

**ADIKAVI NANNAYA UNIVERSITY**  
**Bachelor of Vocation: Food Technology**  
**2019-20 Admitted Batch**  
**I Year Semester I**

S.No	Course	Mid Exam*	Sem End Exam	Total Marks	Teaching Hours	Credits
	<b>General Education</b>					
1	English Communication Skills-I	25	75	100	4	4
2	Organic and Inorganic Chemistry	25	75	100	4	4
3	Organic and Inorganic Chemistry (Practical)	0	50	50	2	2
4	Foundation course –I (Environmental Studies)	0	50	50	2	2
	<b>Skill Education</b>					
1	Food Production Trends and Human Nutrition	25	75	100	4	4
2	Fundamentals of Food Microbiology	25	75	100	4	4
3	Fundamentals of Food Microbiology (Practical)	0	50	50	2	2
4	Fundamentals of Food Chemistry	25	75	100	4	4
5	Fundamentals of Food Chemistry (Practical)	0	50	50	2	2
6	On Job Training - I	0	50	50	2	2
	<b>Total</b>			<b>750</b>	<b>30</b>	<b>30</b>

**ADIKAVI NANNAYA UNIVERSITY**  
**Bachelor of Vocation: Food Technology**  
**2019-20 Admitted Batch**  
**I Year; Semester II**

S.No	Course	Mid Sem Exam*	Sem End Exam	Total Marks	Teaching Hours	Credits
	<b>General Education</b>					
1	English Communication Skills-II	25	75	100	4	4
2	Chemistry (General and Physical Chemistry)	25	75	100	4	4
3	Chemistry (General and Physical Chemistry) Practical	0	50	50	2	2
4	Foundation course –II (ICT-I)	0	50	50	2	2
	<b>Skill Education</b>					
1	Biochemistry	25	75	100	4	4
2	Biochemistry (Practical)	0	50	50	2	2
3	Food Microbiology	25	75	100	4	4
4	Food Microbiology (Practical)	0	50	50	2	2
5	Principles of Food Preservation	25	75	100	4	4
6	On Job Training - II	0	50	50	2	2
	<b>Total</b>			<b>750</b>	<b>30</b>	<b>30</b>

**ADIKAVI NANNAYA UNIVERSITY**  
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**II Year; Semester III**

S.No	Course	Mid Exam*	Sem End Exam	Total Marks	Teaching Hours	Credits
	<b>General Education</b>					
1	English Communication Skills-III	25	75	100	4	4
2	Organic and Inorganic Chemistry	25	75	100	4	4
3	Organic and Inorganic Chemistry (Practical)	0	50	50	2	2
4	Foundation course –III (ICT-II)	0	50	50	2	2
	<b>Skill Education</b>					
1	Food Chemistry of Macro Nutrients	25	75	100	4	4
2	Food Chemistry of Macro Nutrients (Practical)	0	50	50	2	2
3	Fermentation and Industrial Microbiology	25	75	100	4	4
4	Fermentation and Industrial Microbiology (Practical)	0	50	50	2	2
5	Food Additives	0	50	50	2	2
6	Seminar - 1	0	50	50	2	2
6	On Job Training - III	0	50	50	2	2
	<b>Total</b>			<b>750</b>	<b>30</b>	<b>30</b>

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**II Year; Semester IV**

S.No	Course	Mid Sem Exam*	Sem End Exam	Total Marks	Teaching Hours	Credits
	<b>General Education</b>					
1	Fundamentals of Statistics	25	75	100	2	2
2	Practical on Fundamentals of Statistics	0	50	50	2	2
3	Spectroscopy and Physical Chemistry	25	75	100	4	4
4	Practical on Spectroscopy and Physical Chemistry	0	50	50	2	2
5	Fundamentals of Economics & Marketing	25	75	100	2	2
	<b>Skill Education</b>					
1	Food Chemistry of Micro Nutrients	25	75	100	4	4
2	Food Chemistry of Micro Nutrients (Practical)	0	50	50	2	2
3	Fruit and Vegetable Processing	25	75	100	4	4
4	Fruit and Vegetable Processing (Practical)	0	50	50	2	2
5	Legume and Oil seed technology	25	75	100	4	4
6	On Job Training - IV	0	50	50	2	2
	<b>Total</b>			<b>750</b>	<b>30</b>	<b>30</b>

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**III Year; Semester V**

S.No	Course	Mid Sem Exam*	Sem End Exam	Total Marks	Teaching Hours	Credits
	<b>General Education</b>					
1	Inorganic and Organic Physical Chemistry - 1	25	75	100	4	4
2	Inorganic and Organic Physical Chemistry-1 Practical	0	50	50	2	2
3	Inorganic and Organic Physical Chemistry-2	25	75	100	4	4
4	Inorganic and Organic Physical Chemistry-2 Practical	0	50	50	2	2
	<b>Skill Education</b>					
1	Cereal Processing	25	75	100	4	4
2	Cereal Processing (Practical)	0	50	50	2	2
3	Processing of Milk and Milk Products	25	75	100	4	4
4	Processing of Milk and Milk Products (Practical)	0	50	50	2	2
5	Processing of Meat and Meat Products	25	75	100	4	4
6	Processing of Spices and Plantation Crops	0	50	50	2	2
	<b>Total</b>			<b>750</b>	<b>30</b>	<b>30</b>

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**III Year; Semester VI**

S.No	Course	Total Marks	Mid Sem Exam*	Sem End Exam	Total Marks	Teaching Hours	Credits
	<b>General Education</b>						
1	Environmental Chemistry	100	25	75	100	4	4
2	Environmental Chemistry (Practical)	50	0	50	50	2	2
3	Food Packaging	100	25	75	100	4	4
4	Food Quality and Certification	50	0	50	50	2	2
	<b>Skill Education</b>						
1	Food Processing Equipment	100	25	75	100	4	4
2	Food Laws and Regulations	50	0	50	50	2	2
3	Techniques in Food Analysis	100	25	75	100	4	4
4	Techniques in Food Analysis (Practical)	50	0	50	50	2	2
5	Food Trade and Business Management	100	25	75	100	4	4
6	Project Work	50	0	50	50	2	2
	<b>Total</b>	<b>750</b>			<b>750</b>	<b>30</b>	<b>30</b>

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**I Year Semester – I**

**ENGLISH COMMUNICATION SKILLS – 1**

**UNIT – 1**

**VOCABULARY BUILDING**

1. Vocabulary Building
  - Classification of Words
  - 1a. Prefixes and Suffixes
  - 1b. Conversion
  - 1c. Compounding
  - 1d. Analogy
2. One word Substitutes
3. Words Often Confused
4. Synonyms and Antonyms
5. Phrasal Verbs
6. Idioms

**UNIT -II**

**GRAMMAR -1**

1. Types of Verbs
2. Subject Verb Agreement

**UNIT – III**

**GRAMMAR -2**

1. Meanings of Modals
2. Tense (present and past)and aspect
3. The several Possibilities for denoting future time
4. Articles and prepositions

**UNIT– IV**

**LISTENING SKILLS**

1. The Importance of Listening
2. Types of Listening
3. Barriers to effective Listening
4. Strategies for Effective listening

**UNIT - V**

**READING SKILLS**

1. Skimming
2. Scanning & Intensive Reading and Extensive Reading & Comprehension

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**I Year Semester – I**

**ORGANIC AND INORGANIC CHEMISTRY**

**INORGANIC CHEMISTRY**

**UNIT –I**

**P-BLOCK ELEMENTS**

Group-13: Synthesis and structure of diborane and higher boranes ( $B_4H_{10}$  and  $B_5H_9$ ), boron-nitrogen compounds ( $B_3N_3H_6$  and BN) and carboranes Group - 14: Preparation and applications of silanes, silicones and graphitic compounds. Group - 15: Preparation and reactions of hydrazine, hydroxylamine and Phosphazenes.

**UNIT-II**

**P-BLOCK ELEMENTS -II**

Group - 16: Classifications of oxides based on (i) Chemical behaviour and (ii) Oxygen content, Oxyacids of sulphur (structures only). Group-17: Inter halogen compounds, pseudo halogens and comparison with halogens.

**2. Organometallic Chemistry**

Definition - classification of Organometallic compounds - nomenclature, preparation, properties and applications of alkyls of Li and Mg.

**ORGANIC CHEMISTRY**

**UNIT-III**

Structural theory in Organic Chemistry. Types of bond fission and organic reagents (Electrophilic, Nucleophilic, and free radical reagents including neutral molecules like  $H_2O$ ,  $NH_3$  &  $AlCl_3$ ). Bond polarization: Factors influencing the polarization of covalent bonds, electro negativity - inductive effect. Application of inductive effect (a) Basicity of amines (b) Acidity of carboxylic acids (c) Stability of carbonium ions. Resonance or Mesomeric effect, application to (a) acidity of phenol, and (b) acidity of carboxylic acids. Hyperconjugation and its application to stability of carbonium ions, Free radicals and alkenes, carbanions, carbenes and nitrenes. Types of Organic reactions : Addition - electrophilic, nucleophilic and free radical. Substitution - electrophilic, nucleophilic and free radical. Elimination- Examples.

**UNIT-IV**

**1. Acyclic Hydrocarbons**

Alkenes - Preparation of alkenes. Properties: Addition of hydrogen - heat of hydrogenation and stability of alkenes. Addition of halogen and its mechanism. Addition of HX, Markonikov's rule, addition of  $H_2O$ , HOX,  $H_2SO_4$  with mechanism and addition of HBr in the presence of peroxide (anti - Markonikov's addition). Dienes - Types of dienes, reactions of conjugated dienes - 1,2 and 1,4 addition of HBr to 1,3 – butadiene and Diel's - Alder reaction.



Alkynes - Preparation by dehydrohalogenation of dihalides, dehalogenation of tetrahalides, Properties; Acidity of acetylenic hydrogen (formation of Metal acetylides). Preparation of higher acetylenes, Metal ammonia reductions, Physical properties. Chemical reactivity - electrophilic addition of  $X_2$ ,  $HX$ ,  $H_2O$  (Tautomerism), Oxidation with  $KMnO_4$ ,  $OsO_4$ , reduction and Polymerisation reaction of acetylene.

2. Alicyclic hydrocarbons (Cycloalkanes) Nomenclature, Preparation by Freund's method, Wislicenus method. Properties - reactivity of cyclopropane and cyclobutane by comparing with alkanes, Stability of cycloalkanes - Baeyer's strain theory, Sachse and Mohr predictions and Pitzer's strain theory. Conformational structures of cyclobutane, cyclopentane, cyclohexane.

#### **UNIT-V**

Benzene and its reactivity. Concept of resonance, resonance energy. Heat of hydrogenation, heat of combustion of Benzene, mention of C-C bond lengths and orbital picture of Benzene. Concept of aromaticity - aromaticity (definition), Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation) Reactions - General mechanism of electrophilic substitution, mechanism of nitration, Friedel Craft's alkylation and acylation. Orientation of aromatic substitution – Definition of ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like  $NO_2$  and Phenolic). Orientation of (i) Amino, methoxy and methyl groups (ii) Carboxy, nitro, nitrile, carbonyl and sulphonic acid groups (iii) Halogens (Explanation by taking minimum of one example from each type)

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**ORGANIC AND INORGANIC CHEMISTRY (PRACTICAL)**

**QUALITATIVE INORGANIC ANALYSIS**

Analysis of simple salt containing one anion and cation from the following

Anions: Carbonate, Sulphate, Chloride, Bromide, Acetate, Nitrate, Borate, Phosphate.

Cations: Lead, Copper, Iron, Aluminum, Zinc, Manganese, Nickel,  
Calcium, Strontium, Barium, Potassium and Ammonium.

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**FOUNDATION COURSE -1**

**ENVIRONMENTAL STUDIES**

**Unit-I**

Natural Resources: Definition, scope and importance. Need for public awareness. Brief description of Forest resources: Use and over-exploitation. Deforestation; timber extraction, mining, dams. Effect of deforestation environment and tribal people Water resources: Use and over-utilization. Effects of over utilisation of surface and ground water. Floods, drought. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Food resources: World food problems, Effects of modern agriculture; fertilizer, pesticide, salinity problems. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Land resources: Land as resources, land degradation, man induced landslides, soil erosion and desertification

**Unit-II**

Ecosystems, Biodiversity and its conservation Concept of an ecosystem Structure and function of an ecosystem Producers, consumers and decomposers Food chains, food webs and ecological pyramids Characteristic features of the following ecosystems:- Forest ecosystem, Desert ecosystem, Aquatic ecosystem. Value of biodiversity: Consumptive use, productive use. Biodiversity in India. Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts. Endangered and endemic species of India Conservation of biodiversity

**Unit-III**

Environmental Pollution Definition Causes, effects and control measures of :- a. Air pollution b. Water pollution ANUR c. Soil pollution d. Noise pollution Solid waste management; Measures for safe urban and industrial waste disposal Role of individual in prevention of pollution Disaster management: Drought, floods and cyclones

**Unit-IV**

Social Issues and the Environment From Unsustainable to Sustainable development Water conservation, rain water harvesting, watershed management. Climate change, global warming, ozone layer depletion, Environment protection Act Wildlife Protection Act, Forest Conservation Act

**Unit-V**

Human Population and the Environment Population explosion, impact on environment. Family welfare Programme Environment and human health Women and Child Welfare Value Education Role of Information Technology in Environment and human health.

**Text Book**

Environmental Studies by Dr.M.Satyanarayana, Dr.M.V.R.K.Narasimhacharyulu, Dr.G.

Rambabu and Dr.V.VivekaVardhani, Published by Telugu Academy, Hyderabad.

**Books for Reference**

1. Environmental Studies by Dr.M.Satyanarayana, Dr.M.V.R.K.Narasimhacharyulu, Dr.G. Rambabu and Dr.V.VivekaVardhani, Published by Telugu Academy, Hyderabad.
2. Environmental Studies by R.C.Sharma, Gurbir Sangha, published by Kalyani Publishers.
3. Environmental Studies by Purnima Smarath, published by Kalyani Publishers.

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**FOOD PRODUCTION TRENDS AND HUMAN NUTRITION**

**Unit-I:** Status of food processing industry in India & Abroad, Indian Food Industry, Reasons for slow growth, Scope for Expansion, future priorities in food production need, magnitude and inter dependence of food production and processing agencies.

**Unit-II:** Dairy, Bakery, Confectionery, Beverage and Snack foods and their growth, popularity of Indian foods, National and International Projects and their food products.

**Unit-III:** Ministry of food processing industries (MOFPI), objectives and functions, APEDA - its objectives and functions, food characteristics, classification of foods, types of foods, convenience foods - Recent Trends for processing of foods, genetically modified foods.

**Unit-IV:** Functional foods and their advantages and disadvantages, Food Demand and Supply, Factors affecting Food Demand, Food Laws, Factors affecting food laws

**Unit-V:** Global demand for food, World Food Day- its importance and action plan, classification of food crops, food losses, production and estimation of post harvest losses, Development programmes and strategies to eliminate food losses, Employment generation through post harvest operations.

**Textbook**

N.N. Potter, Food Science, III edition,. AVI Publishing Co. Inc., West Port, USA, 1978.

**Books for Reference**

1. N.N. Potter, Food Science, III edition,. AVI Publishing Co. Inc., West Port, USA, 1978.
2. K. Vijaya Raghavan, Agricultural Administration in India.
3. Chidda Singh, Modern Techniques of Raising Field Crops, Oxford & IBH Publishing Co, New Delhi.
4. Graft and Saguy, Food Product Development, CBS Publishers, New Delhi.
5. M. Swaminathan, Food and Nutrition, Vol I &II, The Bangalore Printing & Publishing Co. Ltd, Bangalore.

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**I Year Semester – I**  
**FOOD PRODUCTION TRENDS AND HUMAN NUTRITION**

Time: 3 Hours

Maximum: 75 Marks

**SECTION – A**

Answer any **FIVE** questions. Each question carries equal marks. (5\*5 = 25)

1. Write about Post Harvest losses in foods.
2. What is the Scope for Expansion of Indian Food Industry?
3. Write about Classification of Foods.
4. Explain in detail about Food laws and Factors effecting Food Laws.
5. Write about World Food Day and its importance.
6. Explain different National and International Projects related to Food Industry.
7. Write about Reasons for Slow growth of Food Industry.
8. Write about Classification of Food Crops.

**SECTION – B**

Answer **All** the questions. Each question carries **TEN** marks (5\*10 = 50)

9. a) Write in detail about Scope, Future Priorities and Interdependence of Indian Food Processing Industry.

**(OR)**

- b) Write about the Status of Food Processing Industries in India and Abroad.

10. a) Explain the Status of Dairy sector in India.

**(OR)**

- b) Explain the Status of Beverage and Snack Food Industry in India

11. a) Explain MOFPI.

**(OR)**

b) Write about APEDA.

12. a) Write about Convenience Foods in detail.

**(OR)**

b) Explain Functional Foods in detail.

13. a) What are different Developmental Programmes and Strategies adopted to eliminate food losses?

**(OR)**

b) Write about Global Demand for Food. Write about Scope for Future Expansion of Food Industry in India and Abroad.

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**I Year Semester – I**

**FUNDAMENTALS OF FOOD MICROBIOLOGY**

**UNIT-I:** Cultivation of bacteria, nutritional requirement, Nutritional classification of bacteria, Physical conditions required for growth, growth of bacteria, normal growth curve, yeast, morphological characteristics. Algae - Protozoa- Destruction of micro organisms – control of micro organisms by chemical agents.

**UNIT-II:** History of Food Microbiology - important micro-organisms associated with foods – mould, yeast and bacteria, micro-organisms in natural food products, Microbes used in food biotechnology,

**UNIT-III:** Extrinsic and intrinsic parameters affecting growth and survival of microbes, chemical changes caused by microorganisms, Organic acids, other compounds, lipids, pectic substances.

**UNIT-IV:** Food Spoilage – Contaminants of various foods stuffs – vegetables, cereals, pulses, oilseeds, milk, meat, egg and poultry during handling and processing.

**UNIT-V:** Principles of food preservation, methods of food preservation, application in food preservation, preservation by use of low temperatures, growth of microorganisms at low temperatures, chilling or cold storage, frozen storage, sharp freezing and quick freezing, changes during freezing.



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**I Year Semester – I**

**FUNDAMENTALS OF FOOD MICROBIOLOGY (PRACTICAL)**

1. Microscope demonstration.
2. Preparation of bacterial smears, staining – simple differential staining of spore, molds & Yeast
3. Sterilization and inoculation techniques.
4. Preparation of different nutrient media for cultivation of bacteria, yeast and molds.
5. Isolation of micro organisms – Pour plate methods, spread plate and streak plate methods.
6. Morphological identification of important molds, yeasts in foods (Slides and Cultures).

**Text Book**

P Tauro K. K. Japur and K.S. Yadav, An Introduction to Microbiology, Wiley Eastern Limited

**Books for Reference**

1. P Tauro K. K. Japur and K.S. Yadav, An Introduction to Microbiology, Wiley Eastern Limited, New Delhi.
2. C.B. Power and H.F. Dagainawala, General Microbiology, Himalaya Publishing House, Bombay.
3. Frazier, W.C. and Westhoff, D.C. IV Edn., Food Microbiology, Mc Graw Hill Inc, New Delhi, 1988.
4. Adam, M.R and Moss M.O, Food Microbiology, New Age International Pvt. Ltd, New Delhi.
5. Frazer, Math and Deibel, Laboratory Manual for Food Microbiology, Burgers Publishers, Minnesota, USA.

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**I Year Semester – I**

**FUNDAMENTALS OF FOOD MICROBIOLOGY**

Time: 3 Hours

Maximum: 75 Marks

**SECTION – A**

Answer any **FIVE** questions. Each question carries equal marks. (5\*5 = 25)

1. Draw a neat sketch of Bacterial Growth Curve and explain in detail.
2. Write about Cultivation of Bacteria.
3. Write about Morphology of Yeasts.
4. How do you control Microbial Action in food by using chemical agents?
5. Write about Microbial Spoilage of Milk during handling and processing.
6. Explain Types of Freezing in detail.
7. Write about Methods of Food Preservation.
8. Write about Preservation of Foods at low temperature

**SECTION – B**

Answer **All** the questions. Each question carries **TEN** marks (5\*10 = 50)

9. a) Write in detail about Extrinsic and Intrinsic that effect the growth of Microbes.

**(OR)**

b) Write about usage of Microbes in Food Biotechnology.

10. a) Write about Microbial Spoilage pattern of Vegetables and Poultry.

**(OR)**

b) Write about Microbial Spoilage pattern of Cereals, Pulses and Oilseeds.

11. a) What is meant by Food Preservation? What are different methods for preserving foods?

**(OR)**

b) Explain Freezing of Foods in detail.

12. a) Define Bacteria. Write about Nutritional Requirement and Classification of Bacteria.

**(OR)**

b) Write in detail about Important Micro-organisms associated with foods.

13. a) Write about Microbial Food Spoilage in detail.

**(OR)**

b) Explain in detail about Yeast, Bacteria and Mould that invade foods during storage.

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**I Year Semester – I**

**FUNDAMENTALS OF FOOD CHEMISTRY**

**UNIT I:** Introduction to Food Chemistry, Approach to the study of Food Chemistry, biochemical changes in foods, moisture in foods, water activity and sorption isotherms, shelf life of foods, Hysteresis, colloidal state, colloidal solutions, classification of colloidal solutions, protective colloids and gold number.

**UNIT II:** Emulsions, classification of emulsions, Properties of emulsions, Gels, Types of Gels, properties of gels, food gels, introduction to the proximate composition of foods, official methods for the analysis of foods – AOAC, AACC, AOCS.

**UNIT -III:** Carbohydrates Introduction, Classification of Carbohydrates, structure and food sources, chemical properties in foods, functional properties of carbohydrates. Changes of carbohydrates on cooking, crude fiber, browning reactions in foods, application of stabilizers and thickeners in foods.

**UNIT -IV:** Lipids (Fats and Oils) Classification, Sources and Chemistry of lipids – physical properties and chemical properties in foods. Steps in manufacture of food fats. Role of fat and applications in food preparation, Shortenings, shortening value and factors affecting it.

**UNIT-V:** Selection of fats and oils, fat substitutes, Deterioration of fats/ oils, Rancidity, Tests for Rancidity, Reversion and Polymerization. Anti-oxidants natural and synthetic, their mechanism, Application of Enzymes in food industry, Anti-nutritional factors in foods.

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**I Year Semester – I**

**FUNDAMENTALS OF FOOD CHEMISTRY (PRACTICAL)**

1. Safety rules in the laboratory, first aid and introduction to the lab equipment and glassware.
2. Preparation of standard solutions, Buffers and determination of pH content in food samples.
3. Demonstrating the principles and applications of colorimeter and Spectrophotometer.
4. Verification of Beer's law by using Colorimeter.
5. Qualitative tests for the carbohydrates, Amino acids,
6. Determination of ash content of foods and preparation of mineral solution.
7. Determination of carbohydrate content in foods by Anthrone method.
8. Determination of reducing sugars by Nelson Somogyi's method.
9. Determination of saponification value of Fats/ oils.
10. Determination of FFA content in fats/ oils.

**Text Book**

Dr. Ling, H D Belitz, Dr. Ing, W. Grosch, Food Chemistry, Springer, New York, 1987.

**Books for Reference**

1. Dr. Ling, H D Belitz, Dr. Ing, W. Grosch, Food Chemistry, Springer, New York, 1987.
2. Braverman, Introduction to the Bio-Chemistry of Foods, Elsevier Scientific Publishing Company.
3. AOAC Methods for Food Analysis.
4. Meyer, Food Chemistry, AVI Publishing Company, USA 1983.
5. Sadasivam and Manickyam, Biochemical Methods, New Age International Publications, New Delhi, 1996.
6. John M. Deman, Principles of Food Chemistry, Springer International edition, Third edition, 2007.
7. Meenakshipaul, Experimental Food Chemistry, Published gene tech books New Delhi, 2012.
8. Fenema. R, Food Chemistry, Fourth edition, CRC Press Taylors and Francis group.
9. R.P.Srivastava and Sanjeev Kumar, Fruits and vegetables preservation, principles and practices, International Book Distribution Co. Third revised edition.

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**FUNDAMENTALS OF FOOD CHEMISTRY**

Time: 3 Hours

Maximum: 75 Marks

**SECTION – A**

Answer any **FIVE** questions. Each question carries equal marks. (5\*5 = 25)

1. Write about different Biochemical Changes that occur during food processing.
2. Give the Classification of Carbohydrates with examples.
3. Explain in detail about Proximate Composition of foods
4. Write a note on Manufacturing of Fats.
5. Write about different Tests for Rancidity.
6. Define colloids. Explain about Protective Colloids and Gold Number.
7. Explain in detail about AOAC.
8. Write a short note on Anti-oxidants.

**SECTION – B**

Answer **All** the questions. Each question carries **TEN** marks (5\*10 = 50)

9. a) Write in detail about Food Gels.

**(OR)**

- b) Write about Food Emulsions in detail.

10. a) Write about Food Colloids.

**(OR)**

- b) Explain about Moisture Sorption Isotherms in Foods.

11. a) Define Carbohydrates. Write about Properties of Carbohydrates.

**(OR)**

b) Write about Applications of Stabilizers and Thickeners in foods

12. a) Explain in detail about Lipids.

**(OR)**

b) Write about Anti-nutritional factors in foods.

13. a) Explain Deterioration of fats in detail.

**(OR)**

b) Write about Applications of Enzymes in food industry.

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**ON JOB TRAINING-1**

On Job Training provides students adequate experience in planning and managing an enterprise in totality starting from procurement of raw material to processing, production, packaging and storage of products, organizing resources and utilities, sale of products, maintain accounts and analyze profits. Finally, students will present their work along with a report of their performance. The Report should contain following.

**Developing a Business Plan/ Project Proposal**

- i Identification of the product to be manufactured
- ii Market Survey
- iii Analysis of the existing status of the identified product and targeted market and customer
- iv Innovativeness and Creativity
- v Preparation of the project proposal with supply chain of inputs, personnel plan, production plan, finance plan, etc. and its preparation

**Plan for the Production**

- i Organization of resources
- ii Organizing utility
- iii Sequential grouping of activities
- iv Packaging and storage
- v Product pricing – physical inputs, man-hours, depreciation, etc.
- vi Time management

**Production**

- i Regularity in production
- ii Adhering to production plan
- iii Product quality assessment
- iv Maintenance of production records
- v Team work

**Sales**

- i Sales strategy
- ii Sales volumes
- iii Assessment of sales performance
- iv Profit generated including C/B ratio, payback period, etc.

**Documentation and Report Presentation &**

- Evaluation** ii Personnel Management
- ii Preparation of final report & Oral performance



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**ENGLISH COMMUNICATION SKILLS - II**

CSS 02 aims at improving the speaking skills of the learner. For many learners of English, the sound-spelling relationship of the language appears an archaic. Another problem many Indian learners face is English word accent. Unit I and Unit II help learners overcome these problems to a great extent. The remaining units are on the two productive skills, speaking and writing. The techniques of day-to-day conversations and the important characteristics of interviews and GDs presented in this course strengthen the learner's speaking skills. The last unit presents various aspects of presentation in writing.

**Unit I: Pronunciation - 1**

The Sounds of English

**Unit II: Pronunciation – 2**

1. Word Accent
2. Intonation

**Unit III: Speaking Skills -1**

1. Conversation Skills
2. Interview Skills
3. Presentation Skills
4. Public Speaking

**Unit IV: Speaking Skills -2**

1. Role Play
2. Debate
3. Group Discussion

## **Unit V: Writing Skills**

1. Spelling

2. Punctuation

3. Information Transfer

Tables

Bar Diagrams

Line Graphs

Pie Diagrams

Flow Charts

Tree Diagrams

Pictures

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**CHEMISTRY (PHYSICAL AND GENERAL CHEMISTRY)**

**PHYSICAL CHEMISTRY**

**UNIT-I**

**SOLID-STATE**

Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. The law of symmetry. Definition of lattice point, space lattice, unit cell. Bravis lattices and crystal systems. X-ray diffraction and crystal structure. Bragg's law. Defects in crystals. Stoichiometric and non-stoichiometric defects.

**UNIT-II**

**1. GASEOUS STATE**

Compression factors, deviation of real gases from ideal behavior. Vander Waal's equation of state. P-V Isotherms of real gases, Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. The Vander Waal's equation and the critical state. Law of corresponding states. Relationship between critical constants and Vander Waal's constants. Joule Thomson effect.

**2. LIQUID STATE**

Structural differences between solids, liquids and gases. Liquid crystals, the mesomorphic state. Classification of liquid crystals into Smectic and Nematic. Differences between liquid crystal and solid/liquid. Application of liquid crystals as LCD devices.

**UNIT-III**

**SOLUTIONS**

Liquid-liquid - ideal solutions, Raoult's law. Ideally dilute solutions, Henry's law. Nonideal solutions. Vapour pressure - composition and vapour pressure- temperature curves. Azeotropes- HCl-H<sub>2</sub>O, ethanol-water systems and fractional distillation. Partially miscible liquids-phenol-water, trimethylamine-water, nicotine-water systems. Effect of impurity on consolute temperature. Immiscible liquids and steam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

## **GENERAL CHEMISTRY**

### **UNIT-IV**

#### **1.SURFACE CHEMISTRY**

Definition of colloids. Solids in liquids(sols), preparation, purification, properties - kinetic, optical, electrical. Stability of colloids, Hardy-Schulze law, protective colloid. Liquids in liquids (emulsions) preparation, properties, uses. Liquids in solids (gels) preparation, uses. Adsorption: Physical adsorption, chemisorption. Freundlich, Langmuir adsorption isotherms. Applications of adsorption

#### **2.CHEMICAL BONDING**

Valence bond theory, hybridization, VB theory as applied to  $\text{ClF}_3$ ,  $\text{Ni}(\text{CO})_4$ , Molecular orbital theory - LCAO method, construction of M.O. diagrams for homonuclear and hetero-nuclear diatomic molecules ( $\text{N}_2$ ,  $\text{O}_2$ ,  $\text{CO}$  and  $\text{NO}$ ).

### **UNIT-V**

#### **STEREOCHEMISTRY OF CARBON COMPOUNDS**

Molecular representations- Wedge, Fischer, Newman and Saw-Horse formulae. Optical isomerism: Optical activity- wave nature of light, plane polarised light, optical rotation and specific rotation. Chiral molecules- definition and criteria(Symmetry elements)- Definition of enantiomers and diastereomers – Explanation of optical isomerism with examples Glyceraldehyde, Lactic acid, Alanine, Tartaric acid, 2,3-dibromopentane. D,L and R,S configuration methods and E,Z- configuration with examples.

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**CHEMISTRY (GENERAL AND PHYSICAL CHEMISTRY) ( PRACTICAL )**

Analysis of Mixture Salt

(At the end of Semester-II)

**Qualitative inorganic analysis**

Analysis of mixture salt containing two anions and two cations (From two different groups) from the following:

**Anions:** Carbonate, sulphate, chloride, bromide, acetate, nitrate, borate, phosphate.

**Cations:** Lead, copper, iron, aluminum, zinc, manganese, calcium, strontium, barium, potassium and ammonium.

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**FOUNDATION COURSE – II**

**INFORMATION & COMMUNICATION TECHNOLOGY –1 (ICT-1)**

**Computer Fundamentals and Office Tools**

**Unit-I**

Basics of Computers :Definition of a Computer - Characteristics and Applications of Computers – Block Diagram of a Digital Computer – Classification of Computers based on size and working – Central Processing Unit – I/O Devices.

**Unit-II**

Primary, Auxiliary and Cache Memory – Memory Devices. Software, Hardware, Firmware and People ware – Definition and Types of Operating System – Functions of an Operating System – MS-DOS – MS Windows – Desktop, Computer, Documents, Pictures, Music, Videos, Recycle Bin, Task Bar – Control Pane.

**Unit-III**

**MS WORD**

Features of MS-Word – MS-Word Window Components – Creating, Editing, Formatting and Printing of Documents – Headers and Footers – Insert/Draw Tables, Table Auto format – Page Borders and Shading – Inserting Symbols, Shapes, Word Art, Page Numbers, Equations – Spelling and Grammar – Thesaurus – Mail Merge

**Unit-IV**

**MS-PowerPoint**

Features of PowerPoint – Creating a Blank Presentation - Creating a Presentation using a Template - Inserting and Deleting Slides in a Presentation – Adding Clip Art/Pictures - Inserting Other Objects, Audio, Video - Resizing and Scaling of an Object – Slide Transition – Custom Animation

## **Unit-V**

### **MS-Excel**

Overview of Excel features – Creating a new worksheet, Selecting cells, Entering and editing Text, Numbers, Formulae, Referencing cells – Inserting Rows/Columns –Changing column widths and row heights, auto format, changing font sizes, colors, shading.

### **Text Book**

Fundamentals of Computers by ReemaThareja, Publishers : Oxford University Press, India

### **Books for Reference**

1. Fundamentals of Computers by ReemaThareja, Publishers : Oxford University Press, India
2. Fundamentals of Computers by V.Raja Raman, Publishers : PHI
3. Microsoft Office 2010 Bible by John Walkenbach, Herb Tyson, Michael R.Groh and Faithe Wempen, Publishers : Wiley

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**I Year Semester - II**

**BIOCHEMISTRY**

**Unit - 1**

Introduction - Importance of biochemistry - Scope and history of biochemistry. Carbohydrates Definition of carbohydrates, functions, classification of carbohydrates - Carbohydrates physical properties - Isomerism, Structural isomerism, Stereoisomerism, optical isomerism, Enantiomers, Anomers, Mutarotation, Epimers, Chemical properties of carbohydrates - Dehydration, oxidation, reduction, formation of esters, amination, glucoside formation, formation of osazones, cyano hydrine reaction, oximes formation

**Unit - 2**

Amino acids - occurrence - classification - Protein and non-protein amino acids – essential and non essential amino acids - classification based on Hydrophobicity of R-side chain groups, based on the structure, based on the polarity, based on the nutritional and metabolic rate, Chemical properties of amino acids - Ninhydrin - peptide bond reaction - decarboxylation Schiff base formation - Transamination - oxidative and non - oxidative deamination - sangersreagent - Edmans reagent - Dansyl chloride test, Structure of proteins and forces involved in the stabilizing proteins, Classification of proteins - based on solubility, function, properties of proteins - U.V.absorption Denaturation, Renaturations and immune reaction, Purification techniques of proteins - salting in, salting out, Gel filtration, Ion exchange chromatography

**Unit – 3**

Enzymes - Characteristics of enzymes, chemical nature, specificity, active site and mechanism of action - Lock and key model, Induced fit model, Measurement of enzymatic activity, factors affecting enzymes activity, Enzymatic inhibitions, Iso enzymes, co-enzymes, halo enzymes, prosthetic group, classification and Nomenclature of enzymes



#### **Unit – 4**

Lipids - Occurrence - Classification, functions and structures of saturated and unsaturated fatty acids, importance of essential fatty acids, Chemical properties of fatty acids Rancidity, saponification, Iodine number, Reichart Meissel number, acid value, Nucleic acids - functions, structure of Nitrogen bases, Nucleosides and Nucleotides - ATP, GTP, CTP, UTP, TTP, Secondary structure of DNA, Various types of DNA and RNA, Metabolism - Anabolism - Catabolism - stages of respiration, overall metabolic view of carbohydrate, protein and lipids

#### **Unit -5**

Glycolysis and its energetic, TCA cycle and its energetic, Gluconeogenesis, Glycogen metabolism - Glycogenesis, Glycogenolysis, Hexose mono phosphate pathway, Metabolism of lipids - Anabolism of saturated fatty acids, unsaturated fatty acid, Catabolism of lipids - Triacyl glycerols and  $\omega$  - oxidation of fatty acids in brief and  $\beta$  - oxidation in detail. Vitamins - Occurrence, chemistry and structure of vitamins, Metabolic functions of fat, Bio chemical functions of vitamins, Biochemical functions of Minerals.

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**I Year Semester - II**

**BIOCHEMISTRY PRACTICAL**

1. Safety measures in the laboratory
2. Preparation of standard acid, and alkali solutions
3. Quantitative tests for peptide bonds and proteins (Biuret test & Folin - Lowry test)
4. Precipitation of proteins with heavy metals, acidic reagents, organic solvents, salting out of proteins.
5. Qualitative test for lipids - Solubility test ,Translucency test, Emulsification test, litmus and Saponification test
6. Test for glycerol and Test for cholestrol
7. Qualitative tests for RNA (Orcinol test, Phosphate test)
8. Qualitative tests for DNA (Diphenylamine test, phosphate test)
9. Isolation of RNA from Plant sample
10. Separation of Amino Acids by paper chromatography

**Text Book**

Lehninger, A.L., Nelson, D.A and Cox, M.M. 2005. Principles of Biochemistry. CBS Publishers and Distributors, Delhi.

**Books for Reference**

Buchanan, B.B., Gruissem, W. and Jones, R.L. 2002. Biochemistry and Molecular Biology of Plants. John Wiley and Sons, UK.

Conn, E.E., Stumpf, P.K., Bruening, G. and Doi, R.H. 1995. Outlines of Biochemistry. John Wiley and Sons Inc., Singapore.

Jayaraman, J. 1980. Laboratory Manual in Biochemistry. Wiley Eastern Publishers, New Delhi.

Lehninger, A.L., Nelson, D.A and Cox, M.M. 2005. Principles of Biochemistry. CBS Publishers and Distributors, Delhi.

Plummer, D.T. 1979. An introduction to Practical Biochemistry. Tata McGraw-Hill Publishing Co., New Delhi.

Rameshwar, A. 2006. Practical Biochemistry. Kalyani Publishers, Ludhiana

Sadasivam, S. and Manickam, A. 1996. Biochemical methods for Agricultural Sciences.  
New Age International Publisher, New Delhi

Stryer, L.2005. Biochemistry. W.H.Freeman and Company, New York.

Voet, D. and Voet, J.G. 2004. Biochemistry. John Wiley and Sons Inc., USA.

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**I Year Semester – II**

**BIOCHEMISTRY**

Time: 3 Hours

Maximum: 75 Marks

**SECTION – A**

Answer any **FIVE** questions. Each question carries equal marks. (5\*5 = 25)

14. Classify Carbohydrates.
15. Write a short note on chemical properties of Amino acids.
16. Write about Classification of proteins.
17. Explain in detail about Factors effecting enzyme activity.
18. Write about chemical properties of lipids.
19. Explain TCA cycle.
20. Write about gluconeogenesis.
21. Write about Glycogenesis.

**SECTION – B**

Answer **All** the questions. Each question carries **TEN** marks (5\*10 = 50)

22. a) Write in detail about classification, properties and functions of Carbohydrates.

**(OR)**

- b) Write about Proteins classification and properties

23. a) Discuss Food enzymes and their mechanism of action

**(OR)**

b) What is Glycolysis? Explain in detail.

24. a) Explain Structure of DNA and RNA.

**(OR)**

b) Write a note on vitamins, Functions and Occurrence.

25. a) Write about biochemical functions of vitamins

**(OR)**

b) Explain Catabolism in detail.

26. a) What are different biochemical functions of minerals.

**(OR)**

b) Classify proteins and explain purification techniques of proteins

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**I Year Semester – II**

**FOOD MICROBIOLOGY**

**UNIT -1**

Microbial spoilage of foods. Cause of spoilage classification of foods by ease of spoilage. Factors affecting kinds and numbers of microorganisms in food. Factors affecting growth and survival of microorganisms in foods. Chemical changes caused by microorganisms - changes in nitrogenous organic compounds, non-nitrogenous organic compounds, organic acids, other compounds. Contamination of Foods. Sources of contamination. Green plants and Fruits, Animals, Sewage, Soil, Water, Air. Microorganisms importance in Food Microbiology Asepsis, removal of Micro organisms. Maintenance of Anaerobic conditions. Food Preservation by use of high temperature. Factors affecting heat resistance (Thermal death time). Heat resistance of Microorganisms and their spores. Determination of heat resistance. Heat penetration - Pasteurization, canning.

**UNIT -2**

Preservation by drying, methods of drying. Treatments of foods before drying. Procedure after drying. Microbiology of dried foods. Intermediate moisture foods. Preservation by food additives - The ideal antimicrobial preservatives. nitrites and nitrates, sulfur dioxide and sulfites. Ethylene and propylene oxide, sugar and salt Preservation by Food Additives - Alcohol, formaldehyde, wood smoke, spices and other condiments and other additives. Other groupings of chemical agents, antibiotics, developed preservatives. Food Preservation by Radiation - U.V. Radiation, ionizing radiations, definition of terms, xrays, gamma rays and cathode rays, Microwave processing. High pressure processing, Pascalization. Microbiology of milk and milk products. Contamination, preservation, pasteurization and ultra pasteurization, vat pasteurization. Vacreation, use of low temperatures, freezing, drying.

**UNIT -3**

Spoilage of milk and cream, gas production proteolysis, ropiness, changes in milk fat. Alkali production. Flavor changes & colour changes. Spoilage of milk at different temperatures. Condensed and dry milk products. Flavour defects, color defects. Microbiology of fruits and vegetables, contamination, preservation of vegetables, asepsis. chilling, freezing, drying, preservatives, CA storage, MA storage. Spoilage of fruits and vegetables. Microbiology of cereal and cereal products contamination, preservation and spoilage of flours Microbiology of cereal and cereal products. Spoilage-Bread, Mold, Rope, Red bread, Chalky Bread

#### **UNIT -4**

Microbiology of Meat and Meat Products. Contamination, preservation. Spoilage of meat and meat products. Invasion of tissues by microorganisms and growth of microorganisms in meat. General types of spoilage of meats. Spoilage under anaerobic conditions, spoilage of different kinds of meats. Microbiology of fish and other sea foods. Contamination, preservation, spoilage. Factors influencing kind and rate of spoilage, evidences of spoilage, bacteria causing spoilage. Microbiology of poultry and eggs. Contamination, preservation, spoilage. Changes during storage. Changes not caused by microorganisms and changes caused by microorganisms

#### **UNIT-5**

Microbiology of sugar and sugar products. Sources of contamination, spoilage and Prevention. Microbiology of salts and spices, sources of contamination, spoilage and prevention, fatty foods and rancidity. Microbiology of canned foods. Causes of spoilage, appearance of the unopened container, types of biological spoilage of canned foods. Flat sour spoilage, TA spoilage, sulfide spoilage. Types of spoilage of canned foods by bacteria, yeasts, molds. Spoilage of canned meat and fish

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**I Year Semester – II**

**FOOD MICROBIOLOGY ( PRACTICAL )**

1. Isolation of molds from foods
2. Microbial examination of cereal and cereal Products – Identification, Isolation - I
3. Microbial examination of vegetable and fruits – Identification, Isolation - I
4. Microbial examination of meat and meat products – Identification, Isolation - I
5. Microbial examination of fish and other sea foods – Identification, Isolation - I
6. Microbial examination of Eggs – Identification, Isolation – I
7. Microbial examination of poultry – Identification, Isolation – I
8. Microbial examination of milk and milk products – Identification, Isolation - I
9. Microbial examination of sugar, salts and spices – Identification, Isolation - I
10. Thermal Death Time determination

**Text Book**

Frazer, Math and Deibel, Laboratory Manual for Food Microbiology, Burgers Publishers –  
Minnesota, USA.

**Books for Reference**

G.L. Ganwart (1987), Basic Food Microbiology, AVI Publishing Co. Inc., USA. Frazier and  
Wes Uobb.

Adam M R and Moss M.O., Food Microbiology, New Age International (P) Ltd., Publishers,  
New Delhi.

Frazer, Math and Deibel, Laboratory Manual for Food Microbiology, Burgers Publishers –  
Minnesota, USA.

Carlvan Derzant and Splittsoessev, Methods for Microbial Examination of Foods, APHA  
Publishers, Washington DC, USA.



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**I Year Semester – II**

**FOOD MICROBIOLOGY**

Time: 3 Hours

Maximum: 75 Marks

**SECTION – A**

Answer any **FIVE** questions. Each question carries equal marks. (5\*5 = 25)

1. Write about chemical changes that occur in foods due to microbial action.
2. Write a note on TDT.
3. Write about IM Foods.
4. Discuss pasteurization of foods.
5. Differentiate CA and MA storage.
6. Explain different flavour detects in milk.
7. Write a short note on food preservation by radiation.
8. Discuss Microbial spoilage of Bread.

**SECTION – B**

Answer **All** the questions. Each question carries **TEN** marks (5\*10 = 50)

9. a) Write in detail about Microbiology of Cereal Products.  
(OR)  
b) Discuss CA and MA storage for foods.
10. a) Write a note on Microbiology of Meat & Meat Products.  
(OR)  
b) Explain about Microbiology of Fish and fish products

11. a) Discuss Microbiology of canned foods.

**(OR)**

b) Write about Microbiology of Sugar and related foods.

12. a) Write about Microbiology of Milk and Cream.

**(OR)**

b) Explain HPP and Pascalization

13. a) Write about Preservation of foods by High temperature.

**(OR)**

b).Discuss Preservation by Food additives in detail.

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**I Year Semester – II**

**PRINCIPLES OF FOOD PRESERVATION**

**UNIT -1**

Scope - Principles of Food Science and Technology - Introduction - Definitions of Food, Food Science and Technology - introduction to other relevant terms pertaining to Food Technology. Food Classification. Food Spoilage-types- factors affecting spoilage - Definition of Food Spoilage - Major types of food spoilage including micro biological - Bio-chemical, physical and enzymatic spoilage (Bio-chemical spoilage). Factors affecting food spoilage - Extrinsic: Temperature- RH- O<sub>2</sub>, CO<sub>2</sub>; Intrinsic - pH – Moisture content- aw, Chemical nature - oxidation reduction potential - physical structure - available nutrients -presence of anti microbial agents. General Principles of Food Preservation - Physical Methods - Chemical Methods -Fermentation - Other Methods

**UNIT -2**

Different processing methods of food - Objectives of Cooking - Cooking methods – Moist heat - dry heat and combination method. Preservation by Thermal Processing - Blanching - Pasteurization-types-equipment -Sterilization. Preservation by canning - different unit operations involved in canning-equipment used in canning- types of canning containers. Use of low temperatures - Types of cold preservation - Chill storage - Procedure of low Temperature storage - types of freezing equipment used. Various changes occurring during freezing and thawing - methods of food freezing – Quick fast freezing and slow freezing-factors affecting storage

**UNIT -3**

Drying / Dehydration - Definition of drying - Advantages of dried foods - Sun drying - Mechanical dehydration - Direct heated driers - Indirect heated driers - Cabinet driers -Tunnel drier - Drum Drier - Fluidized Bed Drier - Spray Drier. Factors affecting dehydration of food- Dehydration - methods of dehydration-advantages & disadvantages of dehydration. Changes in constituents of Food materials - Shrinkage, case hardening - Thermo plasticites- Reconstitution properties - Thin layer drying – Deep Bed Drying

## **UNIT -4**

Flash Evaporator - Freeze Concentration - Ultra Filtration and reverse osmosis. Preservation by radiation - Food irradiation - What is food irradiation - Forms of energy -Ionizing radiation and sources - Units of radiation - Effects of radiation. Irradiation doses for treating foods - Mechanism underlying Irradiation-Advantages- Disadvantages. Preservation by Chemicals - Introduction - Class I Preservatives - Class II Preservatives -Safe limits of usage. Preservation by mould inhibitors, antibiotics, acidulants - Antioxidants - Antibiotics – Mould inhibitors - Parabens - Epoxides - Benzoic acid - Propionic Acid.

## **UNIT -5**

Preservation by fermentation - Definition - Some industrial fermentation in food industries. Recent methods in preservation : Pulsed electric field processing - principle - equipment - Mechanism - effect on quality - advantages – disadvantages. High pressure processing - principle - equipment - Mechanism - effect on quality - advantages- disadvantages. Processing using ultrasound - Principle - equipment - mechanism - effect on food quality. Dielectric and Ohmic heating - Principle - equipment - mechanism - effect on food quality. Infrared heating - Theory - equipments - effect on food quality

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**PRINCIPLES OF FOOD PRESERVATION ( PRACTICAL )**

1. Study of storage structures
2. A visit to the nearby warehouse
3. Different processing methods used in food preparation & changes in food
4. Preservation of foods using high concentration of sugar
5. Preservation of food using Salt
6. Preservation of food using Acid.
7. Preservation of foods by different drying /dehydration methods and reconstitution of foods by dehydration methods.
8. Methods of processing of foods using different temperatures-Dry heat methods
9. Methods of processing of foods using different temperatures-moist methods
10. Preservation of foods by fermentation.

**Text Book**

Shakuntala manay and Shadakshar Swamy. Foods, Facts and Principles. New Age Publishers, New Delhi.

**Books for Reference**

Giridhar Lal, Siddappa G.S and Tandon G.L. Preservation of Fruits and Vegetables. ICAR, New Delhi.

Norman N. Potter .Text Book of Food Science.CBS publishers, New Delhi.

Joseph Hotchis.F.Food Processing Technology .CRC publishers.

Fellows. J.P. Food Processing Technology, Principles and Practices II Edition. Wood Head Publishing, Cambridge.

Vijayakhadar. Text Book on Food Storage and Preservation. Kalyani publishers, Delhi.

Srilakshmi. B. Food Science. New Age Publishers, New Delhi.

Shakuntala manay and Shadakshar Swamy. Foods, Facts and Principles. New Age Publishers,  
New Delhi.

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**I Year Semester - II**

**PRINCIPLES OF FOOD PRESERVATION**

Time: 3 Hours

Maximum: 75 Marks

**SECTION – A**

Answer any **FIVE** questions. Each question carries equal marks. (5\*5 = 25)

1. Write about types of food spoilage.
2. Write about blanching and sterilization of foods.
3. Write about Canning of Foods.
4. Explain in detail about Fluidized bed dryer.
5. Write about Class I Preservatives.
6. Explain HPP.
7. Write about Infra Red heating.
8. Write about Irradiation.

**SECTION – B**

Answer **All** the questions. Each question carries **TEN** marks (5\*10 = 50)

9. a) Write in detail about preservation by Thermal processing.  
(OR)  
b) Write about Dehydration of foods.
10. a) Explain Class –I and Class – II preservatives.  
(OR)  
b) Explain Drying and Dehydration Phenomenon in foods.

11. a) Explain MOFPI.

**(OR)**

b) Write about APEDA.

12. a) Write about PEF and HPP Processing of Foods

**(OR)**

b) Explain different steps in Canning of Foods

13. a) Write about Dielectric heating and ohmic heating in detail.

**(OR)**

b) Write about different changes seen in foods during freezing and thawing



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**I Year Semester – II**

**ON JOB TRAINING –II**

On Job Training provides students adequate experience in planning and managing an enterprise in totality starting from procurement of raw material to processing, production, packaging and storage of products, organizing resources and utilities, sale of products, maintain accounts and analyze profits. Finally, students will present their work along with a report of their performance. The Report should contain following.

**Developing a Business Plan/ Project Proposal**

- I Identification of the product to be manufactured
- ii Market Survey
- iii Analysis of the existing status of the identified product and targeted market and customer
- iv Innovativeness and Creativity
- v Preparation of the project proposal with supply chain of inputs, personnel plan, production plan, finance plan, etc. and its preparation

**Plan for the Production**

- i Organization of resources
- ii Organizing utility
- iii Sequential grouping of activities
- iv Packaging and storage
- v Product pricing – physical inputs, man-hours, depreciation, etc.
- vi Time management

## **Production**

- i Regularity in production
- ii Adhering to production plan
- iii Product quality assessment
- iv Maintenance of production records
- v Team work

## **Sales**

- i Sales strategy
- ii Sales volumes
- iii Assessment of sales performance
- iv Profit generated including C/B ratio, payback period, etc.

## **Documentation and Report Presentation & Evaluation**

- ii Personnel Management
- ii Preparation of final report
- iii Oral performance

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**II Year Semester – III ENGLISH**

**COMMUNICATION SKILLS – III**

A current axiom is that hard skills will get a person an interview, but soft skills will get that person the job. Unit I of the course is on soft skills, which are absolutely necessary in the global job market. Writing is considered the most difficult of all the skills. Units II to V help the learner improve their writing skills, especially academic/formal writing.

**Unit I: Soft Skills**

1. Positive Attitude
2. Body Language
3. SWOT/SWOC Analysis
4. Emotional Intelligence
5. Netiquette

**Unit II: Paragraph Writing**

1. Paragraph Structure
2. Development of Ideas

**Unit III: Paraphrasing and Summarizing**

1. Elements of Effective Paraphrasing
2. Techniques for Paraphrasing
3. What Makes a Good Summary?
4. Stages of Summarizing

**Unit IV: Letter Writing**

1. Letter Writing (Formal and Informal)
2. E-correspondence

**Unit V:**

1. Resume and CV
2. Cover Letter

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**II Year Semester – III ORGANIC**

**AND INORGANIC CHEMISTRY**

**INORGANIC CHEMISTRY**

**UNIT – I**

**1. Chemistry of d-block elements:**

Characteristics of d-block elements with special reference to electronic configuration, variable valence, magnetic properties, catalytic properties and ability to form complexes. Stability of various oxidation states.

**2. Theories of bonding in metals:**

Metallic properties and its limitations, Valence bond theory, Free electron theory, Explanation of thermal and electrical conductivity of metals, limitations, Band theory, formation of bands, explanation of conductors, semiconductors and insulators.

**UNIT – II**

**1. Metal carbonyls :**

EAN rule, classification of metal carbonyls, structures and shapes of metal carbonyls of V, Cr, Mn, Fe, Co and Ni.

**2. Chemistry of f-block elements:**

Chemistry of lanthanides - electronic structure, oxidation states, lanthanide contraction, consequences of lanthanide contraction, magnetic properties. Chemistry of actinides - electronic configuration, oxidation states, actinide contraction, comparison of lanthanides and actinides, separation of lanthanides by ion exchange method and solvent extraction method.

**ORGANIC CHEMISTRY**

**UNIT – III**

**1. Halogen compounds**

Nomenclature and classification of alkyl (into primary, secondary, tertiary), aryl, aryl alkyl, allyl, vinyl, benzyl halides. Nucleophilic aliphatic substitution reaction-classification into  $SN^1$  and  $SN^2$  – reaction mechanism with examples – Ethyl chloride, t-butyl chloride and optically active alkyl halide 2-bromobutane.

## 2. Hydroxy compounds

Nomenclature and classification of hydroxy compounds. Alcohols: Preparation with hydroboration reaction, Grignard synthesis of alcohols. Phenols: Preparation i) from diazonium salt, ii) from aryl sulphonates, iii) from cumene. Physical properties-Hydrogen bonding (intermolecular and intramolecular). Effect of hydrogen bonding on boiling point and solubility in water. Identification of alcohols by oxidation with  $\text{KMnO}_4$ , Ceric ammonium nitrate, Luca's reagent and phenols by reaction with  $\text{FeCl}_3$ .

Chemical properties:

- a) Dehydration of alcohols.
- b) Oxidation of alcohols by  $\text{CrO}_3$ ,  $\text{KMnO}_4$ .
- c) Special reaction of phenols: Bromination, Kolbe-Schmidt reaction, Riemer-Tiemann reaction, Fries rearrangement, azocoupling, Pinacol-Pinacolone rearrangement.

## UNIT-IV

### Carbonyl compounds

Nomenclature of aliphatic and aromatic carbonyl compounds, structure of the carbonyl group. Synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties: Reactivity of carbonyl group in aldehydes and ketones.

Nucleophilic addition reaction with a)  $\text{NaHSO}_3$ , b)  $\text{HCN}$ , c)  $\text{RMgX}$ , d)  $\text{NH}_2\text{OH}$ , e)  $\text{PhNHNH}_2$ , f) 2,4 DNPH, g) Alcohols-formation of hemiacetal and acetal. Base catalysed reactions: a) Aldol, b) Cannizzaro's reaction, c) Perkin reaction, d) Benzoin condensation, e) Haloform reaction, f) Knoevenagel reaction. Oxidation of aldehydes-Baeyer-Villiger oxidation of ketones. Reduction: Clemmensen reduction, Wolf-Kishner reduction, MPV reduction, reduction with  $\text{LiAlH}_4$  and  $\text{NaBH}_4$ . Analysis of aldehydes and ketones with a) 2,4-DNPH test, b) Tollen's test, c) Fehling test, d) Schiff's test

e) Haloform test (with equation)

## UNIT-V

### 1. Carboxylic acids and derivatives

Nomenclature, classification and structure of carboxylic acids. Methods of preparation by a) Hydrolysis of nitriles, amides b) Hydrolysis of esters by acids and bases with mechanism c) Carbonation of Grignard reagents. Special methods of preparation of aromatic acids by a) Oxidation of side chain. b) Hydrolysis by benzotrichlorides.

c) Kolbe reaction. Physical properties: Hydrogen bonding, dimeric association, acidity-strength of acids with examples of trimethyl acetic acid and trichloroacetic acid. Relative differences in the acidities of aromatic and aliphatic acids. Chemical properties: Reactions involving H, OH and COOH groups- salt formation, anhydride formation, acid chloride formation, amide formation and esterification (mechanism). Degradation of carboxylic acids by Huns-Diecker reaction, decarboxylation by Schimdt reaction, Arndt- Eistert synthesis, halogenation by Hell- Volhard- Zelinsky reaction.

## 2. Active methylene compounds

**Acetoacetic ester:** keto-enol tautomerism, preparation by Claisen condensation, Acid hydrolysis and ketonic hydrolysis.

Preparation of

a) monocarboxylic acids.

b) Dicarboxylic acids. c) Reaction with urea

**Malonic ester:** preparation from acetic acid. Synthetic applications: Preparation of

a) monocarboxylic acids (propionic acid and n-butyric acid). b) Dicarboxylic acids (succinic acid and adipic acid) c)  $\alpha,\beta$ -unsaturated carboxylic acids (crotonic acid).

d) Reaction with urea.

## Text Book

1. A Text Book of Organic Chemistry by B.S. Bahl and Arun Bahl

## List of Reference Books

2. Selected topics in inorganic chemistry by W.D.Malik, G..D.Tuli,R.D.Madan

3. Inorganic Chemistry J E Huheey, E A Keiter and R L Keiter

4. A Text Book of Organic Chemistry by B.S. Bahl and Arun Bahl

5. A Text Book of Organic chemistry by Vol I by I.L. Finar Vol I

6. Organic chemistry by Bruice

7. Organic chemistry by Clayden

8. Advanced Inorganic chemistry by Gurudeep Raj

9. Basic Inorganic Chemistry by Cotton and Wilkinson

10. Concise Inorganic Chemistry by J.D.Lee

**ADIKAVI NANNAYA UNIVERSITY**  
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**II Year Semester – III**

**ORGANIC AND INORGANIC CHEMISTRY (PRACTICAL)**

**Practical -III: Titrimetric Analysis and Organic Functional Group Reactions**

**Titrimetric analysis**

1. Determination of Fe (II) using  $\text{KMnO}_4$  with oxalic acid as primary standard.
2. Determination of Cu(II) using  $\text{Na}_2\text{S}_2\text{O}_3$  with  $\text{K}_2\text{Cr}_2\text{O}_7$  as primary standard.

**Organic Functional Group Reactions**

3. Reactions of the following functional groups present in organic compounds:  
(at least four) Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids and Amides

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**FOUNDATION COURSE – III (ICT-II)**

**INFORMATION & COMMUNICATION TECHNOLOGY -2 (ICT -2)**

**Unit I:**

Fundamentals of Internet : Networking Concepts, Data Communication – Types of Networking, Internet and its Services, Internet Addressing – Internet Applications – Computer Viruses and its types – Browser –Types of Browsers.

**Unit II:**

Internet applications: Using Internet Explorer, Standard Internet Explorer Buttons, Entering a Web Site Address, Searching the Internet.

Introduction to Social Networking: Twitter, LinkedIn, Facebook, Flickr, Skype, Yahoo!, Google+, Youtube, WhatsApp, etc.

**Unit III:**

E-mail: Definition of E-mail - Advantages and Disadvantages – User Ids, Passwords, Email Addresses, Domain Names, Mailers, Message Components, Message Composition, Mail Management, Email Inner Workings.

**Unit IV:**

WWW- Web Applications, Web Terminologies, Web Browsers, URL – Components of URL, Searching WWW – Search Engines and Examples

**Unit V:**

Basic HTML: Basic HTML – Web Terminology – Structure of a HTML Document – HTML, Head and Body tags – Semantic and Syntactic Tags – HR, Heading, Font, Image and Anchor Tags –Different types of Lists using tags – Table Tags, Image formats – Creation of simple HTML Documents.

**Reference Books**

1. In-line/On- line: Fundamentals of the Internet and the World Wide Web, 2/e – by Raymond Green law and Ellen Hepp, Publishers:



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**II Year Semester - III**

**FOOD CHEMISTRY OF MACRO NUTRIENTS**

**Unit -1**

Food chemistry - Definition, Introduction, Importance and History of Food Chemistry, Humectants - Role of Humectants in enhancing the shelf life of foods. Dispersed systems of foods - Sols - Types of sols, lyophilic sols, lyophobic sols, Preparation, purification and Properties of sols. Foam - Formation and structure. Starch - Starch granules, Granule gelatinization (Gelatinization of starch), Hydrolysis of starch. Functional properties of sugars

**Unit – 2**

Pure proteins of plant and animal origin with their functional characteristics. Plant proteins - cereal proteins, tuber proteins and pulse storage proteins. Milk proteins - Casein, whey proteins and colostrums. Egg proteins - Egg white proteins, Egg yolk proteins

**Unit-3**

Lipids - Introduction - Fatty acids, Acylglycerols, Phospholipids. Classification of edible fats - Milk fats, lauric acids, vegetable butters, oleic-Linoleic acids, linolenic acids, Animal fats, Marine oils. Physical aspects of lipids - Crystallization, Consistency. Chemical aspects of lipids - Lipolysis, Auto-oxidation, Thermal decomposition, polymerization. Edible fats and oils - Melting properties, chemical properties.

**Unit-4**

Technology of edible fats and oils - Rendering, pressing, solvent extraction. Chemistry of fat and oil processing : Refining, Hydrogenation, Interesterification. Frying technology of edible fats and oils - Chemistry of frying, Behaviour of frying oil. Behaviour of food during frying, chemical and physical changes, Tests for assessing the quality of frying oils

**Unit-5**

Rancidity and its types, detection techniques. Enzymes in food industry - Carbohydrases- Amylases, pectinolytic enzymes, cellulases and hemicellulases. Proteases - Endopeptidases, Metallo peptidases. Lipid hydrolyzing enzymes - Lipases, Phospholipases. Chemical reactions of interest to food processing

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**II Year Semester - III**

**FOOD CHEMISTRY OF MACRO NUTRIENTS (PRACTICAL)**

1. Determination of moisture content in foods.
2. Determination of total carbohydrate content in foods
3. Determination of reducing sugars in foods
4. Determination of enzymatic and non-enzymatic browning in foods
5. Determination of protein in foods by kjeldhal method
6. Determination of protein in foods by folin – Lowry method
7. Determination of lipid content in foods by soxhlet apparatus
8. Determination of methionine in foods
9. Determination of selected amino acids in foods
10. Determination of saponification value of foods.

**Textbook**

Fenema O.R. Maraceladikllor, Food Chemistry – London.

**Books for Reference**

HD. Belitz, Dr.W.Grasch 1987, Food Chemistry – Spirigerverl, Newyork.

Fenema O.R. Maraceladikllor, Food Chemistry – London.

Food Chemistry - Meyer.

Harry H. Sisler, Calvin: A.Vander Werf. Food Chemistry

N.A. Michael Eskin Biochemistry of Foods 2nd edition.

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**FOOD CHEMISTRY OF MACRO NUTIRENTS**

Time: 3 Hours

Maximum: 75 Marks

**SECTION – A**

Answer any **FIVE** questions. Each question carries equal marks.

(5\*5 = 25)

27. Write about Food Sols
28. Discuss Gelatinization of Starch
29. Write about Plant proteins.
30. Explain Auto Oxidation of Foods
31. Write about Carbohydrates
32. Explain Refining process of oils.
33. Write about chemical properties of fats.
34. Write about Foam formation and structure.

**SECTION – B**

Answer **All** the questions. Each question carries **TEN** marks

(5\*10 = 50)

35. a) Write in detail about Milk and Egg proteins

**(OR)**

- b) Classify Edible fats and Exemplify them.

36. a) Discuss frying technology of edible fats and oils.

**(OR)**

- b) Write about proteases and lipases.

37. a) What are different Tests for assessing quality of Frying oils

**(OR)**

b) Write a note on Applications of Enzymes in Food industry

38. a) Write about Chemical and Physical aspects of Lipids

**(OR)**

b) Discuss Chemical reactions that occur in foods during processing.

39. a) What are Humectants? What is their Role in Food Preservation?

**(OR)**

b) What is Rancidity? Write about its Detection Techniques in Foods

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**II Year Semester – III**

**FERMENTATION AND INDUSTRIAL MICROBIOLOGY**

**Unit-1**

Microbes as friend's - Normal flora - History of Industrial Microbiology, Microbes influencing our lives - Primary metabolites & secondary metabolites produced by the microorganisms. Screening of Microorganisms - Primary screening - Isolation of desired and interested microorganisms - Secondary screening - yield potential of microbes - both qualitative and quantitative approach. Strain Improvement - Preservation of Microorganisms - Organizations involved in microbiological work

**Unit-2**

Fermentation media - Characteristics of an ideal production medium, Raw materials as media, Precursors and Inducers, Repressors, Antifoams. Industrial sterilization - Principles of Sterilization - Sterilization of equipment, Sterilization of Production media and sterilization of air. Types of fermentors - Fermentor - Components of a Fermentor, Parts of Fermentors, Peripheral parts and accessories, Alternative Vessel Designs, Additional accessories and Peripherals, Feed pumps, Exit gas analysis, Common measurements and Control systems (Speed Control, Temperature control, Control of Gas Supply, Control of pH, Control of Oxygen) Types of fermentations

**Unit-3**

Probiotics, Biocolours therapeutic and medicinal value - enhances digestion. Bacteriocins - Nisin - Production - metabolism - Fermentation conditions – Inoculum. Plant growth regulators and Hormones - Role in metabolic activity of plants – Microorganisms involved in the production of Auxins, Gibberellins, Cytokinins, purification. Role of Ethylene and abscisic acid in plant metabolic activity, Production of Bioinsecticides, SCP. Food based fermented products .Biochemical changes in fermented foods.

**Unit-4**

Industrially important secondary metabolites - Production of Organic acids - Citric acid, Lactic acid, Itaconic acid, Acetic acid, Gluconic acid, Kojic acid, Gallic acid - Production - Microorganisms & Metabolisms - Fermentation conditions - Inoculum preparation – Carbon and nitrogen source - Trace elements - pH and temperature - Aeration and Agitation. Yield and Recovery. Uses of organic acids. Production of Antibiotics - Screening of antibiotic producers- lactam antibiotics - Penicillin- Amino glycoside antibiotics - Tetracyclines, Chloramphenicol, Griseofulvin, Macrolide antibiotics, Rifamycins. Streptomycin - Chemical nature and biosynthesis – Commercial production - Inoculum - Media - Fermentation process - Temperature - Aeration - pH - Biomass production - Recovery and purification - uses of antibiotics

## **Unit – 5**

Production of Microbial enzymes Steps of enzyme production - Factors affecting submerged culture. Production of Amylases, proteases, Pectinases, Cellulases. Extraction of enzymes. Downstream processing .Microbial polysaccharides - Bacterial polysaccharides - Fungal polysaccharides - cell wall polysaccharides - Lichen cell wall polysaccharides - fungal exopolysaccharides , Blue green algae, Production of amino acids – Historical developments - Manufacturing methods – Extractive Isolation. Production of vitamins - General aspects - Nomenclature and production

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**II Year Semester – III**

**FERMENTATION AND INDUSTRIAL MICROBIOLOGY (PRACTICAL)**

1. Standardization of physical factors for higher yields of citric acid
2. Production and assay of antibiotics
3. Isolation, identification of cultures producing biocolours
4. Production and assay of carotenes
5. Production of Beer
6. Production of Angkak ( Red rice )
7. Estimation of colouring compounds
8. Production and assay of fungal amylase
9. Production and assay of fungal proteases
10. Production of Xanthan or Pullan
11. Production and assay of amino acids
12. Production of Beer
13. Production and assay of nisin from lactic acid bacteria
14. Production of Single cell protein
15. Bakers yeast effect in Bread preparation
16. Preparation of food based fermented product

**Textbook**

AshokPandey, Christian Larroche, *Advances in Fermentation Technology*

**Books for References**

AshokPandey, Christian Larroche, *Advances in Fermentation Technology*

Presscot / Dunn, *Industrial Microbiology*

Agrawal / Parihar, *Industrial Microbiology - Fundamentals and Applications.*

Underkofler and R.J Hickey, *Industrial Fermentation Vol. II Al.*

R.Y Stainer, M.Doudroff, *General Microbiology.*

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**II Year Semester – III**

**FERMENTATION AND INDUSTRIAL MICROBIOLOGY**

Time: 3 Hours

Maximum: 75 Marks

**SECTION – A**

Answer any **FIVE** questions. Each question carries equal marks.

(5\*5 = 25)

1. Write about Strain Improvement.
2. Write a short note on Sterilization of Foods
3. Draw a neat sketch of Fermentor and identify parts.
4. Explain in detail about Control systems in Fermentors
5. Discuss Blue Green Algae production
6. Discuss any two Secondary Metabolites
7. Write about Down stream processing of Antibiotics
8. Write about Probiotics.

**SECTION – B**

Answer **All** the questions. Each question carries **TEN** marks

(5\*10 = 50)

9. a) Write in detail about Types of Fermentors

**(OR)**

- b) Write about Screening of Microbes.

10. a) Discuss Types of Fermentations.

**(OR)**

- b) Discuss Probiotics and their Health Benefits.



11. a) Discuss about Plant Growth Regulators.

**(OR)**

b) Write a note on Bacteriocin Production.

12. a) Write about Production of Antibiotics.

**(OR)**

b) Write about Production of Enzymes.

13. a) What are different Microbial Polysachharides? Explain them in detail.

**(OR)**

b) Write about Production of Vitamins.

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**II Year Semester – III**

**FOOD ADDITIVES**

**Unit – 1**

Introduction: What are Food Additives? - Role of Food Additives in Food Processing - functions - Classification - Intentional & Unintentional Food Additives. Toxicology and Safety Evaluation of Food Additives - Beneficial effects of Food Additives / Toxic Effects - Food Additives generally recognized as safe (GRAS) - Tolerance levels & Toxic levels in Foods - LD 50. Values of Food additives Naturally occurring Food Additives - Classification - Role in Food Processing – Health Implications

**Unit-2**

Preservatives - What are preservatives - natural preservation- chemical preservatives – their chemical action on foods and human system. Anti-oxidants & chelating agents - what are anti oxidants - their role in foods - types of antioxidants- natural & synthetic - examples - what are chelating agents - their mode of action in foods - examples. Surface active agents - What are surface active agents - their mode of action in foods -examples.

**Unit-3**

Bleaching & maturing agents: what is bleaching - Examples of bleaching agents - what is maturing - examples of maturing agents - their role in food processing. Starch modifiers: what are starch modifiers - chemical nature - their role in food processing. . Food colors - What are food colors - Natural Colours and classification

**Unit-4**

Buffers - Acids & Alkalis - examples - types - their role in food processing. Sweeteners - what are artificial sweeteners & non nutritive sweeteners - special dietary supplements & their health implication - role in food processing. Food Colors - Synthetic food colors - types - their chemical nature - their impact on health.

**Unit-5**

Flavoring agents - natural flavors & synthetic flavors - examples & their chemical nature - role of flavoring agents in food processing. Anti-caking agents - their role in food processing . Humectants - definition on their role in food processing. Clarifying agents - definition examples - their role in food processing.

**Textbook**

Srivastava, R.P. Fruit & Vegetable Preservation – Principles and Practices. International Book Distributing Co. CIBDC, New Delhi.

## **Book for Reference**

Belitz . Food Chemistry . 3rd Revised Edition. Springer International.

Deshpande , S.S. Hand book of Food Toxicology. Marcel and Dekker .CRC Publishers.

Mahindru , S.N. Food Additives – Characteristics, Detection and Estimation .Tata McGraw Hill Publishing, India.

Shakuntala Manay and Shadakshar Swamy. Food Facts and Principles. New Age International Publishers, New Delhi.

Srivastava, R.P. Fruit & Vegetable Preservation – Principles and Practices. International Book Distributing Co. CIBDC, New Delhi.

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**II Year Semester – III**

**FOOD ADDITIVES**

Time: 3 Hours

Maximum: 75 Marks

**SECTION – A**

Answer any **FIVE** questions. Each question carries equal marks. (5\*5 = 25)

1. Define Food Additives. What is the role of Food additives in Food Processing
2. Write a short note on GRAS.
3. Write about Chelating agents
4. Explain in detail about Nutritive Sweeteners.
5. Write about Clarifying Agents
6. Explain mode of action of Surfactants in foods.
7. List out different Food Additives
8. Write about Alkalis used in Food processing.

**SECTION – B**

**Answer All the questions. Each question carries TEN marks** **(5\*10 = 50)**

9. a) Write in detail about Flavoring Agents used in Food Processing  
**(OR)**

b) Write about Humectants.

10. a) Discuss Sweeteners used in Food Industries.

**(OR)**

b) Discuss Food Colours

11. a) Explain Starch modifiers

**(OR)**

b) Write a note on Antioxidants

12. a) Write about Chemical Preservatives used in Foods

**(OR)**

b) Explain different Food additives along with their EU numbers.

13. a) Classify Food Additives.

**(OR)**

b) What is the Role of Food Additives in Processing

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**2019-20 Admitted Batch**  
**II Year Semester – III**

**ON JOB TRAINING - III**

On Job Training provides students adequate experience in planning and managing an enterprise in totality starting from procurement of raw material to processing, production, packaging and storage of products, organizing resources and utilities, sale of products, maintain accounts and analyze profits. Finally, students will present their work along with a report of their performance. The Report should contain following.

**Developing a Business Plan/ Project Proposal**

- I Identification of the product to be manufactured
- ii Market Survey
- iii Analysis of the existing status of the identified product and targeted market and customer
- iv Innovativeness and Creativity
- v Preparation of the project proposal with supply chain of inputs, personnel plan, production plan, finance plan, etc. and its preparation

**Plan for the Production**

- i Organization of resources
- ii Organizing utility
- iii Sequential grouping of activities
- iv Packaging and storage
- v Product pricing – physical inputs, man-hours, depreciation, etc.
- vi Time management

- i Regularity in production
- ii Adhering to production plan
- iii Product quality assessment
- iv Maintenance of production records
- v Team work

- i Sales strategy
- ii Sales volumes
- iii Assessment of sales performance
- iv Profit generated including C/B ratio, payback period, etc.

**Documentation and Report Presentation & Evaluation**

- ii Personnel Management Ii
- Preparation of final report
- iii Oral performance

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**II Year Semester – IV**

**FUNDAMENTALS OF STATISTICS**

**Unit-1**

Introduction- Various Definitions of Statistics, Singular and plural reference of Statistics, a comprehensive definition of Statistics, Importance of Statistics in agriculture, limitations of statistics. Frequency Distribution - exclusive and inclusive methods, discrete and continuous variables. Central tendency - Definition, measures of Central tendency, list of all the different measures and study of Arithmetic Mean in detail (including merits and average) Arithmetic Mean for ungrouped and grouped data

**Unit-2**

Measures of Dispersion - meaning of measures of Dispersion, Standard Deviation for ungrouped and grouped data. Coefficient of Variation (C.V), Standard Error (S.E.) and difference between S.D. and S.E. Normal Curve and its properties, identification of normality through data i.e. ,  $\mu \pm \sigma$  criterion. Etc., expression for frequency function of normal distribution Testing of Hypothesis - Concept, Null hypothesis, Type 1 and Type II Errors, Level of Significance, critical region, general setup of testing

**Unit-3**

SND test for one sample when  $\sigma$  known and unknown. SND test for two sample when  $\sigma$  known and unknown. Students t-test for one and two samples. Paired t- test and F-test Chi-Square test for  $2 \times 2$  and  $m \times n$  contingency Table, Yate's Correction for continuity. Correlation – Scatter diagram, positive and negative correlation. Correlation Coefficient “r” and its testing. Regression – Fitting of linear regression equation of Y on X and X on Y and the inter relation-ship with “r” and testing of regression coefficients

**Unit-4**

Analysis of Variance (ANOVA), Definition and assumptions, ANOVA with One-way Classification. ANOVA with Two way Classification. Need for experimental designs and planning of an experiment. Principles and Planning of experimental designs Uniformity Trials- its use in determining optimum plot size, shape and size of Blocks. Uniformity Trials – Maximum Curvature method, FF Smith Methods. Completely Randomized Design (CRD) – layout and analysis with equal and unequal repetitions, advantages and disadvantages Randomized Block Design (RBD) – layout and analysis, advantages and disadvantages Latin-Square Design(LSD) - layout and analysis, advantages and disadvantages.

## **Unit-5**

Missing Plot technique – in RBD with one missing value. Missing Plot technique – in LSD with one missing value. Factorial Experiments – Introduction , 22 Factorial Experiments using Yate's method. Factorial Experiments – 23 Factorial Experiments using Yate's method. Mixed factorial Experiments. Introduction to Sampling, Sampling Vs Census, Purposive and Random Sampling. Simple Random Sampling, method of selection, estimates of Population Mean and Total and the estimates of their variances and confidence limits. Stratified Random Sampling with random allocation, estimates of Population Mean and Total and the estimates of their variances and Confidence Limits



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**II Year Semester – IV**

**PRACTICALS ON FUNDAMENTALS OF STATISTICS**

1. Preparing frequency distribution for ungrouped data by using inclusive and exclusive methods
2. Computation of A.M. for grouped and un-grouped data by direct and deviation methods
3. S.D and CV% for grouped and ungrouped data
4. SND test for one Sample, two sample with known and unknown conditions
5. Student's t-test for single sample, two sample and paired t- test
6. F-test ( Test for homogeneity of variances)
7. Chi-square test and Yates Correction in Chi-square test
8. Correlation Coefficient and its testing
9. Fitting of Linear Regression and its testing
10. Analysis of CRD with equal and unequal repetitions
11. Analysis of RBD
12. Analysis of LSD.
13. Missing plot Technique in RBD and LSD.
14. Analysis of Factorial experiments using Yates' method
15. Simple Random Sampling
16. Stratified Random Sampling with random allocation

**Text Book**

Nageswara Rao, G 2007, Statistics for Agricultural Sciences, B S Publications, Hyderabad

**Books for Reference**

Nageswara Rao, G 2007, Statistics for Agricultural Sciences, B S Publications, Hyderabad

Rangaswamy, R 1995, A Text Book of Agricultural Statistics, New Age International (P) Limited, Hyderabad

**ADIKAVI NANNAYA UNIVERSITY**  
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**II Year Semester – IV**

**SPECTROSCOPY AND PHYSICAL CHEMISTRY**

**SPECTROSCOPY**

**UNIT-I**

General features of absorption - Beer-Lambert's law and its limitations, transmittance, Absorbance, and molar absorptivity. Single and double beam spectrophotometers. Application of Beer-Lambert law for quantitative analysis of 1. Chromium in  $K_2Cr_2O_7$   
2. Manganese in Manganous sulphate

**Electronic spectroscopy:**

Interaction of electromagnetic radiation with molecules and types of molecular spectra. Energy levels of molecular orbitals ( $\sigma$ ,  $\pi$ ,  $n$ ). Selection rules for electronic spectra. Types of electronic transitions in molecules effect of conjugation. Concept of chromophore and auxochrome.

**UNIT-II**

**Infra red spectroscopy**

Different Regions in Infrared radiations. Modes of vibrations in diatomic and polyatomic molecules. Characteristic absorption bands of various functional groups. Interpretation of spectra-Alkanes, Aromatic, Alcohols carbonyls, and amines with one example to each.

**Proton magnetic resonance spectroscopy ( $^1H$ -NMR)**

Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals - spin-spin coupling, coupling constants. Applications of NMR with suitable examples - ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate, toluene and acetophenone.

**PHYSICAL CHEMISTRY**

**UNIT-III**

**Dilute solutions**

Colligative properties. Raoult's law, relative lowering of vapour pressure, its relation to molecular weight of non-volatile solute. Elevation of boiling point and depression of freezing point. Derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods of determination. Osmosis, osmotic pressure, experimental determination. Theory of dilute solutions. Determination

of molecular weight of non-volatile solute from osmotic pressure. Abnormal Colligative properties- Van't Hoff factor.

## **UNIT-IV**

### **Electrochemistry-I**

Specific conductance, equivalent conductance. Variation of equivalent conductance with dilution. Migration of ions, Kohlrausch's law. Arrhenius theory of electrolyte dissociation and its limitations. Ostwald's dilution law. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Definition of transport number, determination by Hittorfs method. Application of conductivity measurements- conductometric titrations.

## **UNIT-V**

### **1. Electrochemistry-II**

2. Single electrode potential, sign convention, Reversible and irreversible cells  
Nernst Equation- Reference electrode, Standard Hydrogen electrode, calomel electrode, Indicator electrode, metal – metal ion electrode, Inert electrode, Determination of EMF of cell, Applications of EMF measurements - Potentiometric titrations.

### **3.Phase rule**

Concept of phase, components, degrees of freedom. Thermodynamic Derivation of Gibbs phase rule. Phase equilibrium of one component system - water system. Phase equilibrium of two- component system, solid-liquid equilibrium. Simple eutectic diagram of Pb-Ag system, simple eutectic diagram, desilverisation of lead., NaCl-Water system, Freezing mixtures.

## **Text Book**

1. Spectroscopy by William Kemp
2. Spectroscopy by Pavia

## **List of Reference Books**

3. Spectroscopy by William Kemp
4. Spectroscopy by Pavia
5. Organic Spectroscopy by J. R. Dyer
6. Modern Electrochemistry by J.O. M. Bockris and A.K.N.Reddy
7. Advanced Physical Chemistry by Atkins
- 6.Introduction to Electrochemistry by S. Glasstone
- 7.Elementary organic spectroscopy by Y.R. Sharma
8. Spectroscopy by P.S.Kalsi

**ADIKAVI NANNAYA UNIVERSITY**  
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**II Year Semester – IV**

**SPECTROSCOPY AND PHYSICAL CHEMISTRY (PRACTICALS)**

**Practical Paper - IV Physical Chemistry and IR Spectral Analysis**

**Physical Chemistry**

1. Critical Solution Temperature- Phenol-Water system
2. Effect of NaCl on critical solution temperature (Phenol-Water system)
3. Determination of concentration of HCl conductometrically using standard NaOH solution.
4. Determination of concentration of acetic acid conductometrically using standard NaOH Solution.

**IR Spectral Analysis**

5. IR Spectral Analysis of the following functional groups with examples
  - a) Hydroxyl groups
  - b) Carbonyl groups
  - c) Amino groups
  - d) Aromatic groups

**ADIKAVI NANNAYA UNIVERSITY**  
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**II Year Semester – IV**

**FUNDAMENTALS OF ECONOMICS & MARKETING**

**Unit-1**

Economics - meaning, definitions, nature, scope and subject matter of economics. Traditional and modern approach of economics. Nature of micro and macro economics. Basic terms and concepts - Goods and services, classification of goods. Utility - meaning, characteristics of utility and forms of utility. Price - meaning; wealth - attributes of wealth, types of wealth, distinction between wealth and welfare. Wants - meaning, characteristics of human wants and classification of wants. Demand - meaning, individual and aggregate demand schedule, individual and aggregate demand curves, types of demand-price demand, income demand, cross demand. Factors affecting demand

**Unit-2**

Law of demand - Contraction and extension in demand, increase and decrease in demand. Elasticity of demand - Types of Elasticity of demand - degrees of elasticity of demand and practical importance of elasticity of demand. Stock, Supply - meaning, difference between stock and supply, supply schedule, supply curve, types of supply- factors influencing supply Law of supply - Extension, contraction and increase and decrease in supply. Elasticity of supply-degrees of elasticity of supply-factors influencing elasticity of Supply. Consumers surplus –meaning, importance, assumptions, explanation of the consumers surplus with table and diagram, difficulties in measuring consumers surplus

**Unit-3**

Conditions of perfect and imperfect markets, characteristics of perfect and imperfect Competition. Classification of imperfect competition-monopolistic-oligopoly- duopoly- monopoly-monopsony, bilateral monopoly. Price determination under perfect market situations. Law of diminishing marginal utility- law, assumptions, importance, explanation and limitations of the law.Law of Equi-marginal utility-meaning, assumptions of law, importance, explanation and limitations of the law. Nature and scope of Agricultural Economics, its role and importance

**Unit-4**

Characteristics of factors of production, measures to improve land productivity, Government Policies.Labour – division of Labour - meaning, forms of division of labour, problems of unemployment, under employment and disguised unemployment. Capital meaning, Characteristics of capital, fixed and working capital, capital formation meaning three stages in capital formation, factors affecting capital formation. Forms of business organizations-individual enterprises or individual proprietorship, partnership, joint stock company their advantages and disadvantages

## **Unit-5**

Forms of business organizations - Co-operative enterprises and public enterprises and their advantages and disadvantages. Market – definition, functions, essentials of markets, classification of markets based on different criteria. National income-concepts. National income – measurements. Inflation –meaning, classification, types of inflation. Inflation –Causes of inflation and remedial Measures. Public Revenue/Tax- meaning, cannons of taxation, kinds of taxes, direct and indirect Taxes. Characteristics features of developed and under developed economies

### **Text book**

Jain P.C. 1960, A Text Book of Modern Economics - Allahabad Chaitanya Publishing House, Allahabad.

### **Books for Reference**

Dewett K.K. and Verma J.D. 1986, Elementary Economic Theory - S.Chand & Co., New Delhi.

Jain P.C. 1960, A Text Book of Modern Economics - Allahabad Chaitanya Publishing House, Allahabad.

Ruddor Dutt, K.P.M.Sundaram 1996, Indian Economy - S. Chand & Co., New Delhi.

Mishra S.K. and Puri V.K. 1996, Indian Economy - Himalaya Publishing house, New Delhi.

Subba Reddy S. , Raghu Ram, Neelakanta Sasthri and Bhavani Devi, 2009.

Agricultural Economics. Oxford and IBH publishing Co.Pvt. Ltd., New Delhi.

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**II Year Semester – IV**

**FOOD CHEMISTRY OF MICRO NUTRIENTS**

**Unit-1**

Introduction - Definition of Micronutrient, Classification of Micronutrients, Significance and Scope. Flavor - Definition, Methods for Flavor Analysis, Taste and Nonspecific Saporous Sensations, Taste Substances; Sweet, Bitter, Sour, and Salty sensations, Structural basis of taste modalities, Non specific Saporous substances; Flavour Enhancers, Astringency, Pungency and Cooling. Flavors related to Spices - Sulfur Containing volatiles in *Allium* sp. - Sulfur Containing volatiles in Cruciferae. Flavors related to vegetables - Methoxy Alkyl Pyrazine Volatiles in Vegetables – Volatiles derived from Fatty Acids by enzymatic action -Volatile from Branched Chain Amino Acids

**Unit-2**

Flavors related to fruits - Flavors derived from the Shikimic Acid Pathway - Volatile Terpenoids - Citrus Flavors -Flavors of Herbs. Flavor volatiles - from Lactic acid, ethanol fermentation, fats and oils, Muscle foods and Milk. Pigments - Introduction - Pigments in animal and plant tissue - heme compounds, Chlorophyll, carotenoids, Flavonoids and other phenols, Betalains. Heme compounds - Myoglobin/hemoglobin, Structure of heme compounds. Myoglobin - Chemistry and color, Cured Meat pigments, stability of Meat pigments. Chlorophyll - Structure and derivatives of chlorophyll - Physical characteristics. Alterations of Chlorophyll by Enzymatic - Heat and Acid - Metallo complex formation -Allomerization - Photodegradation

**Unit-3**

Loss of green color during thermal processing - different technologies of green colour preservation - Acid neutralization to retain chlorophyll, High Temperature Short Time Processing, Enzymatic conversion to chlorophyllides, Commercial application of metallo complex, Regreening of thermal processing.. Carotenoids - Structures of Carotenoids - Occurance and distribution - Physical propertiesChemical properties of carotenoids - Oxidation, Anti oxidative activity, Cis/Trans Isomerization – Stability during processing

**Unit-4**

Flavonoids and other phenols - Anthocyanins - Structure - Color and Stability of Anthocyanins Factors affecting stability of Anthocyanins - Structural transformation and pH - Temperature - oxygen and Ascorbic acid - Light, Sugars and their degradation products, metals, Sulfur dioxide, Co pigmentation, Enzyme reactions. Other flavonoids - physical properties - Importance in foods - Proanthocyanidins – Tannins - Quinoids and xanthones. Betalaines - Structure - Physical properties - Chemical properties - Conversion of Betacyanin to Betaxanthin

**Unit-5**

Vitamins - Introduction, Toxicity of vitamins - Different sources of vitamins – Dietary Recommendations, Minerals, Introduction - Principles of mineral chemistry - Nutritional aspects of minerals - Essential mineral elements - Recommended Dietary allowances – Bioavailability, Optimization in foods Bioavailability and properties. Modification of food using enzymes. Role of

endogenous enzymes in food quality - color - Texture - Flavor and aroma changes in foods - Nutritional quality. Enzymes as processing aids and ingredients. Enzymes in Baking – Brewing



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**II Year Semester – IV**

**FOOD CHEMISTRY OF MICRO NUTRIENTS (PRACTICAL)**

1. Preparation of mineral solution by using ash and tri acid method (Dry and wet oxidations)
2. Estimation of calcium in foods.
3. Estimation of Phosphorous
4. Estimation of Iron
5. Estimation of Magnesium
6. Estimation of Tannins
7. Estimation of phenols
8. Estimation of Vitamin A
9. Estimation of  $\beta$ -Carotene
10. Estimation of Thiamine

**Text Books**

Meyer. Food Chemistry - Food Chemistry - HARRY H. SISLER, Calvin : A Vander werf.

**Books for References**

Dr. Ling HD. Belity, Dr. Ing, W.Grach 1987, Food Chemistry - Spirigerverl, New York.

Eeskin - herderson Food Biochemistry - Town send.

R. Marceladikllor, Food Chemistry - Fenema, London.

Meyer. Food Chemistry - Food Chemistry - HARRY H. SISLER, Calvin : A Vander werf.

Braverman Introduction to the Biochemistry of Foods - Elsevier Scientific Publishing Company  
Sadasisivam - Biochemical Methods

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**II Year Semester – IV**

**FOOD CHEMISTRY OF MICRO NUTIRENTS**

Time: 3 Hours

Maximum: 75 Marks

**SECTION – A**

Answer any **FIVE** questions. Each question carries equal marks. (5\*5 = 25)

40. Write about Methods for Flavour Analysis.
41. Write about Flavanoids and Pigments
42. Discuss Regreening of Foods after thermal processing.
43. Write about Physical Properties of Betalains.
44. Write about Structural Transformation of Anthocyanins.
45. Give sources of Vitamins.
46. Give sources of Minerals.
47. Discuss Principles of Mineral Chemistry.

**SECTION – B**

Answer **All** the questions. Each question carries **TEN** marks (5\*10 = 50)

48. a) Write in detail about Physical and Chemical Properties of Carotenoids.

**(OR)**

b) Discuss alterations of Chlorophyll during processing in detail.

49. a) Write a note on Anthocyanins.

**(OR)**

b) Discuss Sources, Dietary Recommendations and Toxicity of Vitamins.

50. a) Write about role of endogenous enzymes in food industry.

**(OR)**

b) Discuss enzymes in Baking and Brewing

51. a) Discuss Bioavailability of Minerals.

**(OR)**

b) Discuss different technologies for colour preservation in foods.

52. a) Discuss about Pigments in Animal tissues.

**(OR)**

b) Discuss about Pigments in Animal tissues.

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**II Year Semester – IV**

**FRUIT AND VEGETABLE PROCESSING**

**Unit-1**

Production and processing scenario of Fruits and vegetables in India and world-scope of fruit and vegetable processing industry in India - present status, constraints and prospective. Overview of Principles of preservation - Drying /dehydration - process - types – pretreatments required factors affecting rate of dehydration - Reconstitution - coefficient of rehydration Freezing – process, Concentration, Chemical Preservation, Hurdle Concept, Irradiation, Concentration - types of concentration - changes during concentration

**Unit-2**

Processing Technology of Jam - What is Jam? - Ingredients and their role in quality of Jam - Processing of Jam(flowcharts) - Tests for end point determination-Problems in Jam making. Pectin - properties - theories - Olsen's theory, Spencer's theory, Hinton's theory, Fibril Theory. Jelly and Marmalades - Jelly - Difference between Jam and Jelly - Processing of Jelly – End point determination - Failure of Jellies to set- Cloudy or foggy Jellies - Formation of crystals - Syneresis. Marmalades, Fruit preserves and candied fruits, Glazed Fruits

**Unit-3**

Glazed fruit - preparation, Crystallized fruit - preparation-problems in preparation of preserves and candied fruit. Chutneys - Preparation of chutney; Pickles - Types of Pickling-Pickling with salt – Dry salting – Brining. Pickling with Vinegar and fermentation - Saurkraut - Role of lactic acid bacteria in pickling; Pickling with oil - pickling with mixture of salt, oil and spices - Problems/ spoilage in pickles. Sauces and Ketchups - What are sauces? - Difference between sauce and a ketchup - classification of sauces-thick and thin sauces-processing of Tomato sauce/ketchup - Preparation of soya sauce(thin sauce) - problems in making of sauces

**Unit-4**

Processing Technology of Fruit Beverage - Unit operations involved in preparation of fruit Beverage. Equipment used in the preparation of beverages - pulping - Screw type juice extractors - Burring machines-rollers-Taglith press by CFTRI, Basket press - Rack and cloth press-Hydraulic press - Deaerators - Sietz filters – Flash Pasteurizers. Types of Beverages - Processing technology of Beverages - Flow charts of Juice - examples- RTS – Nectar, Processing of Beverages like Cordial, Squash, Crush - FPO Specification – Processing method - Ingredients - Flow Charts. Processing of Syrups - natural and synthetic- rose syrup -almond syrup- fruit syrup. Fruit juice concentrate - Fruit juice powder - Lemon Barley water - Carbonated beverages

**Unit-5**

Processing technology of Fruit Cheese , Toffees, Wafers, Soups, Papads, Equipment required for processing. Fermented products from fruits and vegetables - Vinegar - types of vinegar - methods of vinegar production - Quick method - Orleans slow process - Generator process – problems in vinegar production. Fermented fruit beverages - Wine , Clear wines, Champagne and Cider;

Fortified wines - Sherry, vermouths; orange wine, Perry, Tokay, Port. Cashew wine/ Brandy (Feni), Neera, Toddy, Arrack and different distilled spirits – their source and alcohol percentages

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**II Year Semester – IV**

**FRUIT AND VEGETABLE PROCESSING (PRACTICAL)**

1. Canning of Fruits and Vegetables
2. Preparation of Jams
3. Preparation of Jelly and Marmalade
4. Preparation of Preserves, Candies and Crystallized Fruits
5. Preparation of Chutneys
6. Preparation of Pickles
7. Preparation of Sauces, Ketchups
8. Preparation of Fruit Squashes, Fruit Juices and RTS
9. Preparation of Fruit nectar, Cordial and Crush
10. Preparation of Fruit cheese and Toffee
11. Dehydration of Fruits and Vegetables
12. Dehydration of leafy vegetables and Soup Powders
13. Visit to Fruit and Vegetable Processing Industry

**Text Books**

Srivastava.P.R. and Sanjeev Kumar. Fruit and vegetable preservation - 3rd Edition. International Publishers, Delhi.

**Books for Reference**

Giridharlal, Siddappa and Tandon. Preservation of fruits and vegetables.ICAR, New Delhi.

Sudhir Gupta (Compiled). Fruits and Vegetables Processing Hand Book.EIRI, Delhi.

Srivastava.P.R. and Sanjeev Kumar. Fruit and vegetable preservation - 3rd Edition. International Publishers, Delhi.

EIRI Board of Consultants and Engineers. Manufacture of Snacks, Namkeen, Papads and Potato products-EIRI.

Norman.N.Potter.Food Science.CBS publishers and distributors,New Delhi.

Joshi and Pandey.Biotechnology: Food Fermentation, Volume-II. Educational Publishing and Distributing Co.

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**II Year Semester – IV**

**FRUIT AND VEGETABLE PROCESSING**

Time: 3 Hours

Maximum: 75 Marks

**SECTION – A**

Answer any **FIVE** questions. Each question carries equal marks. (5\*5 = 25)

1. Describe Dehydration Phenomenon in Foods
2. Discuss about concentration of foods and changes during concentration.
3. Give flowchart for Jam Preparation
4. Explain Auto Oxidation of Foods
5. Write about Spoilage of Pickles.
6. Give processing flowchart for any two fruit beverages
7. Give FPO specifications for any five fruit and beverage products.
8. Write about theories of pectin.

**SECTION – B**

Answer **All** the questions. Each question carries **TEN** marks (5\*10 = 50)

9. a) Write in detail about Principles of Preservation.

**(OR)**

b) What is the difference between Jam and Jelly? What are problems in Jelly making?

10. a) Discuss processing details of Ketchups and Sauces.

**(OR)**

b) Write about Preserves. Discuss Problems in Food Preservation.

11. a) Discuss types of Pickling.

**(OR)**

b) Discuss different equipment used in preparation of beverages.

12. a) Discuss Methods of Vinegar production

**(OR)**

b) Give detailed flowchart for Wine processing.

13. a) Give detailed flowchart for Fruit Cheese and Toffees.

**(OR)**

b) Discuss Unit operations involved in preparation of fruit beverage.



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**II Year Semester – IV LEGUME**

**AND OIL SEED TECHNOLOGY**

**Unit-1**

Present status and future prospects of legumes - Current trends in area, production and yield - Technology Mission on Oil seeds and Pulses (TMOP). Morphological description of pulses. Classification and types of legumes - Chemical composition and nutritional Value. Processing of legumes - Milling, Soaking, Germination, Fermentation, Roasting and Parching, Extrusion, Parboiling and Agglomeration. Physical and chemical changes during the processing of legumes Dehulling of pulses - Advantages - Methods of dehulling - Traditional and modern methods of Dehulling. Dehulling pretreatments. Seed characteristics that affect dehulling - Nature of seed coat and physical characteristics of grains. Storage of pulses - Insect control measures in pulses. Milling of pulses

**Unit-2**

Dry milling of Tur, Black gram, Bengal gram, Lentil, Peas and Green gram. Wet milling of Tur - Modern CFTRI method of pulse milling. Dhal milling equipments and effect on quality Principal products. Fermented products of legumes - Idli, Dosa, Soya curd(Tofu), Textured Vegetable Protein (TVP), Soya sauce, Tempeh, Natto and Miso. Cooking quality of dhal - Factors affecting cooking quality of dhal and Legumes – Processed legume products - Puffed chick pea and Peas, Canned dry pea

**Unit-3**

Quick cooking dhal and instant dhal - Uses of pulses - Role of pulses in cookery - Medicinal value of pulses. Present status and future prospects of oil seeds - Annual oil crops, Perennial oil seed plants and Minor oil seeds - Chemical composition and characteristics of oil seeds and oils. Post Harvest Technology of oil seeds - Handling- Drying and Storage - Grading - Pretreatments - Cleaning - Dehulling - Size reduction - Flaking - Heat treatment

**Unit-4**

Oil extraction - Rendering - Traditional methods - Ghani - Power ghanis - Hydraulic Press - Expellers - Principle and structural design of expeller. Solvent extraction process - Principle - Pretreatment - Breaking - Cracking - Flaking - Extraction principles - Factors affecting the extraction process – Desolventisation. Processing of oil seeds - Production and refining of cotton seed oil - Mechanical expression of cotton seed oil - Refining of crude cotton seed oil

## **Unit-5**

Solvent extraction of soya bean oil - Sunflower oil - Palm oil - Coconut oil. Utilization of rice bran - Stabilization of rice bran - Dry heat treatment - Wet heat treatment.. Extraction of rice bran oil - Solvent extraction - batch and continuous methods. Refining of oils- Principles and process controls. Refining of crude bran oil into edible oil - Uses of bran and bran oil. Hydrogenation and hydrogenated products. New technologies in oil seed processing Utilization of oil seed meals for different food uses. High protein products - Protein concentrates - Protein isolates

### **Textbooks**

Chakraverty A, Majumdar A.S, Vijaya Raghavan G.S and Ramaswamy H.S. Hand Book of Post Harvest Technology. Marcel Dekker Inc., New York. Basel.

Umaid Singh. Methods for Dehulling of Pulses: A Critical Appraisal. J. Food Sci.Technol, 1995, Vol.32, No.2, 81-93.

Sahay K.M and Singh K.K. Unit operations of Agricultural Processing. Vikas Publishing House Pvt. Ltd.

### **Books for References**

Achhayya K.T. Oil seeds and Oil Milling in India. Oxford and IBH Publishing Co., New Delhi. Barid and Hamson. Hand Book of Solvent Extraction.

Chakraverty A. Post Harvest Technology of Cereals, Pulses and Oil seeds. Oxford and IBH Publishing Co. Ltd., Calcutta.

Chakraverty A, Majumdar A.S, Vijaya Raghavan G.S and Ramaswamy H.S. Hand Book of Post Harvest Technology. Marcel Dekker Inc., New York. Basel.

Guriqbal Singh, Harbhajan Singh Sekhon and Jaspinder Singh Kolar. Pulses. Agrotech Publishing Academy, Udaipur.

Jaswanth Singh and Shukla B.D. Post Harvest Technology of Oil Seeds. Central Institute of Agricultural Engineering, Bhopal.

Narasimha H.V, Ramakrishnaiah N, Pratape V.M, Sasikala V.B and Narasimhan K.S. Milling and Storage of Pulses in India. Indian Food Industry. Nov-Dec. 2002, Vol.21, No. 6, 32-39.

Sahay K.M and Singh K.K. Unit operations of Agricultural Processing. Vikas Publishing House Pvt. Ltd.

Shukla B.D, Srivastava P.K and Gupta R.K. Oilseeds Processing Technology. Central Institute of Agricultural Engineering, Bhopal.

Srilakshmi B. Food Science. 2nd Edn. New Age International (P) Ltd Publishers, New Delhi.

Subbulakshmi G and Shobha A. Udipi. Food Processing and Preservation. New Age International(P) Ltd Publishers, New Delhi.

Swaminathan M. Food Science, Chemistry and Experimental Foods. The Bangalore Printing and Publishing Co. Ltd., Bangalore.

Swern D. Baileys Industrial Oils and Fats. Inter Science Publishers, Inc., New Delhi.

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**II Year Semester – IV**

**LEGUME AND OIL SEED TECHNOLOGY**

Time: 3 Hours

Maximum: 75 Marks

**SECTION – A**

Answer any **FIVE** questions. Each question carries equal marks.

(5\*5 = 25)

1. Write about TMOP.
2. Discuss processing flowchart for TVP
3. How to check cooking quality of dhal?
4. Give processing flowchart for soy sauce.
5. Discuss different heat treatments for rice bran.
6. Discuss uses of bran and bran oil.
7. Write about protein concentrates.
8. Give processing flowchart for coconut oil.

**SECTION – B**

Answer **All** the questions. Each question carries **TEN** marks

(5\*10 = 50)

9. a) Discuss different methods of dehulling of pulses.

**(OR)**

b) Write about storage of pulses.

10. a) Discuss different unit operations involved in post harvest technology of oil seeds.

**(OR)**

b) Explain solvent extraction process of soy bean oil.

11. a) Write about expression and refining of cotton seed oil.

**(OR)**

b) Give flowchart for Rice milling.

12. a) What are new technologies in oil seeds milling?

**(OR)**

b) Discuss High Protein Products.

13. a) Discuss Modern CFTRI method of pulse milling.

**(OR)**

b) Discuss status and future prospects of oilseeds.

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**II Year Semester – IV**

**ON JOB TRAINING – IV**

On Job Training provides students adequate experience in planning and managing an enterprise in totality starting from procurement of raw material to processing, production, packaging and storage of products, organizing resources and utilities, sale of products, maintain accounts and analyze profits. Finally, students will present their work along with a report of their performance. The Report should contain following.

**Developing a Business Plan/ Project Proposal**

- I Identification of the product to be manufactured
- ii Market Survey
- iii Analysis of the existing status of the identified product and targeted market and customer
- iv Innovativeness and Creativity
- v Preparation of the project proposal with supply chain of inputs, personnel plan, production plan, finance plan, etc. and its preparation

**Plan for the Production**

- i Organization of resources
- ii Organizing utility
- iii Sequential grouping of activities
- iv Packaging and storage
- v Product pricing – physical inputs, man-hours, depreciation, etc.
- vi Time management

- i Regularity in production
- ii Adhering to production plan
- iii Product quality assessment
- iv Maintenance of production records
- v Team work

- i Sales strategy
- ii Sales volumes
- iii Assessment of sales performance
- iv Profit generated including C/B ratio, payback period, etc.

**Documentation and Report Presentation & Evaluation**

- ii Personnel Management Ii
- Preparation of final report
- iii Oral performance

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**III Year Semester – V**

**INORGANIC AND ORGANIC PHYSICAL CHEMISTRY -1**

**Paper - V (INORGANIC, ORGANIC & PHYSICAL CHEMISTRY- 1)**

**INORGANIC CHEMISTRY**

**UNIT – I**

**Coordination Chemistry:**

IUPAC nomenclature - bonding theories - Review of Werner's theory and Sidgwick's concept of coordination - Valence bond theory - geometries of coordination numbers 4-tetrahedral and square planar and 6-octahedral and its limitations, crystal field theory - splitting of d-orbitals in octahedral, tetrahedral and square-planar complexes - low spin and high spin complexes - factors affecting crystal-field splitting energy, merits and demerits of crystal-field theory. Isomerism in coordination compounds - structural isomerism and stereo isomerism, stereochemistry of complexes with 4 and 6 coordination numbers.

**UNIT-II**

**1. Spectral and magnetic properties of metal complexes:**

Types of magnetic behaviour, spin-only formula, calculation of magnetic moments, experimental determination of magnetic susceptibility-Gouy method.

**2. Stability of metal complexes:**

Thermodynamic stability and kinetic stability, factors affecting the stability of metal complexes, chelate effect, determination of composition of complex by Job's method and mole ratio method.

**ORGANIC CHEMISTRY**

**UNIT- III**

**Nitro hydrocarbons:**

Nomenclature and classification-nitro hydrocarbons, structure -Tautomerism of nitroalkanes leading to aci and keto form, Preparation of Nitroalkanes, reactivity - halogenation, reaction with HONO (Nitrous acid),Nef reaction and Mannich reaction leading to Micheal addition and reduction.

## UNIT – IV

### Nitrogen compounds:

Amines (Aliphatic and Aromatic): Nomenclature, Classification into 1°, 2°, 3° Amines and Quaternary ammonium compounds. Preparative methods Ammonolysis of alkyl halides 2. Gabriel synthesis 3. Hoffman's bromamide reaction (mechanism).

Reduction of Amides and Schmidt reaction. Physical properties and basic character - Comparative basic strength of Ammonia, methyl amine, dimethyl amine, trimethyl amine and aniline - comparative basic strength of aniline, N-methylaniline and N,N-dimethyl aniline (in aqueous and non-aqueous medium), steric effects and substituent effects. Chemical properties: a) Alkylation b) Acylation c) Carbylamine reaction d) Hinsberg separation e) Reaction with Nitrous acid of 1°, 2°, 3° (Aliphatic and aromatic amines). Electrophilic substitution of Aromatic amines – Bromination and Nitration. Oxidation of aryl and Tertiary amines, Diazotization.

## PHYSICAL CHEMISTRY

### UNIT- V

#### Thermodynamics

15h

The first law of thermodynamics-statement, definition of internal energy and enthalpy. Heat capacities and their relationship. Joule-Thomson effect- coefficient. Calculation of  $w$ , for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes. State function. Temperature dependence of enthalpy of formation- Kirchoff's equation. Second law of thermodynamics. Different Statements of the law. Carnot cycle and its efficiency. Carnot theorem. Concept of entropy, entropy as a state function, entropy changes in reversible and irreversible processes. Entropy changes in spontaneous and equilibrium processes.

#### Text Book

Coordination Chemistry by Basalo and

Johnson Organic Chemistry by G.Mare loudan,

#### Books for Reference

1. Concise coordination chemistry by Gopalan and Ramalingam
2. Coordination Chemistry by Basalo and Johnson
3. Organic Chemistry by G.Mare loudan, Purdue Univ
4. Advanced Physical Chemistry by
5. Text book of physical chemistry by S Glasstone
6. Concise Inorganic Chemistry by J.D.Lee
7. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
8. A Text Book of Organic Chemistry by Bahl and Arun bahl
9. A Text Book of Organic chemistry by I L Finar Vol I
10. Advanced physical chemistry by Gurudeep Raj

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**III Year Semester – V**

**INORGANIC AND ORGANIC PHYSICAL CHEMISTRY -1 PRACTICAL**

**Organic Qualitative Analysis:**

Analysis of an organic compound through systematic qualitative procedure for functional group identification including the determination of melting point and boiling point with suitable



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**III Year Semester – V**

**INORGANIC AND ORGANIC PHYSICAL CHEMISTRY -2 Paper -**  
**VI (INORGANIC, ORGANIC & PHYSICAL CHEMISTRY-2)**

**INORGANIC CHEMISTRY**

**UNIT-I**

**1. Reactivity of metal complexes:**

Labile and inert complexes, ligand substitution reactions -  $SN^1$  and  $SN^2$ , substitution reactions of square planar complexes - Trans effect and applications of trans effect.

**2. Bioinorganic chemistry:**

Essential elements, biological significance of Na, K, Mg, Ca, Fe, Co, Ni, Cu, Zn and  $Cl^-$ . Metalloporphyrins – Structure and functions of hemoglobin, Myoglobin and Chlorophyll.

**ORGANIC CHEMISTRY**

**UNIT- II**

**Heterocyclic Compounds**

Introduction and definition: Simple five membered ring compounds with one hetero atom  
Ex. Furan. Thiophene and pyrrole - Aromatic character – Preparation from 1,4-dicarbonyl compounds, Paul-Knorr synthesis.

Properties : Acidic character of pyrrole - electrophilic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions - Diels Alder reaction in furan.

Pyridine – Structure - Basicity - Aromaticity - Comparison with pyrrole - one method of preparation and properties - Reactivity towards Nucleophilic substitution reaction.

**UNIT-III**

**Carbohydrates**

Monosaccharides: (+) Glucose (aldo hexose) - Evidence for cyclic structure of glucose (some negative aldehydes tests and mutarotation) - Proof for the ring size (methylation, hydrolysis and oxidation reactions) - Pyranose structure (Haworth formula and chair conformational formula).

(-) Fructose (keto hexose) - Evidence of 2 - keto hexose structure (formation of pentaacetate, formation of cyanohydrin its hydrolysis and reduction by HI). Cyclic structure for fructose (Furanose structure and Haworth formula) - osazone formation from glucose and fructose – Definition of anomers with examples. Interconversion of Monosaccharides: Aldopentose to Aldohexose (Arabinose to D- Glucose, D-Mannose) (Kiliani - Fischer method). Epimers, Epimerisation - Lobry de bruyn van Ekenstein rearrangement. Aldohexose to Aldopentose (D-Glucose to

D- Arabinose) by Ruff degradation. Aldohexose to Ketohexose [(+) Glucose to (-) Fructose] and Ketohexose to Aldohexose (Fructose to Glucose)

## **UNIT- IV**

### **Amino acids and proteins**

Introduction: Definition of Amino acids, classification of Amino acids into alpha, beta, and gamma amino acids. Natural and essential amino acids - definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples - Glycine, Alanine, valine and leucine) by following methods: a) from halogenated carboxylic acid b) Malonic ester synthesis c) strecker's synthesis.

Physical properties: Zwitter ion structure - salt like character - solubility, melting points, amphoteric character, definition of isoelectric point.

Chemical properties: General reactions due to amino and carboxyl groups - lactams from gamma and delta amino acids by heating peptide bond (amide linkage). Structure and nomenclature of peptides and proteins.

## **PHYSICAL CHEMISTRY**

### **UNIT-V**

#### **1. Chemical kinetics**

Rate of reaction - Definition of order and molecularity. Derivation of rate constants for first, second, third and zero order reactions and examples. Derivation for time half change. Methods to determine the order of reactions. Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy.

#### **2. Photochemistry**

Difference between thermal and photochemical processes. Laws of photochemistry- Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence. Quantum yield-Photochemical reaction mechanism- hydrogen- chlorine, hydrogen- bromine reaction. Qualitative description of fluorescence, phosphorescence, Photosensitized reactions- energy transfer processes (simple example)

### **Text Book**

1. Organic Chemistry by G.Mare loudan, Purdue Univ
2. Advanced Physical Chemistry by Atkins

### **Books for Reference**

3. Concise coordination chemistry by Gopalan and Ramalingam
4. Coordination Chemistry by Basalo and Johnson
5. Organic Chemistry by G.Mare loudan, Purdue Univ
6. Advanced Physical Chemistry by Atkins
7. Text book of physical chemistry by S Glasstone
7. Instrumentation and Techniques by Chatwal and Anand
8. Essentials of nano chemistry by pradeep
9. A Textbook of Physical Chemistry by Puri and Sharma

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**INORGANIC AND ORGANIC PHYSICAL CHEMISTRY -2 PRACTICAL**

1. Determination of rate constant for acid catalyzed ester hydrolysis.
2. Determination of molecular status and partition coefficient of benzoic acid in Benzene and water.
3. Determination of Surface tension of liquid
4. Determination of Viscosity of liquid. Adsorption of acetic acid on animal charcoal, verification of Freundlich isotherm

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**CEREAL PROCESSING**

**Unit-1**

Present status and future prospects of cereals and millets - Current trends in area, production and yield. Structure of cereals - Wheat, Corn, Rice, Barley, Oat, Rye and Sorghum. Composition and nutritive value of cereals. Physico - chemical properties of cereals, major and minor millets - Bulk density, True density, Porosity, Sphericity, Roundness, 1000 grain weight, Coefficient of friction and Angle of repose. Thermal properties - Specific heat - Thermal Conductivity - Thermal diffusivity. Theory of grain drying - Thin layer drying - Moisture content - Moisture measurement - Direct and indirect methods

**Unit-2**

Equilibrium moisture content (EMC) - Determination of EMC - EMC models - Hysteresis -Bound, unbound and free moisture. Drying curves - Constant rate period and falling rate period -Deep bed drying - Problems on moisture content. Methods of grain drying - Conduction, Convection, Radiation, Dielectric, Chemical and Sack drying. Grain dryers - Unheated and heated air dryers - Batch and continuous type - Flat bed type - PHTC type - Columnar type - LSU type - Baffle type - Rotary type

**Unit-3**

Paddy and its handling - Cleaning - Drying - Cracking of paddy during drying and its prevention Methods of paddy drying - Sun drying and mechanical drying. Rice milling. Modern rice milling process - Cleaning, Dehusking, Husk separation, Paddy separation, Polishing and Grading operations and their related equipments. Advantages and disadvantages of milling machineries -Factors that affect rice out turn during milling. By-products of rice milling - Rice bran, rice hulls, broken grains, rice pollards

**Unit-4**

Parboiling of paddy and its principle - Physico - chemical changes during parboiling – Steps in parboiling - soaking, steaming and drying. Effect of parboiling on milling, nutritional and cooking quality of rice. Advantages and disadvantages of parboiling. Methods of parboiling of paddy - Traditional methods- Atapa, Balam, Josh, Sela and Siddha processes. Parboiling - single boiling and double boiling methods - Improved methods - CFTRI method - Schule process - Crystal rice process. Rice conversion process - Jadavpur University method - Malek process - Rice Growers Association of California process - Avorio process

**Unit-5**

Pressure parboiling method. Ageing of rice - Enrichment of rice. Rice fortification - Methods of rice fortification. Processed products from rice - Rice flour - Parched rice - Puffed rice – Flaked rice – Rice starch - Instant rice - Canned rice. Wheat - Types of wheat - Wheat quality and grading. Wheat flour milling - Components of a wheat mill. Corn dry milling and wet milling - Products of corn milling. Milling of Barley, Oats and Rye. Milling of Sorghum, Bajra, Ragi - Their food uses. Malting of cereals - Uses of malt Breakfast cereal foods - Flaked breakfast cereals, puffed breakfast cereals, shredded and granular breakfast cereals and cereals puffed by extrusion

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**CEREAL PROCESSING (PRACTICAL)**

1. Study of morphological characteristics of cereals - I
2. Determination of physical properties of cereals - I
3. Determination of colour of cereals
4. Determination of moisture content of cereals
5. Experiment on parboiling of paddy
6. Cooking quality studies of rice
7. Experiments on rice shelling
8. Experiments on rice polishing
9. Processing of cereal and millet malts
10. Visit to rice bran oil extraction industry
11. Visit to a commercial cereal processing unit

**Text Book**

Chakraverty A. Post Harvest Technology of Cereals, Pulses and Oil seeds. Oxford and IBH Publishing Co. Ltd., Calcutta

**References**

Araullo E.V, Padua D.B.D and Graham. Rice- Post Harvest Technology. IDRC, Canada.

Chakraverty A. Post Harvest Technology of Cereals, Pulses and Oil seeds. Oxford and IBH Publishing Co. Ltd., Calcutta.

Chakraverty A, Majumdar A.S, Vijaya Raghavan G.S and Ramaswamy H.S. Hand Book of Post Harvest Technology. Marcel Dekker Inc., New York. Basel.

Kent N.L and Evers D. Technology of Cereals. Woodhead Publishing Co. Ltd., Cambridge, England. Scott. Flour milling process.

Shakuntala Manay N and Shadaksharaswamy M. Foods - Facts and Principles. New Age International (P) Ltd Publishers, New Delhi.

Srilakshmi B. Food Science. 2nd Edn.. New Age International (P) Ltd Publishers, New Delhi.

Subbulakshmi G and Shobha A. Udipi. Food Processing and Preservation. New Age International (P) Ltd Publishers, New Delhi.

Swaminathan M. Food Science, Chemistry and Experimental Foods. The Bangalore Printing and Publishing Co. Ltd., Bangalore.

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**III Year Semester – V**  
**PROCESSING OF MILK AND MILK PRODUCTS**

**Unit-1**

Milk - Definition - Indian Standards - Composition - Milk Constituents - Food and Nutritive value of milk, Physico-chemical properties of milk constituents - Physico-chemical properties of milk Colostrum and its nutritive value - Milk and Public health - Safe guarding the milk supply - Clean milk production - Buying and collection of milk - Cooling and transportation of milk. Effect of heat on milk. Manufacture, Packaging and Storage of Pasteurized milk- Receiving - Preheating - Filtration/Clarification - Cooling - Storage of raw milk. Standardization - definition and procedure. Pasteurization - Definition - Objectives - Formulation of standards - Methods of Pasteurization- Batch method and HTST method. Vacuum Pasteurization - Standardization - Ultra High Temperature Pasteurization - Uperization

**Unit-2**

Homogenization - Bottling and storage - Flavour defects in milk, their causes and prevention. Ultra filtration and Reverse Osmosis. Cream - Definition - Classification - Composition - Food and Nutritive value – Physicochemical properties. Cream production - Gravity and Centrifugal methods Factors affecting fat percentage of cream - Yield of cream - Collection of cream - Neutralization of cream. Pasteurization of cream - Manufacture of different types of cream - Defects in cream, their causes and prevention. Butter - Definition - Classification - Composition - Method of manufacture, packaging and storage - Butter Over run. Theories of churning - Continuous butter making - Defects in butter, their causes and prevention. Butter oil - Definition - Composition - Nutritive value - Methods of manufacture, Cooling, Packaging, Storage and Distribution - Defects in butter oil, their causes and prevention.

**Unit-3**

Special milks - Sterilized milk - Definition - Method of manufacture - Homogenized milk - Definition - Factors influencing homogenization - Method of manufacture – Homogenizer - Soft curd milk - Definition - Characteristics - Methods of preparation of soft curd milk. Flavoured milks - Definition - Types - Methods of manufacture of chocolate/fruit flavoured milks/drinks - Vitaminized/Irradiated milk - Frozen concentrated milk. Fermented milk - Merits - Types - Starter propagation - Natural butter milk – Cultured butter milk - Acidophilus milk - Bulgarian butter milk - Kumiss – Kefir. Yoghurt - Method of preparation - Flavoured yoghurt preparation - Standardized milk - Reconstituted milk - Recombined milk - Toned milk - Double toned milk - Humanized milk - Miscellaneous milks.

**Unit-4**

Cheese - Definition - Classification - Composition - Nutritive value - Manufacture of cheddar cheese - Curing of cheese. Cottage cheese - Method of manufacture - Different varieties of cheese - Defects in cheese, their causes and prevention. Ice cream - Definition - Classification - Composition - Nutritive value - Role of constituents in ice cream - Method of manufacture, packaging, hardening and storage. Over run in ice cream - Defects in ice cream, their causes and prevention. Manufacture of indigenous milk products - Ghee, Khoa, Chhana - Method of manufacture, packaging and storage - Nutritive value.

**Unit-5**

Paneer, Dahi and Shrikhand - Method of manufacture, packaging and storage. Methods of preparation of Kheer, Rabri, Kulfi and Lassi. Indian milk confectionery - Manufacturing, packaging and storage of Khoa based sweets Kalakhand and Gulabjamun. Manufacturing, packaging and storage of Chhana based sweets Sandesh and Rasogulla. By-products of dairy industry - Classification - Principle and method of utilization. Casein (industrial) - method of manufacture - Defects - Uses - Casein (edible) - method of preparation – Uses. Packaging and storage of milk and milk products

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**PROCESSING OF MILK AND MILK PRODUCTS (PRACTICAL)**

1. Sampling and analysis of milk-COB, Titratable acidity, alcohol test, fat
2. Study of physico- chemical properties, specific gravity and composition of milk
3. Determination of adulterants and preservatives in milk
4. Separation and standardization of milk
5. Heat processing of milk- Pasteurization
6. Preparation of butter
7. Preparation of ghee
8. Preparation of ice cream
9. Preparation of Dahi and Shrikhand
10. Preparation of Lassi
11. Preparation of Khoa
12. Preparation of Khoa and Khoa based sweets
13. Preparation of Chhana and Paneer
14. Preparation of Chhana based sweets
15. Visit to milk chilling centre
16. Visit to Dairy plant

**Text Book**

Sukumar De. Outlines of Dairy Technology. Oxford University Press, New Delhi.

**Books for Reference**

Bangarappa K.S and Acharya K.L. Indian Dairy Products. Asia Publishing House, Bombay.

EIRI Board of Consultants, Engineers. Milk Processing and Dairy Products Industries. EIRI India Research Institute, New Delhi.

Kessler H.G. Food Engineering and Dairy Technology. Published by Verlag A Kessler, Post Box No 1721, D-8050 Fraising (F R Germany)

Nelson J.A and Trout. Judging of Dairy Products. The Olsen Publishing Co., Milwaukee Wisconsin, USA

Srilakshmi B. Food Science. 2nd Edn. New Age International (P) Ltd Publishers, New Delhi.  
Sukumar De. Outlines of Dairy Technology. Oxford University Press, New Delhi.

Swaminathan M. Food Science, Chemistry and Experimental Foods. The Bangalore Printing and Publishing Co. Ltd., Bangalore.

Warner J.N. Principles of Dairy Processing. Wiley Eastern Ltd., New Delhi



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**III Year Semester – V**

**PROCESSING OF MEAT AND MEAT PRODUCTS**

**Unit-1**

Introduction: Sources and development of meat and poultry industries in India and importance of meat and meat industries in national economy. Structure of meat muscle-microscopic view - Myofibrils - Actin - Myosin - Contraction. Chemical composition of meat muscle - muscle proteins - fats - carbohydrates – connective tissue-nutritive value of meat. Pre-slaughter care-requirements - different modes of transport of meat animal. Ante-mortem examination of meat animal; principles and judgements. Slaughtering of meat: Scientific methods of slaughter - Stunning techniques - mechanical, electrical, chemical methods; Ritual/religious methods of slaughter - Jewish, Halal, Jhatka and Spanish methods. Dressing and cutting of carcass in sheep, pig and buffalo. Post mortem examination of carcass and principles of judgement. Grading of meat and packaging of meat.

**Unit-2**

Postmortem changes in meat - Rigormortis - Biochemical changes associated with rigormortis which lead to the conversion of muscle to meat - Factors - Ph decline, resolution of rigor-autolytic proteolytic enzymes - microbial invasion and loss of structural integrity Meat quality parameters - Meat color - Water holding capacity - Marbling - Quantum of connective tissue - firmness and storage conditions. Palatability characters of meat and factors affecting meat quality. Methods of tenderization - aging, enzymes and curing - factors affecting tenderness. Spoilage of meat - Sources of contamination, growth of micro organisms – Deteriorative changes in meat - Identification of spoilage

**Unit-3**

Principles of various meat preservation techniques - Chilling - Freezing- Curing – Smoking - Thermal processing - canning - Dehydration - Irradiation and Hurdle concept. Processing technology of meat products - Basic processing - Comminution – Mechanical deboning - Emulsification - Meat emulsion - methods of stabilization of meat emulsion meat extension - preblending - Hot processing - Cooking Techniques. Cured meats - Process of curing, methods of curing - commercial processing of ham and Bacon - Sausage processing - Production of Intermediate moisture and shelf stable meat Products. Restructured meat products - tumbling - massaging - chunking - forming - tearing and Forming

**Unit-4**

Value added meat products like luncheon meats - meat patties - meat loaves - meat balls and meat nuggets. Safety standards in meat industry - Meat food product order - HACCP-ISO-9000 standards. Meat plant sanitation and hygiene. Structure of egg - different parts of an egg. Composition of egg - Proteins of Egg white, Yolk proteins and lipids and nutritive value of egg. Egg quality characteristics - Internal Quality - Haugh's unit - Terms indicating defective quality and Egg grading. Antemortem and post mortem examination of poultry birds - principles of judgement. Preslaughter care, handling, Transport and dressing of a poultry bird

**Unit-5**

Cuts of poultry bird and Indian Standards of a dressed chicken. Microbial spoilage of eggs - types of spoilage in eggs - indications - organisms causing spoilage. Preservation and maintenance of eggs - Preservation of shell eggs - Egg cleaning – Oil Treatment - Cold storage - Thermo stabilization - Immersion in liquids. Preservation of Albumin and yolk-powder production. Preservation of poultry meat - Chilling, Freezing,

Curing, Smoking, Dehydration, Canning and Radiation. Processing of value added products - Chicken barbecue, chicken sausage, meat balls and pickling

### **Text Books**

Sharma, B.D. Modern Abattoir Practices and Animal By - Products Technology. Jaypee Brothers Medical Publishers Pvt. Ltd, New Delhi.

### **Books for Reference**

Lawrie R.A. Meat Science, Paragoan Press, Oxford and New York.

Sharma, B.D. Modern Abattoir Practices and Animal By - Products Technology. Jaypee Brothers Medical Publishers Pvt. Ltd, New Delhi.

Sharma, B.D. Meat and Meat Products Technology (Including Poultry Products Technology), Jaypee Brothers Medical Publishers Pvt. Ltd, New Delhi.

NIIR Board of Consultants .Preservation of Meat and Poultry . Asia Pacific Business Press Inc, Delhi.

Meat Processing and Meat Products Hand Book. EIRI, Delhi.

William J. Stadel. Egg Science. CBS Publishers, New Delhi.

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**III Year Semester – V**

**PROCESSING OF SPICES AND PLANTATION CROPS**

**UNIT-1**

Introduction and History of Spices and condiments, production and processing scenario of spices and plantation crops and its scope. Value addition of spices and spice products with different processing methods. Definition of major spices, Classification of spices, post harvest technology, processed products and their marketing in trade. Different technologies involved in the preparation of spice powders, spice oils, oleoresins and micro encapsulated products. Standards and specifications of spices, packaging of spices and spice products, market value of spices in India. Herbs and leafy vegetables used as spices and condiments

**UNIT-2**

Definition of plantation crops, Commercial value of plantation crops that are grown in India. Garlic- introduction, harvesting, post harvest technology, processing methods, Processed products and its grades. Turmeric - Introduction, harvesting, post harvest technology and treatments, processing into marketed products, adulteration, specifications for marketed products, packaging and different grades. Onion - Introduction, harvesting, post harvest technology and treatments, processing into marketed products, adulteration, specifications for marketed products, packaging and different grades

**UNIT-3**

Pepper- Introduction, harvesting, post harvest technology and treatments, processing into marketed products, adulteration, specifications for marketed products, packaging and different grades. All spice and Dil seed , Nutmeg and Mace: and Cinnamon : Introduction, harvesting, post harvest technology and treatments, processing into marketed products, adulteration, specifications for marketed products, packaging and different grades

**UNIT-4**

Tea - Introduction, harvesting, post harvest technology and treatments, processing into marketed products, adulteration, specifications for marketed products, Types of tea packaging and different grades. Rubber - Introduction, harvesting, post harvest technology and treatments, processing into marketed products, adulteration, specifications for marketed products, packaging and different grades. Cocoa - Introduction, harvesting, post harvest technology and treatments, processing into marketed products, adulteration, specifications for marketed products, packaging and different grades

**UNIT-5**

Clove and Coriander, Annie seed and Fennel seeds, Chilli - Introduction, harvesting, post harvest technology and treatments, processing into marketed products, adulteration, specifications for marketed products, packaging and different grades. Cumin and Ajowan, Areca nut, Cardamom -Sweet basil and Mint - Sage and Savory - Marjoram and Saffron , Oil palm , Cashew nut , Vanilla and Annatto - Thyme and Rosemary , Coconut , Asofoetida and caraway seed, Ginger: Introduction, harvesting, post harvest technology and treatments, processing into marketed products, adulteration, specifications for marketed products, packaging and different grades, Chemistry of different spice flavors including coffee, tea, vanilla, nutmeg, mace, cinnamon, mint and Ajowan.

### **Text Books**

Shanmugavelu K.G. Spices and Plantation Crops. Oxford & IBH Publishing Co. New Delhi

### **Books for Reference**

Shanmugavelu K.G. Spices and Plantation Crops. Oxford & IBH Publishing Co. New Delhi

Purseglave J.W., Brown E.G., Green C.L., and Robins. Spices Vol.1 and Vol.II SRJ Academic Press. New Delhi.

Thampan P.K. Hand Book of Coconut Palm. IBA Publishing Company, New Delhi

Gupta S. Hand Book of Spices and Packaging with Formulae. Engineers India Research Institute, New Delhi.

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**III Year Semester – VI**

**ENVIRONMENTAL CHEMISTRY**

**UNIT-I**

**Introduction**

Concept of Environmental chemistry - Scope and importance of environment in now a days – Nomenclature of environmental chemistry – Segments of environment - Natural resources – Renewable Resources – Solar and biomass energy and Non-renewable resources – Thermal power and atomic energy – Reactions of atmospheric oxygen and Hydrological cycle.

**UNIT-II**

**Air Pollution**

Definition – Sources of air pollution – Classification of air pollution – Acid rain – Photochemical smog – Green house effect – Formation and depletion of ozone – Bhopal gas disaster – Controlling methods of air pollution.

**UNIT-III**

**Water pollution**

Unique physical and chemical properties of water – water quality and criteria for finding of water quality – Dissolved oxygen – BOD, COD, Suspended solids, total dissolved solids, alkalinity – Hardness of water – Methods to convert temporary hard water into soft water – Methods to convert permanent hard water into soft water – eutrophication and its effects – principal wastage treatment – Industrial waste water treatment.

**UNIT-IV**

**Chemical Toxicology**

Toxic chemicals in the environment – effects of toxic chemicals – cyanide and its toxic effects – pesticides and its biochemical effects – toxicity of lead, mercury, arsenic and cadmium.

**UNIT-V**

**Ecosystem and biodiversity**

**Ecosystem:** Concepts – structure – Functions and types of ecosystem – Abiotic and biotic components – Energy flow and Energy dynamics of ecosystem – Food chains – Food web – Tropic levels – Biogeochemical cycles (carbon, nitrogen and phosphorus)

**Biodiversity:** Definition – level and types of biodiversity – concept - significance – magnitude and distribution of biodiversity – trends - biogeographical classification of India – biodiversity at national, global and regional level.

## REFERENCE BOOKS

1. Fundamentals of Ecology by M.C.Dash
2. A Text book of Environmental chemistry by W. Moore and F.A. Moore
3. Environmental Chemistry by Samir K. Banerji

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**III Year Semester – VI**

**ENVIRONMENTAL CHEMISTRY (PRACTICAL)**

1. Determination of carbonate and bicarbonate in water samples (acidity and alkalinity)
2. Determination of hardness of water using EDTA
  - a) Permanent hardness
  - b) Temporary hardness
3. Determination of Acidity
4. Determination of Alkalinity
5. Determination of chlorides in water samples

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**III Year Semester – VI**

**FOOD PACKAGING**

**Unit-1**

Introduction to the subject, packaging situations in world and in India - Packing is pervasive and essential - Historical development of packing - 'A package must protect what it sells and sell what it protects. Need of Packaging food - Logistics - Merchandising Outlets - Handling - Transportation - Packaging machinery - Technology upgradation - Public Distribution - Cost effective packaging. Packaging requirements - Levels of Packaging - Packaging functions - Attractiveness - Protection - Convenience - Printability – Differentiability. Machinability - Environmental Impact - Low cost containment - Communication – Resealing features - Non toxicity - Aroma retention Chemistry Aseptic Packaging - Need for Aseptic Packaging - Materials used in Aseptic Packaging. Comparison of Conventional and Aseptic Packaging Aseptic Packaging System – Advantages.

**Unit-2**

Hazards acting on Package during transportation - Moisture impact - Light impact – Common insect pests - Changes in food quality - Biological changes in food quality Storage - Factors influencing - Shelf Life of fruits and vegetables - Atmospheric packaging - Respiratory Metabolism Controlled Atmospheric Packaging Technology (CAP) - Modified Atmospheric Packaging Technology (MAP) - Advantages of CAP and MAP - Effect of gases on MAP foods - N<sub>2</sub>, O<sub>2</sub>, CO<sub>2</sub> Labeling Laws - Packaging laws and Regulations - SWMA Rules - PFA Rules - FPO Rule - MFPO Rules - Agmark Rules - Class 'A' commodities - Class 'B' commodities – Misbranded Labeling rules for infant foods, National Standards on Packaging code for foodstuffs and Perishables - Classification of food stuffs according to the code - Decreasing order of their perishability - Milk and milk products

**Unit-3**

Fruits and vegetables - Meat, fish and poultry - Bakery rich foods - Protein rich foods -Edible starch and starch products - Oils and Fats - Food grains and food grain products -Sugar and Honey Stimulant foods - Alcoholic drinks and carbonated beverages - Food Additives and Spices and Condiments. Packaging materials - Classification of Packages - Paper as packaging material – Paper manufacture - Pulp - Mechanical pulp - Chemical pulping - Alkaline processes – Soda process - Sulfate process - Sulfite process - Semi chemical pulping - Digestion. Bleaching - Beating and Refining - Paper making - Converting - Calendering – Strength additives - Sizing agents. Types of paper - Kraft paper - Bleached paper - Grease proof paper - Glassine paper - Vegetable parchment Waxed paper



#### **Unit-4**

Paper Boards - Paper board grades - Folding Cartons - Kinds of carton boxes – Beverage Cartons - Molded Pulp containers - Printing and varnishing - Die cutting and creasing - Gluing and sealing. Glass as Package material - Composition of Glass - Basic parts of Glass container - Closures Parts of Closures - Types of Closures - Properties of glass - Internal pressure resistance - Vertical load Strength. Resistance to impact - Resistance to Scratches and Abrasions - Glass manufacture - Press and Blow (P&B) - Narrow Neck Press and Blow (NNPB) - Shape of glass Container Improvements in glass manufacturing - Hot and Cold end treatment of surface – Inspection of Glass - Advantages and Disadvantages. Metal as Packaging material - Introduction - Materials used in Can Manufacture – Properties. Manufacture of Tin Plate - Pig Iron - Steel making - Tin plating - Basic types of Metal Plate - Tin free steel (TFS)

#### **Unit-5**

Manufacture of ECCS- Aluminum Cans - Manufacture of Aluminium cans - Container - Advantages and Disadvantages Making Processes - End Manufacture - Three Piece Can Manufacture - Welded Side seams Soldered Side seams - Double Seaming - Two Piece Can Manufacture DWI Cans - DRD Cans - Protective and Decorative (Lacquers/ Enamels) - Aluminium foils and Containers - Tubes - Retort Pouch - Corrosion of Metals, Plastic Consumption and use in World and in India - Plastic as packaging material Classification of Plastics, Properties of Each Plastics - Uses and Machineries used in Food Packaging. Packaging of Specific Foods Like Bread, Biscuits, Coffee, Milk Powder, Egg Powder -Carbonated Beverages - Snack Foods Mechanical and Functional Tests on Packaging, on Packaging boxes and on Packaging Materials.

#### **Text Books**

Neelam Khetarpaul and Darshan Punia, Food Packaging

#### **Books for Reference**

EIRI Board of Consultants and Engineers, New Delhi, Modern Packaging Technology

Neelam Khetarpaul and Darshan Punia, Food Packaging

Richard Coles, Food Packaging Technology.

NIIR Food Packaging Technology, Hand Book

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**III Year Semester – VI**

**FOOD QUALITY AND CERTIFICATION**

**Unit-1**

Food Quality - its need and its role in Food Industry Food Quality and Quality Attributes - Classification of Quality Attributes and their role in food Quality Objectives, Importance and Functions of Quality Control Methods of quality concepts of Dough Rheology, Quality Assessment of Food materials - Fruits and Vegetables, Quality Assessment of Food materials - Cereals and legumes, Quality Assessment of Food materials - Dairy Products / Milk and Milk Products,

**Unit-2**

Quality Assessment of Food materials - Meat, Poultry, Egg and Processed food Products, Statistical Quality Control of Foods, Sensory Evaluation of Food Quality - Introduction - Panel Screening - Selection of Panel members Requirements for conducting Sensory Evaluation and serving procedures. Methods of Sensory Evaluation and Evaluation cards - Ranking and Rating procedures. Different methods of Quantitative descriptive analysis. Determination of Sensory thresholds and taste Interactions.

**Unit-3**

Objective/Instrumental analysis of Quality Control. Food laws and Standards (BIS) Consumer Studies - Types of Consumer studies - Preference Studies and Acceptance Studies. Consumer Studies - Types of Consumer studies - Preference Studies - Objectives of Consumer Preference Studies - factors affecting consumer acceptance. Information obtained from Consumer Study - Factors Influencing results from Consumer surveys.

**Unit-4**

Methods of Approach - Development of the questionnaire - Types of Questionnaire and other methods of data collection. Comparison of Laboratory Panels with Consumer panels. Limitations of Consumer Survey. Fundamentals of Food regulations - pertaining to Additives and Contaminants. Food regulations pertaining to aspects of Hygiene - Novel Foods & aspects of Labelling. Different existing Food legislations-norms in implementation.

**Unit-5**

Food grade and standards. International food regulations and certifications. Indian food regulations and Certifications. Concept of Codex Alimentarius. The concept and process of implementation of HACCP in an industry. USFDA - the cause of its existence - it's role in safe guarding food quality - ISO9000 series- Significance. Food Adulteration and Food Safety

## **Text Book**

Ranganna.S . *Handbook of Analysis and Quality Control – Fruits and Vegetable Products*Tata  
Mc Graw Hill, New Delhi BIS standards on *Sensory Evaluation*

## **References**

Imteaz Ali. Food Quality Assurance – Principles and Practices .CHIPS, Texas.

Multon. J.L. Quality Control for Food and Agricultural Products .CHIPS, Texas.

Amerine, Pangborn. M.A. and Roseiur.Principles of Sensory Evaluation of Food.

Birk, G.G. Berman and Parker.K.J.Sensory Properties of Food.Applied Science, London.

Pattee.Evaluation of Food quality of fruits and vegetables. AVI publishers, Westport.

Ranganna.S . *Handbook of Analysis and Quality Control – Fruits and Vegetable Products*. Tata  
Mc Graw Hill, New Delhi BIS standards on *Sensory Evaluation*

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**PROCESSING EQUIPMENT**

**Unit-1**

Introduction to Material Handling and Transportation-Belt conveyor, Bucket elevator, Screw conveyor, Pneumatic conveyor, Chain conveyor. Selection of material handling machines and Conveyors. Belt conveyor; Belt conveyor idlers, Idler spacing, Belt tension, Chain conveyor Bucket Elevator: Head section, Boot section, Elevator legs, Elevator Belts, Buckets, Drive mechanism, HP requirement Screw Conveyor: Screw conveyor details, various shapes of screw conveyor trough, Capacity and Horse Power. Pneumatic conveyor, Limitations of pneumatic conveying Cleaning, Sorting and Grading

**Unit-2**

Peeling, Dehulling, Dehusking, Mixing Definition, Measurement of Mixing, Mixing index, Mixing Equipment- Double cone mixer, Ribbon mixer, Kneader, Propeller mixer, Forming-Bread moulders, Pie and biscuit formers, Confectionery moulders, Size Reduction and Separation-Introduction, Grinding and cutting, Energy used in grinding, Kick's law, Rittinger's law, Bond's law, Cutting & Grinding Equipment, Jaw crusher, Gyratory crusher, Hammer mill, Ball mill, Tumbling mill, Separation by Centrifugation, Filtration –Equipment and introduction Introduction to heat processing - Blanching, Pasteurization, Sterilization Interaction of Heat Energy and Food Components - Introduction to Reaction Kinetics,

**Unit-3**

Separation by Expression, Extraction using solvents, Membrane concentration. Introduction and importance of Physical properties-Shape and size of grains, Shape and size of Fruits, Bulk density of the grains. True density of the grains, Porosity, Angle of repose, Test weight. Co-efficient of external friction, Co-efficient of internal friction, colour of food Materials. The need to consider hygienic design, Hazards, How to approach Hygienic design, Hygienic design Priorities, Hygienic design principles, some general design pointers (Do's & Don'ts).Some Basic Concepts of Rheology, Biological systems and mechanical properties, ASTM

**Unit-4**

Standard Definition of terms related to mechanical properties, Some Basic Concepts of Rheology, Biological systems and mechanical properties, ASTM Standard Definition of Terms related to mechanical properties. Other Definitions related to Mechanical Properties, Physical states of a material, Classical Ideal materials, Ideal elastic behavior (Hookean body), Ideal plastic behavior (St. Venant body), Ideal viscous behavior (Newtonian liquid), Rheological models, Electrical equivalence of mechanical models. Temperature Dependence of Kinetics, Thermal Destruction of microorganisms, Thermal Destruction of Enzymes, Thermal Destruction of Nutrients and quality factors

## **Unit-5**

Aero and Hydrodynamic Properties. Drag coefficient and Terminal velocity, Evaporation, Boiling point Elevation, Types of Evaporators, Batch Type pan evaporator, Natural circulation evaporators. Rising film evaporator, Falling film evaporator, Rising and Falling film evaporator, Forced - circulation evaporator, Agitated thin-film evaporator, Design of a single effect evaporator, Material and energy balances, Evaporator efficiency, multiple effect evaporator, Sizing of multiple effect evaporators. Thin layer drying, Moisture content, Equilibrium moisture content, Hysteresis, Drying curves, Constant - rate period, Falling - rate period. Tray and cabinet dryer, Tunnel dryer, Puff-drying, Fluidized - Bed drying, Spray drying, Freeze – Drying.

### **Text Books**

Fellows P.J. Food Processing Technology, Principles and Practice. Wood Head Publishing Ltd., Cambridge, England.

Fennema. Principles of Food Science. Part II. Marcel Dekker Inc. publishers.

### **Books for Reference**

Cabe Mc., Smith J.C and Harriot P. Unit operations of Chemical Engineering. Mc Graw Hill Publishers. New Delhi.

Mohesinin N. N. Physical properties of Plant and Animal materials.

Stanley E.C. Fundamentals of Food Engineering. AVI Publishers. Westport. USA.

Sahay K.M and Singh K.K. Unit operations of Agricultural Processing. Vikas Publishing House Pvt. Ltd. New Delhi.

Earle R.L. Unit operations in Food Engineering.

Fellows P.J. Food Processing Technology, Principles and Practice. Wood Head Publishing Ltd., Cambridge, England.

Singh R. P and Heldman D.R. Introduction to Food Engineering. 3rd Edn.,

Smith P.G. Introduction to Food Process Engineering.

Chakraverty A. Post Harvest Technology of Cereals, Pulses and Oilseeds. Oxford & IBH Publishers. New Delhi.

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**LAWS AND REGULATIONS**

**Unit-1**

Introduction - What is the need for food/standards and their enforcement. Various types of laws- Mandatory/Regulatory and Voluntary/Optional - Introduction to various food laws (Mandatory) - Food Safety and Standards Act, 2006 (FSSA), Edible Oils Packaging (Regulation) Order, 1998, Environment (Protection) Act, 1986, Fruit Products Order, 1955 (FPO), Meat Food Products Order, 1973 (MFPO), Milk and Milk Product Order, 1992 (MMPO), Solvent Extracted Oil, De-oiled Meal and Edible Flour (Control) Order, 1967, Standards of Weights and Measures Act, 1976, The Essential Commodities Act, 1955, The Export (Quality Control and Inspection) Act, 1963, The Insecticides Act, 1968, Vegetables Oil Products(Control) Order, 1998, Prevention of Food Adulteration Act & Rules (PFA Act), 1954

**Unit-2**

Introduction to various food laws (Voluntary) - Agmark Standards (AGMARK), Codex Alimentarius Standards, BIS Standards and Specifications, Consumer Protection Act, 1986 Food Safety and Standards Act, 2006 (FSSA) - Need, Scope and Definitions (Chapter I of FSSA, 2006), Establishment of Food Safety and Standards Authority of India (FSSAI) (II), Composition of FSSAI and qualifications for appointment of its Chairperson & other Members, Functions of the chairperson and other members of FSSAI. Establishment and Functions of Central Advisory Committee, Scientific Panels, Scientific Committees. Duties and functions of Food Authority General principles to be followed in the administration of FSSA (III).

**Unit-3**

General provisions as to articles of food in the FSSA (IV). Special responsibility as to safety (VI). Analysis of food (VIII). Offences and penalties (IX) Enforcement of FSSA (VII). Food Safety Officer (FSO)/ Food Inspector (Called so by PFA Act) - Powers, Duties and functions of FSO. Prevention of Food Adulteration Act & Rules (PFA Act), 1954. Definition. Object of the act. Central committee for food standards. Analysis of Food - Public Analysts & Food Inspectors. Powers of the food Inspectors. Procedures to be followed by the Food Inspectors. Report of public analyst. (PFA Act 1954 and Part IV of PFA Rules, 1955) Sealing, fastening and dispatch of samples

**Unit-4**

Powers of Court (Section 14 to 25 of PFA Act, 1954) Consumer Protection Act, 1986 and Consumer Protection Rules, 1987. - Need, Scope, Functions and Enforcement. Environment (Protection) Act, 1986. - Need, Scope, Functions and Enforcement. The Insecticides Act, 1968. - Need, Scope, Functions and Enforcement. The Export (Quality Control and Inspection) Act,

1963. - Need, Scope, Functions and Enforcement. Fruit Products Order, 1955 (FPO). - Need, Scope, Functions and Enforcement. Milk and Milk Product Order, 1992 (MMPO).- Need, Scope, Functions & Enforcement

### **Unit-5**

The Plants, Fruits and Seeds (Regulation of Imports in India) Order, 1989. - Need, Scope, Functions and Enforcement. Edible Oils Packaging (Regulation) Order, 1998. - Need, Scope, Functions & Enforcement. Meat Food Products Order, 1973 (MFPO).- Need, Scope, Functions & Enforcement Standards of Weights and Measures Act, 1976. - Need, Scope, Functions & Enforcement The Essential Commodities Act, 1955. - Need, Scope, Functions & Enforcement. Optional food standards. Their scope, Need - Procedure to obtain that standard (ISO 9001,14000 etc.) AGMARK Bureau of Indian Standards (BIS) Codex Alimentarius. Scope of Codex Alimentarius and Codex Standards Codex standards for Cereals & Pulses Codex standards for Fruits and Vegetables Codex standards for Meat and Poultry products Recommended International Code of hygiene for various food products

### **Text Books**

Ranganna S. Hand book of Analysis and Quality Control for Fruit and Vegetable Products .  
Srilakshmi B. Food Science .

### **Reference books**

Patricia and A curtis An operational Text Book, Guide to Food Laws and Regulations.

Ranganna S. Hand book of Analysis and Quality Control for Fruit and Vegetable Products .  
Srilakshmi B. Food Science .

Avanthi Sharma A text book of Food Science and Technology.

Sumati R Mudambi, Shalini M Rao and Rajagopal M.V. - Food Science.

Norman N Potter and Joseph H Hotchkiss - Food science.

Dev Raj, Rakesh Sharma and V.K. Joshi Quality for Value Addition in Food Processing.

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**TECHNIQUES IN FOOD ANALYSIS**

**Unit-1**

Introduction to the chemical analysis of food - Definitions of food analysis, Quality control, Official methods of analysis. Association of Official Analytical Chemists, American Association of Cereal Chemists, American Oil Chemists Society, Rules and Regulations of Food Analysis, Nutritional Labelling, Food Inspection and Grading, food safety - Safety rules in the chemistry- Safety rules - What to do in case of an accident - Broken Glass - Small chemical spill - Large chemical spill - Chemical splash in your face - Large splash of dangerous chemical on your clothing and or body, small confined fire, small open fire, large fire, your clothing on fire

**Unit-2**

First Aid -Thermal burns, chemical burns, minor bleeding, toxic fumes, fainting and shock, chemical splashes. Sampling and Sampling Techniques - Introduction - Definitions of Population, Laboratory. Sample, sample, precision, accuracy, sensitivity, Reproducibility - of Analysis – Official Samples, Raw Materials. Basic principles of spectrophotometer and colorimeter and its application Analysis of Carbohydrates - Introduction - Importance of Carbohydrate Analysis – Methods of Analysis - Sample preparation - Extraction of Monosaccharides, Oligo saccharides

**Unit-3**

Chemical methods for carbohydrates - Gravimetric methods - Titrimetric methods - Colorimetric methods - phenol sulfuric acid - Enzymatic methods. Physical methods - Polarimetric method, Refractive index measurements, Density, Infrared radiation, Immuno assays, Analysis of starch and crude fibre Analysis of proteins - Introduction - Importance of protein analysis - Determination of overall protein concentration by Kjeldhal method, Enhanced Dumas method, using U.V. Visible spectroscopy. Direct measurement at 280 nm, Biuret method, Lowry method, Dye binding method, Turbido metric method

**Unit-4**

Protein and characterisation - Basic principles of chromatography - types of chromatography and its applications. Analysis of lipids - Introduction - Importance of analysis of lipids - Determination of total lipid concentration - solvent extraction. Extraction of lipids - solvent, Non solvent extraction methods, instrumentation methods



## **Unit-5**

Determination of lipid composition - Separation and analysis by chromatography – lipids fractions of TLC - Fatty acid methyl esters by GC - Chemical techniques - acid value, instrumental techniques of analyzing lipid oxidation in foods - Chromatography, peroxide value - Characteristics of physico chemical properties Analysis of minerals - Introduction - Importance of mineral analysis - Dry ashing – Wet ashing - Low plasma ashing, Adsorption spectroscopy

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**TECHNIQUES IN FOOD ANALYSIS (PRACTICAL)**

1. Introduction to Food Analysis Techniques
2. Preparation of solutions
3. Preparation of Buffers
4. Preparation of standard graph
5. Sampling techniques and methods of sample preparation
6. Colorimetry and spectrophotometry
7. Determination of pH of Food samples (milk, flours, jams)
8. Determination of Titratable acidity
9. Determination of Moisture and Total solids
10. Estimation of carbohydrates by Phenol Sulphuric Acid method
11. Test for adulterants in Sugar, Jaggery, Honey
12. Test for adulterants in Milk, Ghee
13. Test for adulterants in plantation crops (Tea, coffee) and Turmeric
14. Test for adulterants in spices (Cardamom, cloves, pepper)

**Text Books**

Mano Ranjan Kalia First Edition 2002, Food Analysis and Quality Control. Kalyani Publishers, New Delhi, Hyderabad.

**Books for Reference**

S.S. Nilson, Food Analysis, Aspen Publishers, Gaithery Berg, Mary Land.  
AOAC methods For Food Analysis.

Y. Pomeranz and C.E. Meloan, Food Analysis, Theory and practice, A.V.I Publishing Company, INC West Port, Connecticut, U.S.A.,

Jayaraman, J. 1980. Laboratory Manual in Biochemistry. Wiley Eastern Publishers, New Delhi. Plummer, D.T. 1979. An introduction to Practical Biochemistry. Tata Mc Graw-Hill Publishing Co., New Delhi.

Sadasivam, S. and Manickam, A. 1996. Biochemical methods for Agricultural Sciences. New Age International Publisher, New Delhi.

ManoRanjanKalia First Edition 2002, Food Analysis and Quality Control. Kalyani Publishers, New Delhi, Hyderabad.

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**FOOD TRADE AND BUSINESS MANAGEMENT**

**Unit-1**

Business - meaning - characteristics of business - divisions of business - industry – commerce. Theories of Management. Functions of management - Planning - nature of planning - importance of planning - kinds of enterprise plans - planning premises - forecasting - steps in forecasting. Organization - Meaning - importance - features of all organization structures - views of organization - process of organization - principles of organization. Staffing and directing - nature of direction - principles of direction- communication - Motivation. Controlling - nature of controlling- requirements of good control system.

**Unit-2**

Co-ordination - features of co-ordination-techniques of co-ordination. Fixed capital - factors determining fixed capital requirements - sources of fixed capital - working capital - gross and net classification-determinants and sources. Human resource development - man power planning - manpower utilization - current man. power assessment - future man power demand - employment trends Objectives of purchase department- steps in purchasing - store keeping - objectives and functions of store keeping.

**Unit-3**

Marketing Management - Definition - Meaning - Importance - Marketing mix - 4Ps of Marketing- Product - Place - Price - Promotion - 4 c's of marketing mix Different Process of Marketing- Market Segmentation - Methods of market Segmentation - Target marketing - Market Penetration- Market positioning. Product life cycle - Introduction stage - Growth - Maturity - Saturation - Decline – why Products fail - Extending the life cycle of a product. . Personnel Management - importance - objectives - scope of Personal Management Sectors in food Industry

**Unit-4**

International Trade - Definition - Basis for International Trade - Distinction between Home trade and foreign trade. Advantages and Disadvantages of International Trade. Principles of International trade - Classical theory - theory of absolute advantage - Theory of comparative costs. Modern theory of International Trade Free trade Vs protection - Methods of protection -

Quotas, bounties, exchange control, De-valuation - commercial treaties. Terms of trade - Balance of Trade - Balance of payments, Introduction, Current and Capital accounts Terms of trade - Equilibrium - Dis-equilibrium in balance of payments - Methods of Correcting dis-equilibrium. EXIM policy - Commodity agreements. Foreign exchange - Introduction - mode of foreign payments - Exchange rate Determination - Under Gold Standard

## **Unit-5**

Theories of Exchange rate determination – the Purchasing Power Parity (PPP) theory. Modern theory of exchange rate determination Achievements of GATT - International Economic organization - GATT – Brief history of GATT rounds – Achievements of GATT. WTO – Functions of WTO – Objectives of WTO – Structure of WTO – Scope of WTO. Role of WTO in International Trade - Difference between WTO and GATT - Superiority of the WTO over the GATT. United Nations conference on trade and development (UNCTAD). European Economic Community (EEC). Trade related aspects intellectual property rights – Trade mark – Trade secret – Patents – Industrial Designs – Copy rights etc. Government institutions related to international food trade - APEDA, Tea board. Management of export import organization – Registration – Documentation. Agencies of International Trade ECM, EFTA 1959, LAFTA, CACM, UNCTAD

## **Text Book**

Dewett K.K. and Varma J.D. , Elementary Economic Theory.

## **Books for Reference**

Dewett K.K. and Varma J.D. , Elementary Economic Theory.

Dewett K.K. and Chand S. , Modern Economic Theory.

Paul R.R., Money, Banking and International Trade.

Vaish and Sudama Singh M.C. , International Economics.

Prabhakara Rao J.V. and Ranganathachari R.V. , International Business.

David D and Erickson S. 1987, Principles of Agri business management - Mc Graw Hill Book Co., New Delhi.

Harold Koontz, O Donnell and Weihrich 1987 Management.

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Cundiff Higler 1993, Marketing in the international environment -, P H I New Delhi.

Batra G. S. and Narindev kumar (1994 ), GATT implications of Denkel proposals - Azmol publications Pvt., New Delhi.

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Tripathi and Reddy 1994 Principles of Management.

Ahuja K.K. 1998 Personal management.

Rajan Sexena 1998 Marketing management.

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Gupta R.S., Sharma B.D. and Bhalla N.S. (1999) Principles and Practices of Management.

Mirza S Saiyadain 2006 Human Resource Management.

Bhushan Y.K. 2008 Fundamentals of Business Organization and Management.

Mohini Sethi 2008 Institutional Food Management.

Seetharaman S. and Venkateswara Prasad B. 2009 Human Resource Management.

Narayanappa G.L. 2009 Human Resource Management.