of R*f* values and identification of organic compounds:Separation of green leaf pigments (spinach leaves may be used)	**8**
IV	**Estimation of Gluten in Wheat Flour**	**14**

Suggested Readings:
Principles & Techniques of Practical biochemistry by Wilson N . Walker

This course can be opted as an elective by the students of following subjects: Chemistry in 12th Class

Suggested Continuous Evaluation Methods:

Viva voce	(10 marks)
Mock test	(10 marks)
Overall performance	(05marks)

Course prerequisites: To study this course, a student must have had the chemistry in 12th class

Suggested equivalent online courses:
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Further Suggestions:
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