**Bachelor of Technology (Food Technology)**

**Credit-Based**

SCHEME OF STUDIES/EXAMINATIONS (Modified)

**Semester – III (w.e.f. session 2019-20)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S. No. | Course No. | Course Title | Teaching Schedule | Credits | Allotment of Marks | Duration of Exam(Hrs.) |
| L | T | P | Hours/Week | Major Test | Minor Test | Practical | Total |
| 1 | FTT-201A |  Food Microbiology | 3 | 0 | 0 | 3 | 3.0 | 75 | 25 | 0 | 100 | 3 |
| 2 | FTT-203A | Food chemistry | 3 | 0 | 0 | 3 | 3.0 | 75 | 25 | 0 | 100 | 3 |
| 3 | FTT-205A |  Unit Operation In Food Engg. – I | 3 | 0 | 0 | 3 | 3.0 | 75 | 25 | 0 | 100 | 3 |
| 4 | FTT-207A |  Food processing | 3 | 0 | 0 | 3 | 3.0 | 75 | 25 | 0 | 100 | 3 |
| 5 | FTT -211L A | Food Microbiology Lab | 0 | 0 | 3 | 3 | 1.5 | 0 | 40 | 60 | 100 | 3 |
| 6 | FTT – 213LA | Food chemistry Lab | 0 | 0 |  4 | 4 | 2.0 | 0 | 40 | 60 | 100 | 3 |
| 7 | FTT – 215 LA |  Unit Operation In Food Engg. - I Lab | 0 | 0 | 4 | 4 | 2.0 | 0 | 40 | 60 | 100 | 3 |
| 8 | FTT – 217 LA | Food processing Lab | 0 | 0 | 4 | 4 | 2.0 | 0 | 40 | 60 | 100 | 3 |
|  |  | **Total** | **12** | **0** | **15** | **27** | **19.5** | **300** | **260** | **240** | **800** |  |
| 9 | FTT-219A | Industrial Training-I | 2 | 0 | 0 | 2 | - | - | 100 | - | 100 | - |
| 10 | \*MC-902A | Constitution of India | 3 | 0 | 0 | 3 |  | 75 | 25 | 0 | 100 | 3 |

**Note:** FTT-219 A is a mandatory credit less course in which the students evaluated for the industrial training undergone after 2nd semester and students will be required to get passing marks to qualify.

**\*MC-902A** is a mandatory credit less course in which the student will be required to get passing marks in the major test.

**Bachelor of Technology (Food Technology)**

**Credit-Based**

SCHEME OF STUDIES/EXAMINATIONS (Modified)

**Semester – IV (w.e.f. session 2019-20**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S. No. | Course No. | Course Title | Teaching Schedule | Credits | Allotment of Marks | Duration of Exam(Hrs.) |
| L | T | P | Hours/Week | Major Test | Minor Test | Practical | Total |
| 1 | FTT-202A | Human Nutrition | 3 | 0 | 0 | 3 | 3.0 | 75 | 25 | 0 | 100 | 3 |
| 2 | FTT- 204A | Thermal Processing | 3 | 0 | 0 | 3 | 3.0 | 75 | 25 | 0 | 100 | 3 |
| 3 | FTT – 206A | Unit Operation In Food Engg. – II | 3 | 0 | 0 | 3 | 3.0 | 75 | 25 | 0 | 100 | 3 |
| 4 | FTT- 208 A | Dairy Technology | 3 | 0 | 0 | 3 | 3.0 | 75 | 25 | 0 | 100 | 3 |
| 5 | FTT-210A | Fruit and Vegetable Processing | 3 | 0 | 0 | 3 | 3.0 | 75 | 25 | 0 | 100 | 3 |
| 6 | FTT- 214LA | Thermal Processing Lab | 0 | 0 | 3 | 3 | 1.5 | 0 | 40 | 60 | 100 | 3 |
| 7 | FTT -216LA | Unit Operation In Food Engg. - II Lab | 0 | 0 | 3 | 3 | 1.5 | 0 | 40 | 60 | 100 | 3 |
| 8 | FTT-218LA | Dairy Technology Lab | 0 | 0 | 3 | 3 | 1.5 | 0 | 40 | 60 | 100 | 3 |
| 9 | FTT-220LA | Fruit and Vegetable Processing Lab | 0 | 0 | 3 | 3 | 1.5 | 0 | 40 | 60 | 100 | 3 |
|  |  | **Total** | **15** | **0** |  **12** | **27** | **21** | **375** | **285** | **240** | **900** |  |
| 10 | MC-901A\* | Environmental Sciences\* | 3 | 0 | 0 | 3 |  | 75 | 25 | 0 | 100 | 3 |

**\*MC-901A**is a mandatory credit less course in which the student will be required to get passing marks in the major test.

**Note :** All the students have to undergo 4-6 weeks industrial training after IV semester and to be evaluated in V semester.

|  |  |
| --- | --- |
| **FTT-201A** | **Food Microbiology** |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **75** | **25** | **100** | **3h** |
| **Purpose** | **To introduce the Basics concept of Microbiology.** |
| **Course Outcomes(CO)** |
| **CO 1** | To teach about the history and scope of food microbiology.  |
| **CO 2** | To learn about the role of microorganisms in different foods. |
| **CO 3** | To impart knowledge of different fermented foods produced by microorganisms. |
| **CO 4** | Describe the microbial spoilage and food borne diseases and their control. |

**Unit-I**

**Introduction** – History of microbiology, cellular organization- eukaryotic and prokaryotic organisms, Food borne and related organisms-bacteria, yeast, molds & viruses. Importance of microorganism in food industry.

 **Unit-II**

**Type & Growth Pattern**- Growth pattern in microbes, relationship between number of generations and total number of microbes., physical & chemical factors affecting growth and destruction of microbes- aerobes and anaerobes, psychrophiles, psychrotrophs, pedophiles, thermo uric, thermopiles, halophiles, osmophiles & spore formers.

 **Unit-III**

**Metabolism & Microbial Techniques:-** Fermentation, putrefaction, lipolysis, antagonism and synergism in microorganisms. Rapid methods of microbial analysis: immunoassays, nucleic acid probes & PCR in food analysis. Techniques of pure culture: Definition, Serial Dilution, pour plate, streak plate, spread plate, slant,broth and enrichment culture, lyophilization.

 **Unit-VI**

 **Food borne infections**– Types of food poisonings, important features and control, microbial toxins, mushrooms and algae as foods, probiotics, indicator organisms, detection & quantification of microbes and their products including toxins, sources and control of microorganisms-asepsis, sanitation.

**Recommended Books:-**

|  |  |
| --- | --- |
| **Author** | **Title** |
| James M. J.  | Modern Food Microbiology, 5th Edition, CBS Publishers |
| W.C. Frazier | Food Microbiology |
| Bibek Ray  | Fundamental Food Microbiology, CRC Press. |
| Roger. Y. Stainier  | General Microbiology’, 5th Edn. Macmillan, 1987. |

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

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| --- | --- |
|  **FTT -211LA** | **Food Microbiology Lab** |
| **L** | **T** | **P** | **Credit** | **Practical** | **Minor Test** | **Total** | **Time** |
| **-** | **-** | **3** | **1.5** | **60** | **40** | **100** | **3h** |
| **Purpose** | **Give the knowledge of basic practicals of Food Microbiology.**  |
| **Course Outcomes** |
| **CO1** | **To make the students familiar with the experiments of Microbiology.**  |
| **CO2** | **To give the knowledge of handling of the experiments related with Food Microorganisms.**  |

**Note: Student will be required to perform the following Experiments:--**

**List of Experiments**

1. Working study of various equipments related to Microbiology.

2. Isolation of pure culture using pour plate technique.

3. Isolating pure culture using spread plate technique.

4. Measurement the size of given microbial cell using micrometry.

5. Enumeration total viable count in a culture.

6. To perform Gram staining technique of bacteria.

7. To study the microbial spoilage of given food sample**.**

|  |  |
| --- | --- |
| **FTT-203A** | **Food chemistry** |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **75** | **25** | **100** | **3h** |
| **Purpose** | **To introduce the Basics concept of Food Chemistry.** |
| **Course Outcomes(CO)** |
| **CO 1** | To teach about the role of food chemistry in food proseccing.  |
| **CO 2** | To learn about the role of biomolecules in food chemistry. |
| **CO 3** | To impart knowledge of different tupes of biomolecules. |
| **CO 4** | Describe the details of Carbohydrates, Proteins, Vit. etc. |

 **UNIT-I**

**Introduction:-** Development of food chemistry and its role in food processing.

**Water:** Importance of water in foods. Structure of water & ice. Concept of bound & free water and their implications.

**Unit-II**

**Proteins:-**Proteins in human’s diet, classification and properties of amino acids, chemicaland physical properties of protein, structure of amino acids, essential and non-essential amino acids, isolation of amino acids, criteria of purity of proteins, separation, qualitative and quatitative analysis of proleins. Changes during processing, protein determination methods.

**Carbohydrates:** Nomenclature and classification, structure, physical and chemicalproperties of polysaccharides (cellulose, starch, fructans, galactans, hemi-cellulose, pectic substances) and their functions, changes in carbohydrates during processing.

**Unit-III**

**Lipids:-**Structure, physical and chemical properties, utilization of fats and oils, margarine, shortenings, salad and cooking oils in diet, introduction to hydrogenation and its importance.

**Browning Reactions:-** Enzymatic and non-enzymatic browning. Advantages and disadvantages factors affecting their reaction and control.

**Vitamins & Minerals**:- Types, chemistry and functions, source and deficiency diseases. Changes during Processing

**Unit-IV**

**Enzymes**: Nomenclature, mechanism of enzyme action, factors affecting enzyme action, enzymes important in foods.

**Pigments**: Structure and properties of chlorophyll, anthocyanins, tannin, myoglobin and carotenoids, chemical changes during processing.

 **Recommended Books**

|  |  |
| --- | --- |
| **Author**  | **Title** |
| M.C code and Smith | Unit operations of Chemical Engineering |
| Cadger & Bancharo  | Introduction to Chem. Engg  |

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

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| **FTT -213L A** | **Food Chemistry Lab** |
| **L** | **T** | **P** | **Credit** | **Practical** | **Minor Test** | **Total** | **Time** |
| **-** | **-** | **4** | **2.0** | **60** | **40** | **100** | **3h** |
| **Purpose** | **Give the knowledge of basic practicals of Food Chemistry.**  |
| **Course Outcomes** |
| **CO1** | **To make the students familiar with the experiments of Chemistry.**  |
| **CO2** | **To give the knowledge of handling of the experiments related with food chemistry.**  |

**Note: Student will be required to perform the following Experiments:--**

**List of Experiments**

1 Preparation of sample for analysis

2. Determination of acidity/pH of food samples.

3. Qualitative tests for the presence of carbohydrates & Proteins in food samples.

4. Estimation of preservatives, ant oxidation & tannins Estimation of pectin in fruit (Guava).

5. Determination of saponification value and un-saponifiable matter.

6. Determination of vitamin C in food sample.

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|  **FTT-205A** | **Unit Operation In Food Engg. – I** |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **75** | **25** | **100** | **3h** |
| **Purpose** | **To introduce the Basics concept of Food Chemistry.** |
| **Course Outcomes(CO)** |
| **CO 1** | To teach about the Measurement Techniques.  |
| **CO 2** | To learn about the role of mixing & Agitation in food Engg. |
| **CO 3** | To impart knowledge of different types of fluid Transport. |
| **CO 4** | Describe the details of Fluidization. |

 **UNIT-I**

**Fluid Transport:-** Analogy between Momentum, Heat and Mass transfer, Transportestimation, Dependence of velocity on temperature, pressure and composition, boundary conditions, velocity profiles thro pipes & flat plates, annulus space, Euler’s equation & its application in stationary & moving fluid bodies, moment urn transport in turbulent flows. Flow of fluids, Nozzies and diffusers, Transportation of fluids, pumps, centrifugal reciprocating, Plunger, gear pump and vaccum pump, compressors, single and multistage, Ejectors.

 **UNIT-II**

 **How Measurement Techniques**: Venturi meter, orifice meter Rotameter, V-notch, Squarenotch and weirs, pitot tube, simple numerical problems.

**UNIT-III**

**Mixing And Agitation:**Different type of Agitators such as Propeller, paddle and Turbine,power calculation in agitation for Newtonian and non-Newtonian fluids, various types of mixers such as Ribbon mixer, Halical mixer etc. Mixing index, difference between mixing and Agitation.

**UNIT-IV**

**Fluidization:-**Flow through packed beds, Mechanism of fluidization, Minimum porosity,bed height minimum fluidization velocity. Two phase flow, pneumatic conveying and applications.

**Recommended Books**

|  |  |
| --- | --- |
| **Author**  | **Title** |
| Fennama | Food Chemistry |
| Lehhninger | Principles of Biochemistry |
| Frank A. Lee  | Basic Food Chemistry’, Springer Publication, 2013 |
| L.H. Meyer, L.H. Van  | Food Chemistry’, Reinhold Company Publication, New York |
| Lehninger | Principles of Biochemistry’, Palgrave Macmillan Publication |

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

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| **FTT -215L A** | **Unit Operation In Food Engg. - I Lab**  |
| **L** | **T** | **P** | **Credit** | **Practical** | **Minor Test** | **Total** | **Time** |
| **-** | **-** | **4** | **2.0** | **60** | **40** | **100** | **3h** |
| **Purpose** | **Give the knowledge of basic practicals of Food Engg.**  |
| **Course Outcomes** |
| **CO1** | **To make the students familiar with the experiments of unit Operation.**  |
| **CO2** | **To give the knowledge of handling of the experiments related with Food Engg.**  |

**Note: Student will be required to perform the following Experiments:--**

**List of Experiments**

1.To study the process of roasting/

2.To study the effect of time- temperature combination on roasting.

3. Determination of oil uptake by the food product during frying

4. Study on qualitative changes in the fried food product

5. To study the puffing/ popping characteristics of selected grains

6. To determine the efficacy of a blanching process

7. To determine time-temperature combination for a blanching process

8. To determine the efficacy of a sterilization process

9. Numerical problem on thermo bacteriology (D, Z and F)

10. Determination of F value for a product in can/ retortable pouch

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|  **FTT-207A** | **Food Processing** |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **75** | **25** | **100** | **3h** |
| **Purpose** | **To introduce the Basics concept of Food Processing.** |
| **Course Outcomes(CO)** |
| **CO 1** | To teach about the Scope & trends in Food Industry.  |
| **CO 2** | To learn about the different types of preservation methods. |
| **CO 3** | To impart knowledge of different types of unconventional methods. |
| **CO 4** | Describe the details of asepsis of microorganisms. |

 **UNIT-I**

**Scope and Trends in Food Industry:-** Status of Indian food industry with emphasis of Jammu and Kashmir. Definition of food-Food technology, Food science, Food preservation and food engineering basic consideration. Importance of Food processing and preservation. Classification of foods on the basis of shelf life, pH, origin: Different types of Food spoilage viz. microbiological, bio-chemical and physical and their effects on food spoilage viz. microbiogical, bio-chemical, Chemical and Physical and their effects on food quality.

**UNIT-II**

**Preservation by sugar and salt:-**Principle of salt (pickling, fermentation etc.) and sugar preservation. Preparation of intermediate moisture food (IMF)

**Preservation by Low Temperature:-**Low temperature required for different foods-Refrigeration-refrigeration load: refrigeration systems: Slow and fast freezing, freezing process: Types of freezer advantages and disadvantages: storage and thawing of frozen food.

**Preservation by High Temperature:-** Pasteurization, Sterilization, Canning: Definition, advantages and disadvantages, can formation. Unit operations in camming selection of raw material peeling coring. Blanching filling, brining/syruping, exhausting, sealing. Processing, cooling labeling and storage.

**UNIT-III**

 **Moisture Removal:-**Evaporation, concentration, drying, and dehydration, types of dryers, advantages and disadvantages, operation and maintenance of different drying system, selection of dryers, basics of drying calculations

**Chemical preservatives in Food Preservation:-**Types of chemical preservativeused in different food products and their stability during processes.

**UNIT-IV**

 **Radiation preservation of foods:-**Irradiation of Foods, dozes of dozer of irradiation-its effect on food quality

**New and unconventional Methods of Processing:-**

Principles of :

* High pressure Technology of Food preservation
* Infra Ted (IR) technique
* Microwave heating

Asepsis and removal of micro organism

**Recommended Books :-**

|  |  |
| --- | --- |
|  **Author**  |  **Title** |
| Norman N. Potter | Principles of Food Processing |
| Girdhari Lal, G. S. Siddappa, G. L  | Preservation of Fruits & Vegetables |
| P. Fellows | Food Processing Technology: Principles and Practice |

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

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| --- | --- |
| **FTT -217L A** | **Food processing Lab** |
| **L** | **T** | **P** | **Credit** | **Practical** | **Minor Test** | **Total** | **Time** |
| **-** | **-** | **4** | **2.0** | **60** | **40** | **100** | **3h** |
| **Purpose** | **Give the knowledge of basic practicals of Food .**  |
| **Course Outcomes** |
| **CO1** | **To make the students familiar with the experiments of unit Operation.**  |
| **CO2** | **To give the knowledge of handling of the experiments related with Food Engg.**  |

**Note: Student will be required to perform the following Experiments:--**

**List of Experiments**

1. Demonstration of various machineries used in processing.

2. Demonstration of effect of blanching on food quality characteristics.

3. Preservation using heat.

4. Preservation by low temperature.

5. Preservation by high concentration of sugar(Jam/Jelly/Marmalade /syrup/squash).

6. Preservation by using salt (pickling).

7. Preservation by using chemical preservatives (sodium benzoate, calcium propionate).

8. Drying and dehydration of fruit.

9. Drying and dehydration of vegetables

10. Preservation of coconut shreds using humectants.

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| **MC-902A** | **Constitution of India** |
| **Lecture** | **Tutorial** | **Practical** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **-** | **-** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | **To know the basic features of Constitution of India** |
| **Course Outcomes** |
| **CO1** | **The students will be able to know about salient features of the Constitution of India.** |
| **CO2** | **To know about fundamental duties and federal structure of Constitution of India.**  |
| **CO3** | **To know about emergency provisions in Constitution of India.** |
| **CO4** | **To know about fundamental rights under constitution of India.** |

 **UNIT-I**

1. Meaning of the constitution law and constitutionalism, Historical perspective of the Constitution of India. Salient features and characteristics of the Constitution of India.
2. Scheme of the fundamental rights

**UNIT - II**

1. The scheme of the Fundamental Duties and its legal status. The Directive Principles of State Policy – Its importance and implementation. Federal structure and distribution of legislative and financial powers between the Union and the States.
2. Parliamentary Form of Government in India – The constitution powers and status of the President of India

**UNIT - III**

1. Amendment of the Constitutional Powers and Procedure. The historical perspectives of the constitutional amendments in India.
2. Emergency Provisions: National Emergency, President Rule, Financial Emergency. Local Self Government – Constitutional Scheme in India.

**UNIT-IV**

7. Scheme of the Fundamental Right to Equality. Scheme of the Fundamental Right to certain Freedom under Article 19.

8. Scope of the Right to Life and Personal Liberty under Article 21.

**Text Books**

1. Constitution of India. Prof.Narender Kumar (2008) 8th edition. Allahabad Law Agency**.**

**Reference Books:**

1. The constitution of India. P.M. Bakshi (2016) 15th edition. Universal law Publishing.

|  |  |
| --- | --- |
|  **FTT-202A** | **Human Nutrition** |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **75** | **25** | **100** | **3h** |
| **Purpose** | **To introduce the Basics concept of Human Nutrition.** |
| **Course Outcomes(CO)** |
| **CO 1** | To teach about the concept & content of nutrition.  |
| **CO 2** | To learn about the different types of Nutrients. |
| **CO 3** | To impart knowledge of different types of Malnutrition. |
| **CO 4** | Describe the details of assessment of nutritional status. |

 **UNIT-I**

**Concepts and content of nutrition:** Nutrition agencies; Nutrition of community; Nutritional policies and their implementation; Metabolicfunction of nutrients

**Nutrients:** Sources, functions, digestion, absorption, assimilation and transport of carbohydrates, proteins and fats in human beings;

**UNIT-II**

**Water and energy balance**: Water intake and losses; Basal metabolism- BMR; Body surface area and factors affecting BMR. Classification, functions, sources, digestion, requirements, and effects of deficiencies and excess of carbohydrates, fats and proteins.

**UNIT-III**

**Recommended dietary allowances;** For various age group; according physiological status; Athletic and sports man; Geriatric persons

**Malnutrition:** Type of Malnutrition; Multi-factorial causes; Epidemiology of under nutrition and over nutrition; Nutrition infection and immunity; Nutrition education

**UNIT-IV**

**Assessment of nutritional status**: Diet surveys; Anthropometry; Clinical examination; Biochemical assessment; Additional medical information.

 In-born error of metabolism: Blood constituents; Nutrients; Hormones and enzymes; Miscellaneous disorders Food fad and faddism potentially toxic substance in human food.

**Recommended Books :-**

|  |  |
| --- | --- |
| **Author**  |  **Title** |
| Swaminathan M  | Advanced Text Book on Food & Nutrition (Volume I and II)  |
| Stewart Truswell  | ABC of Nutrition (4th edition)  |
| Jim M. and Stewart T.  | Essentials of Human Nutrition  |
| Micheal J. G.,Susan A.L. Aedin  | Introduction to Human Nutrition  |
| Carolyn D. Berdanier, Elaine B.  | Handbook of Nutrition and Food |

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|  **FTT-204A** | **Thermal Processing**  |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **75** | **25** | **100** | **3h** |
| **Purpose** | **To introduce the Basics concept of Thermal Processing.** |
| **Course Outcomes(CO)** |
| **CO 1** | To teach about the concept of heat & mass transfer.  |
| **CO 2** | To learn about the different types of mode of heat transfer. |
| **CO 3** | To impart knowledge of different types of heat exchange. |
| **CO 4** | Describe the details of mass transfer. |

 **UNIT-I**

**Introduction:-**basic concepts of heat and mass transfer, importance of heat and mass transfer in Food Processing.

**UNIT-II**

 **Modes of heat transfer:-**

**(A) Conduction**:- Principle of conduction, derivation of general heat conduction equation in Cartesian and cylindrical coordinates, steady state heat transfer through slabs. Composite walls, cylinders, spheres etc; insulation and its purposes, critical thickness of insulation for cylinders and spheres, general heat transfer equation for extended surfaces (Fins)

**(B)** **Convection:-** Natural and forced convection, dimensional analysis for free and forced convection, dimensionless numbers used in convective heat transfer, Important correlations for free and forced convection.

**(C)** **Radiation:-** Introduction, reflection, absorption and transmission of radiation, characteristics of black, grey and real bodies in relation to thermal radiation, Stefan Boitzman low; kirchoffs law; Wein displacement law, intensity of radiation, radiation between two bodies.

**Unit-III**

**Heat exchangers:-**Classification, overall heat transfer coefficient, fouling factors, log-mean temperature difference for parallel and counter flow heat exchangers, heat transfer in shell and tube heat exchangers, effectiveness of parallel and counter flow heat exchanger by general and NTU (Number of Transfer Units) method, design of heat exchanger, applications of plate heat exchanger in HTST pasteurizer.

**Unit-IV**

**Mass Transfer:-**Introduction to mass transfer and diffusion, Flick’s law of diffusion of mass transfer derivation of general diffusion mass transfer equation, molecular diffusion of gases, solid, liquid and biological materials, convective mass transfer coefficient, Natural and forced convective mass transfer, dimensional analysis for free and forced convective mass transfer.

|  |  |
| --- | --- |
| **Author** | **Title** |
| D.S. Kumar | Heat & Mass Transfer |
| G.K. Roy | Fundamentals of Engineering heat & Mass Transfer |
| R.C. Sachdeva | Fundamentals of Engineering heat & Mass Transfer |

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

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| **FTT -214L A** | **Thermal Processing Lab**  |
| **L** | **T** | **P** | **Credit** | **Practical** | **Minor Test** | **Total** | **Time** |
| **-** | **-** | **3** | **1.5** | **60** | **40** | **100** | **3h** |
| **Purpose** | **Give the knowledge of basic practicals of Thermal Processing lab.**  |
| **Course Outcomes** |
| **CO1** | **To make the students familiar with the experiments of unit Operation.**  |
| **CO2** | **To give the knowledge of handling of the experiments related with Food Engg.**  |

**Note: Student will be required to perform the following Experiments:--**

**List of Experiments –**

1**.** Heat transfer analysis during conduction and convection.

2. Determination of thermal conductivity of food products and insulators.

3. Determination of thermal properties (specific heat, thermal conductivity) of frozen foods.

4. Heat transfer during agitation and mixing.

5. Study of water distillation plant.

6. Demonstration of continuous distillation apparatus in operation.

7. Determination of glass transition temperature of food sample.

8. To study mass transfer during leaching process.

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|  **FTT-206A** | **Unit Operation In Food Engg. – II**  |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **75** | **25** | **100** | **3h** |
| **Purpose** | **To introduce the Basics concept of Food Engg.** |
| **Course Outcomes(CO)** |
| **CO 1** | To teach about the concept of heat & mass transfer.  |
| **CO 2** | To learn about the different types of mode of heat transfer. |
| **CO 3** | To impart knowledge of different types of heat exchange. |
| **CO 4** | Describe the details of mass transfer. |

**UNIT-I**

**Evaporation:** Principles of evaporation, mass and energy balance, factors affecting rate of evaporation, thermodynamics of evaporation (phase change, boiling point elevation, Dühring plot.

**Heat and mass transfer** in evaporator, factors influencing the overall heat transfer coefficient, influence of feed liquor properties on evaporation Evaporation equipment: Natural circulation evaporators, horizontal/vertical short tube, natural circulation with external calandria, long tube, and forced circulation.

Evaporator ancillary plant, design of evaporation systems, single effect, multiple effect evaporators, feeding methods of multiple effect evaporation systems, feed preheating, vapor recompression systems; Fouling of evaporators and heat exchanges; Recompression heat and mass recovery and vacuum creating devices.

**UNIT-II**

**Food freezing**: Introduction, Principles of food freezing, Freezing systems; Direct contact systems, air blast immersion; Changes in foods; Frozen food properties; freezing time, factors influencing freezing time, freezing/thawing time; Frozen food storage: Quality changes in foods during frozen storage Freeze drying: equipment and practice Expression and Extraction: liquid-liquid extraction processes, types of equipment and design for liquid-liquid extraction, continuous multistage counter current extraction.

**UNIT-III**

 **Crystallization and Dissolution**: theory and principles, kinetics, applications in food industry, equipment for crystallization. Distillation: Principles, vapor-liquid equilibrium, continuous flow distillation, batch/differential distillation, fractional distillation, steam distillation, distillation of wines and spirits.

**Baking**: Principles, baked foods, baking equipment; roasting: Principles of roasting, roasting equipment

**UNIT-III**

**Pasteurization**: Purpose, microorganisms and their reaction to temperature and other influences, methods of heating, design and mode of operation of heating equipment, plate heat exchanger.

 **Sterilization**: Principles, design of batch and continuous sterilization, different methods and equipments; UHT sterilization, in the package sterilization, temperature and pressure patterns, equipment for sterilizing goods in the package.

**Aseptic processing**: principles, analysis of thermal resilience, duration mathematics of conduction heating; Blanching: principle and equipment; Homogenization, Emulsification.

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

**Text Books:**

|  |  |
| --- | --- |
| **Author** | **Title** |
| Brenan, Butters, Cowell and Lilly | Food Engineering Operation |
| AlbertIbarz and Gustavo V. Barbosa- Cánovas | Unit Operations in Food Engineering. |
| Earle RL | Unit Operations in Food Processing |
| WarrenL.McCabe Julian Smith Peter Harriott | Unit Operations of ChemicalEngineering |

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| **FTT -216L A** | **Unit Operation In Food Engg. – II Lab**  |
| **L** | **T** | **P** | **Credit** | **Practical** | **Minor Test** | **Total** | **Time** |
| **-** | **-** | **3** | **1.5** | **60** | **40** | **100** | **3h** |
| **Purpose** | **Give the knowledge of basic practicals of Unit Operation In Food Engg lab.**  |
| **Course Outcomes** |
| **CO1** | **To make the students familiar with the experiments of unit Operation.**  |
| **CO2** | **To give the knowledge of handling of the experiments related with Food Engg.**  |

**Note: Student will be required to perform the following Experiments:--**

**List of Experiments –**

**1.** Study of cleaners for grains (Screening, aspiration, abrasion and magnetic cleaning) .

**2.** Study of washers for fruits and vegetables (soaking tank, belt washer).

**3**. Study of crop dryer, hot air dryer and vacuum dryer.

**4**. Study of principle and working of spray dryer.

**5.** Study of principle and working of roller drum dryer and fluidized bed dryer.

**6**. Study of freeze drying process and freeze dryer.

**7.** Study of graders for grains.

**8**. Study of graders for fruits and vegetables.

**9**. Study of different components of flour mill.

**10.** Study of different material handling equipments.

**11**. Layout, design, sizing capacity and drawing of traditional storage structures.

**12**. Visit to traditional storage structure.

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|  **FTT-208A** | **Dairy Technology** |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **75** | **25** | **100** | **3h** |
| **Purpose** | **To introduce the Basics concept of Dairy Tech..** |
| **Course Outcomes(CO)** |
| **CO 1** | To teach about the concept of milk.  |
| **CO 2** | To learn about the different types of milk products. |
| **CO 3** | To impart knowledge about Evaporated and Condensed milk. |
| **CO 4** | Describe the details of processing of milk products. |

**UNIT-I**

Fluid Milk: Composition of milk and factor affecting it. Physico-chemical characteristics of milk and milk constituents. Production and collection , cooling and transportation of milk. Packaging storage and distribution of pasteurized milk.:

**UNIT –II**

Whole, Standardized, Toned, Double toned and skim milk. Test for milk quality and Adulteration. UHT processed milk, flavoured,Sterilized milk. Cleaning and sanitization of dairy equipments. Definition, Classification, Composition and physico-chemical propertiesof cream. Production processes and quality control.

**UNIT -III**

Butter: Definition, Classification, Composition and methods of manufacture, Packaging and storage. Butter oil/Ghee. Ice cream: Definition, Classification and Composition, Constituents and their role. Preparation of mixes and freezing of Ice cream, Overrun,Judging, Grading, and defects of Ice cream.

**UNIT -IV**

Evaporated and Condensed milk: Method of manufacture, Packaging and storage. Defects, Causes, and prevention. Roller and Spray Drying of milk solids. Instantization. Flow ability, Dustiness, Reconstituability, Dispersability, Wet ability, Sink ability and appearance of milk powders.

**Text Books;-**

|  |  |
| --- | --- |
| **Author** | **Title** |
| Vaclavik V.A.and Christian E.W | Essentials of food science. 2nd edition Springer International. |
| Spreer E. (1998) | Milk and dairy product technology. |
| Smit G. | Dairy processing- improving quality. Woodhead Publishing. |
| Hohnson M. and Alford (1987) | Fundamentals of dairy chemistry. 2nd edition. |

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

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| **FTT -218L A** | **Diary Tech. Lab**  |
| **L** | **T** | **P** | **Credit** | **Practical** | **Minor Test** | **Total** | **Time** |
| **-** | **-** | **3** | **1.5** | **60** | **40** | **100** | **3h** |
| **Purpose** | **Give the knowledge of basic practicals of Dairy Tech. lab.**  |
| **Course Outcomes** |
| **CO1** | **To make the students familiar with the experiments of milk products.**  |
| **CO2** | **To give the knowledge of handling of the experiments related with Dairy.**  |

**Note: Student will be required to perform the following Experiments:--**

**List of Experiments;-**

**1.** Sampling of milk and milk products.

**2 .**Platform tests of raw milk (clot on boiling (COB) test, alcohol test.

**3** .Determination of physical properties of milk.

**4** .Determination of proximate composition and biochemical properties of milk.

**5** .Determination of microbiological properties of milk.

**6** .Detection of adulterants in milk.

**7** .Identification and demonstration of liquid milk processing equipment, pipes and fittings.

**8 .**Preparing standardized milk as per requirement.

**9** .Separation of fat from milk.

**10.** Pasteurization and homogenization of milk.

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|  **FTT-210A** | **Fruit and Vegetable Processing** |
| **L** | **T** | **P** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **-** | **-** | **3** | **75** | **25** | **100** | **3h** |
| **Purpose** | **To introduce the Basics concept of Dairy Tech..** |
| **Course Outcomes(CO)** |
| **CO 1** | To teach about the concept of milk.  |
| **CO 2** | To learn about the different types of milk products. |
| **CO 3** | To impart knowledge about Evaporated and Condensed milk. |
| **CO 4** | Describe the details of processing of milk products. |

**UNIT-I**

Production and processing scenario of fruits and vegetables in India and world; Scope of fruit and vegetable processing industry in India. Overview of principles and preservation methods of fruits and vegetables; Supply chain of fresh fruits and vegetables

**UNIT-II**

Primary processing and pack house handling of fruits and vegetables; Peeling, slicing, cubing, cutting and other size reduction operations for fruits and vegetables

 Minimal processing of fruits and vegetables; Blanching- operations and equipment Unit 4 Canning:- Definition, processing steps, and equipment; cans and containers, quality assurance and defects in canned products;

**UNIT-III**

FSSAI specifications and preparation and preservation of juices, squashes, syrups, sherbets, nectars, cordials, etc.; Processing and equipment for above products;

FSSAI specifications of crystallized fruits and preserves, jam, jelly and marmalades, candies Preparation, preservation and machines for manufacture of above products**.**

**UNIT-IV**

Preparation, preservation and machines for manufacture of chutney, pickles, sauce, puree, paste, ketchup; toffee, cheese, leather, dehydrated, wafers and papads, soup powders;

Production of pectin and vinegar Commercial processing technology of selected fruits and vegetables for production of various value added processed products.

.. **Text Books;-**

|  |  |
| --- | --- |
| **Author** | **Title** |
| U.D. Chavan and J.V. Patil. 2013. | Industrial Processing of Fruits and Vegetables. |
| S. Rajarathnam and R.S. Ramteke. | Advances in Preservation and Processing Technologies of Fruits and Vegetables. |
| Y.H. Hui. 2006. | Handbook of Fruits and Fruit Processing. |
| W.V. Cruess. 2004. | Commercial Fruit and Vegetable Products. |
| Y. H. Hui, Sue Chazala, Dee M. Graham, K.D. Murrell and Wai-Kit Nip. | Handbook of Vegetable Preservation and Processing. |

**Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.**

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| **FTT -220L A** | **Fruit & Vegetables Processing Lab** |
| **L** | **T** | **P** | **Credit** | **Practical** | **Minor Test** | **Total** | **Time** |
| **-** | **-** | **3** | **1.5** | **60** | **40** | **100** | **3h** |
| **Purpose** | **Give the knowledge of basic practicals of Fruit & Vegetables processing lab.**  |
| **Course Outcomes** |
| **CO1** | **To make the students familiar with the experiments of primary processing.**  |
| **CO2** | **To give the knowledge of handling of the experiments related with preparation of different types products from fruits.**  |

**Note: Student will be required to perform the following Experiments:--**

**List of Experiments;-**

**1.** Primary processing of selected fruits and vegetables.

2. Canning of Mango/Guava/ Papaya.

3. Qualitative analysis of pectin.

4. Determination of salt concentration in processed/ preserved product.

5. Determination of sulphurdioxide content in processed/preserved product.

6. Preparation of jam from selected fruits.

7. Preparation of jelly from selected fruits.

8. Preparation of fruit marmalade.

9. Preparation of RTS/ nectar.

10. Preparation of squash/ crush.

11. Preparation of cordial.

12. Preparation of anardana.

13. Preparation of pickles.

14. Dehydration of ginger, onion and garlic.

15. Preparation of banana and potato wafers.

16. Preparation of vegetable sauces.

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| **MC-901A** | **Environmental Sciences** |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **0** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | To learn the multidisciplinary nature, scope and importance of Environmental sciences. |
| **Course Outcomes (CO)** |
| **CO1** | The students will be able to learn the importance of natural resources. |
| **CO2** | To learn the theoretical and practical aspects of eco system. |
| **CO3** | Will be able to learn the basic concepts of conservation of biodiversity. |
| **CO4** | The students will be able to understand the basic concept of sustainable development. |

**UNIT 1**

The multidisciplinary nature of environmental studies, Definition, Scope and Importance, Need for public awareness, Natural Resources: Renewable and Non-Renewable Resources: Natural resources and associated problems.

1. Forest Resources: Use and over-exploitation, deforestation, case studies. Timber eztraction, mining, dams and their effects on forests and tribal people.
2. Water Resources: Use & over-utilization of surface & ground water, floods, drought, conflicts over water, dams-benefits and problems.
3. Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
4. Food Resources: World Food Problems, changes caused by agriculture and overgazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
5. Energy Resources: Growing energy needs, renewable & non-renewable energy sources, use of alternate energy sources. Case studies.
6. Land Resources: Land as a resource, land, degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyle.

**UNIT II**

**Ecosystem-Concept of an ecosystem**. Sturcture and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological Succession, Food Chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: (a) Forest Ecosystem, (b) Grassland Ecosystem, (c) Desert Ecosystem and (d) Aquatic Ecosystems (ponds, streams, lakes, rivers, oceans, esturaries

Field Work: Visit to a local area to document Environment assets-river/forest/grassland/hill/mountain, Visit to a local polluted site-Urban /Rural Industrial/Agricultural, Study of common plants, insects and birds, Study of simple ecosystems-pond, river, hill, slopes etc. (Field work equal to 5 lecture hours).

**UNIT III**

**Biodiversity and its conservation:** Introduction, Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversityof global, National and local levels. India as a mega-diversity nation Hot spots of Biodiversity, Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts, Endangered and endemic species of India, Conservation of Biodiversity- In situ and Ex-Situ conservation of biodiversity.

**Environmental Pollution Definition:** Cause, effects and control measures of (a) Air Pollution (b) Water Pollution (c) Soil Pollution (d) Marine Pollution (e) Noise Pollution (f) Thermal Pollution (g) Nuclear Hazards

Solid waste management- cause, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides

**UNIT IV**

**Social Issues and the Environment**. From unsustainable to sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people: Its problems and concerns, Case Studies: Environmental ethics-issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies: Wasteland Reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public Awareness, Human population and the Environment, Population growth, variation among nations, Population explosion-Family Welfare Programme, Environment and human health. Human rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human Health, Case Studies, Drugs and their effects; Useful and harmful drugs, Use and abuse of drugs, Stimulant and depressan drugs, Concept of drug de-addiction, Legal position on drugs and laws related to drugs.

**Suggested Books**

* + - * Environmental Studies- Deswal and Deswal. Dhanpat Rai and Co.
			* Environmental Science and Engineering Anandan, P. and Kumaravelan, R. 2009. Scitech Publications (India) Pvt. Ltd., India.
			* Environmental Studies. Daniels Ranjit R. J. and Krishnaswamy. 2013. Wiley India.
			* Environmental Science- Botkin and Keller. 2012. Wiley , India

**Note: The Examiner will be given the question paper template to set the question paper.**