Jawaharlal Nehru Technological University Anantapur

(Established by Govt. of A.P., Act. No. 30 of 2008)

Ananthapuramu–515 002 (A.P) India

II year B.Tech

Course Structures and Syllabi under R19 Regulations

JNTUA Curriculum
FOOD TECHNOLOGY B. Tech Course Structure

2nd Year to 4th Years Course Structure

Semester – 3 (Theory - 6, Lab – 3, MC-1)					
S.No	Course No	Course Name	Category	L-T-P	Credits
1.	19A54304	Numerical Methods & Probability Theory	BS	2-1-0	3
2.	19A27301T	Food Chemistry	PC	3-0-0	3
3.	19A27302T	Processing Of Cereals, Pulses & Oilseeds	PC	3-0-0	3
4.	19A27303T	Fluid Mechanics for Food Processing	PC	2-1-0	3
5.	19A57301	Basic Microbiology	BS	3-0-0	3
6.	19A27304	Principles Of Food Preservation	PC	2-0-0	2
7.	19A27301P	Food Chemistry Lab	PC	0-0-3	1.5
8.	19A27302P	Processing Of Cereals, Pulses And Oil Seeds Lab	PC	0-0-3	1.5
9.	19A27303P	Fluid Mechanics for Food Processing Lab	PC	0-0-3	1.5
10.	19A99302	Biology For Engineers	MC	3-0-0	0
				Total :	**21.5**

Semester - 4 (Theory - 7, Lab – 2, MC-1)					
S.No	Course No	Course Name	Category	L-T-P	Credits
1.	19A27401T	Processing Of Fruit And Vegetables	PC	3-0-0	3
2.	19A27402T	Mechanical Operations And Material Handling	PC	2-1-0	3
3.	19A27403	Principles Of Food Engineering	PC	2-1-0	3
4.	19A27404	Processing Of Fish And Marine Products	PC	3-0-0	3
5.	19A05304T	Python Programming	ES	2-1-0	3
6.	19A27405	Processing Of Spices And Plantation Crops And Medicinal Herbs	PC	3-0-0	3
7.	19A52301	Universal Human Values	HS	2-0-0	2
8.	19A27401P	Processing of Fruit and Vegetables Lab	PC	0-0-3	1.5
9.	19A27402P	Mechanical operations and Material Handling Lab	PC	0-0-3	1.5
10.	19A99301	Environmental Sciences	MC	3-0-0	0
				Total:	**23**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech – II-II Sem	**L**	**T**	**P**	**C**
	2	**1**	**0**	**3**

19A54304 NUMERICAL METHODS AND PROBABILITY THEORY

Course Objective:

This course aims at providing the student with the knowledge on

- Various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.
- The theory of Probability and random variables.

Unit-I: Solution of Algebraic & Transcendental Equations:

Introduction-Bisection method-Iterative method-Regula falsi method-Newton Raphson method System of Algebraic equations: Gauss Jordan method-Gauss Siedal method.

Unit Outcomes:

Students will be able to

- Calculate the roots of equation using Bisection method and Iterative method.
- Calculate the roots of equation using Regula falsi method and Newton Raphson method.
- Solve the system of algebraic equations using Gauss Jordan method and Gauss Siedal method.

Unit-II: Interpolation

Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

Unit Outcomes:

Students will be able to

- Understand the concept of interpolation.
- Derive interpolating polynomial using Newton's forward and backward formulae.
- Derive interpolating polynomial using Lagrange's formulae.
- Derive interpolating polynomial using Gauss forward and backward formulae.

Unit-III: Numerical Integration & Solution of Initial value problems to Ordinary differential equations

Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule
Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Modified Euler's Method-Runge-Kutta Methods.

Unit Outcomes:

Students will be able to

- Solve integral equations using Simson's 1/3 and Simson's 3/8 rule.
- Solve integral equations using Trapezoidal rule.
- Solve initial value problems to ordinary differential equations using Taylor's method.
- Solve initial value problems to ordinary differential equations using Euler's method and Runge Kutta methods.

Unit-IV: Probability theory:

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.

Unit Outcomes:

Students will be able to

- Understand the concept of Probability.
- Solve problems on probability using addition law and multiplication law.
- Understand Random variables and probability mass and density functions.
- Understand stastical constants of random variables.

Unit-V: Random variables & Distributions:

Probability distribution - Binomial, Poisson approximation to the binomial distribution and normal distribution-their properties-Uniform distribution-exponential distribution

Unit Outcomes:

Students will be able to

- Understand Probability distribution function.
- Solve problems on Binomial distribution.
- Solve problems on Poisson distribution.
- Solve problems on Normal distribution.

Course Outcomes:

After the completion of course, students will be able to

- Apply numerical methods to solve algebraic and transcendental equations
- Derive interpolating polynomials using interpolation formulae
- Solve differential and integral equations numerically
- Apply Probability theory to find the chances of happening of events.
- Understand various probability distributions and calculate their statistical constants.

TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna publishers.
2. Ronald E. Walpole, "Probability and Statistics for Engineers and Scientists", PNIE.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India

REFERENCE BOOKS:

1. B.V.Ramana, " Higher Engineering Mathematics", Mc Graw Hill publishers.
2. Alan Jeffrey, "Advanced Engineering Mathematics", Elsevier.Publishers

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech – II-I Sem

L	T	P	C
3	0	0	3

19A27301T FOOD CHEMISTRY

PREAMBLE

The subject deals with the basic concepts of food analysis, principles of analytical techniques, separation techniques and rapid result methods.

Course Objectives

- To impart knowledge to the students on the Techniques in food analysis
- To read them with the Analytical techniques in Quality control laboratory.

UNIT – I

Sampling and sampling techniques. Proximate analysis- Moisture, ash, crude fat, crude fibre, crude protein and carbohydrates by difference. Principles and methods of food analysis.

Unit Outcomes:

At the end of unit, students will be able to

- Understand the concept of sampling and techniques and its importance
- Know the proximate analysis and its significance

UNIT – II

Basic principles: Refractometry, polarimetry, densitometry, HPLC, GLC, spectrophotometry, electrophoresis, automatic amino acid analyzer.

Unit Outcomes:

At the end of unit, students will be able to

- Illustrate the principles of refractometry, polarimetry and densitometry, automatic amino acid analyzer
- Explain the theory of HPLC, GLC, spectrophotometry, electrophoresis

UNIT – III

Determination of starch. Test for unsaturation of fats, rancidity of fats. Quantitative analysis of protein by Biuret method, Ninhydrin method, Lowry's method and Dye-binding method Bioassays for protein quality of grains.

Unit Outcomes:

At the end of unit, students will be able to

- Understand the various quality tests like starch determination, test for unsaturation of fats
- Describe the quantitative analysis of protein by biuret and ninhydrin methods

UNIT – IV

Chemical, microbiological, flurometric and colorimetric methods of analysis of fat soluble and water soluble vitamins.

Unit Outcomes:

At the end of unit, students will be able to

- Explain the chemical, microbiological methods of analysis of fat and water soluble vitamins
- Know the flurometric and colorimetric methods of analysis of fat and water soluble vitamins

UNIT – V

Principles and methods for estimation of minerals: Atomic absorption spectroscopy, colorimetric, titrimetric and gravimetric methods Methods for determining physical and rheological properties of food.

Unit Outcomes:

At the end of unit, students will be able to

- Describe the principles and methods for estimation of minerals by atomic absorption spectroscopy, colorimetric, titrimetric and gravimetric methods
- Estimate the methods for physical and rheological properties of food.

Course Outcomes

- Understand the concepts of Techniques in food analysis,
- Understand proximate analysis of foods
- Understand Biochemical methods and approaches used in Food analysis

TEXT BOOKS

1. Suzanne Nielsen, "Food Analysis", Springer Publishers.
2. Y. Pomeranz and C.E. Meloan, "Food Analysis", A.V.I Publishing Company, INC West Port, Connecticut, U.S.A.

REFERENCES

1. Plummer, D.T. "An Introduction to Practical Biochemistry", Tata Mc Graw-Hill Publishing Co., New Delhi. 1979.
2. Sadasivam, S. and Manickam, A. "Biochemical methods for Agricultural Sciences", New Age International Publisher, New Delhi, 1996.
3. ManoRanjanKalia "Food Analysis and Quality Control", 1st Edition Kalyani Publishers, New Delhi, 2002.
4. Jayaraman, J. "Laboratory Manual in Biochemistry", Wiley Eastern Publishers, New Delhi, 1980.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech – II-I Sem

L	T	P	C
3	0	0	3

19A27302T PROCESSING OF CEREALS, PULSES & OILSEEDS

PREAMBLE

This course covers fundamentals of cereals and pulses processing, equipments, products and storage requirements.

Course Objectives

- To learn about the processing of major cereals and pulses.
- To gain knowledge about grain storage structure and handling devices.

UNIT – I

Importance of Cereals Pulses and Oilseeds, Composition, Structure and processing characteristics of Cereal grains, Legumes and Oilseeds, Post-harvest technology, Post processing practices for safe storage. Rice: Structure, types, composition, quality characteristics and physicochemical properties of Rice. Milling and parboiling of paddy, Curing and ageing of paddy and rice. Criteria and assessment of milling, cooking, nutritional and storage qualities of raw & parboiled rice. Processed rice products (flaked, expanded and puffed rice), By-products.

Unit Outcomes:

At the end of unit, students will be able to

- Learn composition, structure and processing of cereals, legumes & oilseeds
- Know the post processing operations for storage and further processing
- Knowledge of milling and parboiling of paddy and other processing methods
- Importance of quality assessment related to rice and rice products
- Knowledge on value added products and by products of rice.

UNIT – II

Wheat-Structure, Composition, Types, quality characteristics for milling into flour and Semolina. Flour milling, Turbo grinding and air classification, Blending of flours, Flour grades and their suitability for baking purposes, Milling equipment and milled products (Dalia, Atta, Semolina

and flour). Assessment of flour quality and characteristics, Macaroni products. Dough rheology-influence of flour constituents in dough rheology.
Baked products-Ingredients Technology and quality parameters: Bread, Biscuits, Cakes and Crackers.

Unit Outcomes:

At the end of unit, students will be able to

- Acquired knowledge on fundamentals of wheat and its milling
- Detailed description of quality parameters and value added products from wheat

UNIT – III

Other Cereals: Corn- Structure, types and composition. Dry and wet milling of Corn. Starch and conversion products. Processed corn products (popped corn, corn flakes etc.) Structure and composition of Barley, Malting of barley, Bajra, Jowar and other cereal grains and millets. Pearling of millets. Parched and snack products. Breakfast cereals – types and manufacturing methods.

Unit Outcomes:

At the end of unit, students will be able to

- Variations in processes of dry and wet milling of corn
- Advantages of value added products from corn
- Knowledge of millets and malting process

UNIT – IV

Pulses: Pulses production, types, chemical composition, anti-nutritional factors, milling of pulses, milling equipment, factors affecting quality, secondary processing of pulses, processed products, fermented products, traditional products, Value addition; effect of processing on nutritive value.

Unit Outcomes:

At the end of unit, students will be able to

- Description of pulses and their importance
- Impact of anti-nutritional factors in pulses on processing
- Knowledge on milling of pulses and value added products

UNIT – V

Processing of oil seeds for direct use and consumption, Oil extraction methods- mechanical (Ghani and Expellers) and chemical methods (solvent extraction), Processing of extracted oil: Refining, Hydrogenation, Interesterification. Processing of deoiled cake into protein concentrates and isolates, Texturized vegetable protein, Functional protein preparations. Peanut butter, Margarine and Spread.

Unit Outcomes:

At the end of unit, students will be able to

- Explanation of oil extraction methods
- Need of refining and other processes like hydrogenation etc.
- Importance of protein derivatives from oilseeds

Course Outcomes

- Students will get information about the classification of various grains
- Students also exposed to various processing methods and machinery used
- Students will learn value added products from all grains

TEXT BOOKS

- K. Kulp and J. G. Ponte. Jr., "Hand Book of Cereal Science and Technology", 2nd Edition, CRC, 2000.
- G. Owens, "Cereals Processing Technology", 2nd Edition, Wood head Publishing, 2001.

REFERENCES

1. D.A.V. Dendy and B.J. Dobraszczyk, "Cereals and Cereal products: Chemistry and Technology", Vol. 4, Springer, 1st Edition, 2001.
2. B.O.Juliano, "Rice: Chemistry and Technology", 2nd Edition, AACC,1985.
3. Y.Pomeranz, "Wheat: Chemistry and Technology", 3rd Edition, AACC,1988.
4. A. Karleskind, "Oils and Fats manual", 1st Edition, Lavoisier Publisher, Paris, 1996.
5. R.H. Mathews, Marcel Dekker, "Legumes: Chemistry, Technology and Human Nutrition", 1st Edition, 1989.
6. D. Swer, "Bailey's Industrial Oil & Fat Products", 5th Edition, John Wiley & Sons, 2005.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech – II-I Sem

L	T	P	C
2	1	0	3

19A27303T FLUID MECHANICS FOR FOOD PROCESSING

PREAMBLE

The subject covers properties of fluids and its flow characteristics, flow through pipes. Importance of dimensional analysis and its applicability. Types and Selection of pumps.

Course Objectives

- The basic concepts and fluid-flow phenomena and the kinematics of flow
- To enable the students to design efficient water conveyance systems like canals, channels and pipes from places of origin to delivery points by acquiring knowledge on the principles of mechanics of fluids, water measurement and regulation

UNIT – I

Introduction and Properties of Fluids: Concept of fluid mechanics, definition of fluid, density, specific weight, Viscosity: Newtonian and Non-Newtonian fluids, kinematic viscosity, dynamic viscosity, variation of temperature with viscosity, Surface tension, vapour pressure, incompressible and compressible fluids, ideal and real fluids

Unit Outcomes:

At the end of unit, students will be able to

- Explain the properties of fluids and concept of fluid mechanics
- Differentiate Newtonian and non-Newtonian fluids
- Concept of viscosity and types and their effect on temperature
- Description of basics of classification of fluids

UNIT – II

Fluid Mechanics Pressure Measurement: Static pressure of liquids, absolute and gauge pressures, pressure measurement devices: mechanical instruments, electro-mechanical instruments electronic instruments. Dynamics of Fluid Flow, Euler's equation of motion, Bernoulli's equation, applications of Bernoulli's equation, cavitation.

Unit Outcomes:

At the end of unit, students will be able to

- Measure the fluids by various instruments.
- Explain the different forces acting on fluids.
- Importance of dynamic flow and their applications.

UNIT – III

Kinematics of Fluid Motion and Classification of Flow: Method of describing fluid motion, classification of flow: steady and unsteady; uniform and non-uniform; one, two and three dimensional flow Laminar and turbulent flows, streamline, pathline and streakline Acceleration equations, continuity equations.

Unit Outcomes:

- Description of kinematics of flow.
- Classify the fluid flow.
- Derive the continuity equation and its importance.

UNIT – IV

Analysis of flow through pipes, energy losses in pipe lines, minor losses in pipe lines due to enlargement, contraction, bends and pipe fitting, concept of equivalent length. Problems in Pipe flow: determination of pipe diameter, discharge and head loss. Flow measurements: Measurement of flow in pipes: venturimeter, flow nozzle, sharp edged concentric orifice meter, bend meter, rotameter. Measurement of velocity: pitot tube, hot wire anemometer, current meter.

Unit Outcomes:

At the end of unit, students will be able to

- Calculate the energy losses in pipe & fittings.
- Role of equivalent length in fluid flow.
- Knowledge on various flow measurements.

UNIT – V

Fluid Machines: Pumps – classification, centrifugal pumps, submersible pumps, reciprocating pumps, positive displacement pump. Centrifugal pumps: Pumps in series and parallel, basic equations applied to centrifugal pump, operating characteristics of centrifugal pumps. Submersible pumps: Reciprocating pumps: working of reciprocating pump, double acting pump, gear pump.

Unit Outcomes:

At the end of unit, students will be able to

- Basis for selection of pumps, types of pumps
- Applications of pumps and efficiency of pumps.

Course Outcomes

By the end of the course the students will be able to

- Gain knowledge on Bernoullies theory, Buckingham's Pi theorem, Hagen-Poiseuille equation
- Gain the knowledge on mechanical gauges, flow of fluids in the pumps, and Archimedies principles and theory
- Understand flow through mouth pieces, flow through orifices and pumps

TEXT BOOKS

1. P.G. Smith, "Introduction to Food Process Engineering", 2nd Edition, Lincoln, UK, 2010.
2. R. Paul Singh and Dennis R. Heldman, "Introduction to Food Engineering", 4th Edition, Academic Press, 2009.

REFERENCES

1. Modi, P. M. and Seth, S.M. "Hydraulics and Fluid Mechanics". Standard Book House, Delhi, 1973,
2. Jagdish Lal, "Fluid Mechanics and Hydraulics", Metropolitan Book Co. Private Limited., New Delhi, 1985.
3. Christie John Geankoplis. "Transport Processes and Separation Process Principles" (Includes Unit Operations). 4th Ed. Prentice-Hall, NY, USA., 2003,

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech – II-I Sem

L	T	P	C
3	0	0	3

19A57301 BASIC MICROBIOLOGY

PREAMBLE

This subject includes the basic concepts of microbiology, classification of micro-organisms, growth factors, types of culture media etc.

Course Objectives

- To learn the basic microbiological classification and microbial techniques.
- To enable students to gain knowledge on various microbial cultures and their growth factors.

UNIT – I

Evolution and scope of microbiology; History of microbiology; Classification of microorganisms, Applied areas of microbiology; Microscopy – Optical & Electron- Optical: Bright field, dark field, ultraviolet, phase contrast, fluorescent; Electron- Scanning electron microscopy, Transmission electron microscopy; Morphology, general characteristics & Reproduction of algae; Morphology general characteristics and reproduction of fungi and molds.

Unit Outcomes:

At the end of unit, students will be able to

- Importance of field of microbiology in different areas
- Awareness on microscopy and its types
- Basic information on Morphology, reproduction of algae, fungi

UNIT – II

Morphology general, characteristics, structure, classification, identification, reproduction, nutrition and growth of bacteria, bacteria genetics; bacteria recombination; Bacterial conjugation, transduction; Bacterial transformation

Unit Outcomes:

At the end of unit, students will be able to

- Explain the morphology, reproduction of bacteria
- Know about cell structure, classification and identification of bacteria
- Acquires knowledge on bacterial recombination and their types
- Basics of bacteria genetics

UNIT – III

Mutations: Types of mutations, mutagenesis; Mutation rate, repair of mutations; Phenotypes of bacterial mutants; Designation of bacterial mutants.

Unit Outcomes:

At the end of unit, students will be able to

- Know about the importance of mutation and its types
- Occurrence of mutations and adverse effect and repair of mutations
- Explain the phenotypes of bacterial mutants and their designation

UNIT – IV

Viruses – Structure, shape classification based on nucleic acid; replication and multiplication; food borne viruses

Unit Outcomes:

At the end of unit, students will be able to

- Explain the study of virus structure
- Know the classification of nucleic acid
- Basic concepts of replication and multiplication

UNIT – V

Factors affecting growth of microorganism, Intrinsic factors and Extrinsic factors; Identification of bacteria- bacteria straining, estimating members cell counts, viable , plate counts; Pure culture: Definition, methods of isolation, preservation techniques; control of microorganisms by physical, chemical, antibiotic and other chemotherapeutic agents.

Unit Outcomes:

At the end of unit, students will be able to

- Know the factors affecting growth of microorganisms both internal and external
- Identify the bacteria and enumeration
- Acquires knowledge on pure cultures, isolation methods, preservation techniques
- Various methods of controlling microorganisms

Course Outcomes

By the end of the course, students will learn

- Significance and importance of microbiology
- Morphology of various microorganisms
- Control of microorganisms and preservation of pure cultures

TEXT BOOKS

1. M.J., Pelczar, E.C.S. Chan and N.R. Krieg. "Microbiology". McGraw-Hill New York 1993.
2. W.C Frazier,. and D.C Westhoff,. "Food Microbiology". 4th Edition. Tata McGraw Hill Publishing Co. Ltd., New Delhi 2008.

REFERENCES

1. RY Stainier, JL ML Ingraham, Wheelis & PR.Painter "General Microbiology". MacMillan, 2003.
2. George J Banwart, "Basic Food Microbiology"
3. S S Purohit "Microbiology Fundamentals and Applications"
4. M R Adams & M O Moss "Food Microbiology"
5. James M Jay "Modern Food Microbiology"

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech – II-I Sem

L	T	P	C
2	0	0	2

19A27304 PRINCIPLES OF FOOD PRESERVATION

PREAMBLE

This course helps the students to apply basic food science knowledge and get to know biochemical changes occurring during various processing and preservation techniques.

Course Objectives

- Emphasis on importance of food technology into reduce the spoilage and improve the quality
- To explore the various preservation methods

UNIT – I

Definition and scope of Food Science and Technology, Historical development of food processing and preservation, general principles of food preservation. Degree of perishability of unmodified foods, Causes of quality deterioration and spoilage of perishable foods, intermediate moisture foods, wastage of foods.

Unit Outcomes:

At the end of unit, students will be able to

- Understand the scope and importance of Food Science and Technology
- Know the developments in food processing
- Have idea on principles of preservation and its methods

UNIT – II

Preservation of foods by low temperatures: (A) Chilling temperatures: Consideration relating to storage of foods at chilling temperatures, Chilling injury, Applications and procedures, Controlled and Modified atmospheric storage of foods, Post storage Handling of foods.
(B) Freezing temperatures: Freezing process, Slow and quick freezing of foods; effect on foods, other occurrences associated with freezing of foods. Technological aspects of pre freezing, Actual freezing, Frozen storage and thawing of foods, Individual Quick Freezing.

Unit Outcomes:

At the end of unit, students will be able to

- Gain knowledge on preservation of foods by chilling and its applications
- Understand the concepts of freezing and its types

UNIT – III

Preservation of foods by high temperatures: Basic concepts in thermal destruction of microorganisms D, Z and F values. Heat resistance and thermophilic microorganisms. Cooking, blanching, pasteurization and sterilization of foods. Extrusion, baking, roasting, frying, dielectric heating, ohmic, microwave and infrared heating. Assessing efficacy of thermal processing of foods, General process of canning of foods.

Unit Outcomes:

At the end of unit, students will be able to

- Acquire knowledge on cooking, blanching, pasteurization and sterilization and other high temperature preservation techniques
- Know the concepts on thermal destruction of foods

Unit – IV

Preservation by water removal: (a) Principles, Technological aspects and application of evaporative concentration process; Freeze concentration and membrane process for food concentrations. (b) Principles, Technological aspects and application of drying and dehydration of foods, Cabinet, tunnel, belt, bin, drum, spray, vacuum, foam mat, fluidized-bed and freeze drying of foods.

Unit Outcomes:

At the end of unit, students will be able to

- Understand the importance of concentration and evaporation in food processing
- Know the dehydration and its applications

UNIT – V

Chemical & Natural Preservatives: Classification, Principles, Radiations: Sources of radiations, units and dosages, effect on microorganisms and different nutrients; dose requirements for radiation preservation of foods., safe limits, irradiation mechanism and survival curve, technological aspects; applications of sugar and salt, antimicrobial agents, biological agents, Hurdle technology. Effects of various food processing operations on the nutritive value of foods.

Unit Outcomes:

At the end of unit, students will be able to

- Have knowledge on role of chemical as a preservatives
- Acquires understanding of radiation and its effects on foods
- Know the concept of hurdle technology

Course Outcomes

Upon completion of this course students should be able to understand

- The changes occurring during various food processing techniques
- The changes during storage and preservation
- The effect of enzymes on spoilage reactions of foods

TEXT BOOKS

1. Norman N. Potter and J.H. Hotchkiss, Chapman and Hall, "Food Science", 5th Edition, 1998.
2. P. J. Fellows, "Food processing technology: Principles and Practice", 3rd Edition, Taylor and Francis, 2009.

REFERENCES

1. M. Karel, O.R. Fennema and D.B. Lund, "Principles of Food Science-Part-II: Physical Method of Food Preservation", 2nd Edition, Marcel Dekkar Inc., 2001.
2. V. Kyzlink, "Principles of Food Preservation", 2nd Edition, Elsevier Press, 2003.
3. J. M. Jay, D. Van Nostrand, "Modern Food Microbiology", 7th Edition, 2005.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech – II-I Sem

L	T	P	C
0	0	3	1.5

19A27301P FOOD CHEMISTRY LAB

Course Objectives

- To expertise the students to analyze the proximate composition and other important constituents present in the food.

EXPERIMENTS

1. Sampling plan; Sampling requirements, Sample collection and preparation for analysis procedures and methods
2. Determination of pH
3. Determination of moisture content of foods by oven drying and distillation methods
4. Determination of Total and Acid insoluble ash content in foods
5. Determination of crude fat content by solvent extraction methods in foods
6. Determination of crude Protein by Kjeldhal Lowry method & other methods
7. Determination of reducing and total sugar content in foods
8. Determination of crude fibre content in foods
9. Determination of specific mineral contents in foods such as Calcium, Iron, Phosphorus, Chloride etc.
10. Determination of specific vitamin content of food such as ascorbic acid, carotenes etc.
11. Determination of specific Natural and/ or added Colouring Matters in foods
12. Determination of specific added food Preservatives in foods

Course Outcomes

By the end of the practical exercises, the students will be able to

- Adapt suitable method for food analysis
- Apply the knowledge of Techniques in Food Analysis,
- Differentiate between Qualitative identification and Quantitative estimations

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech – II-I Sem

L	T	P	C
0	0	3	1.5

19A27302P PROCESSING OF CEREALS, PULSES AND OIL SEEDS LAB

Course Objectives

- Determination of parameters by qualitative and quantitative methods
- Study on some important unit operations used for some grains
- Preparation of standard food products

EXPERIMENTS

1. Determination of physical properties (Bulk Density, Porosity, Sphericity, Angle of repose, Test weight, Particle size, Sieve analysis) of different grains.
2. Determination of Gluten content, sedimentation value, alcoholic acidity, water absorption capacity and Polenske value of wheat flour.
3. Determination of adulterant ($NaHCO_3$) in wheat flour/ Maida.
4. Determination of alkali score and gelatinization temperature of rice.
5. Traditional and improved pre-treatments and their effect on dehusking of some legumes.
6. Removal of anti-nutritional compounds from selected pulses and oilseeds.
7. Study of cooking quality of Dhal.
8. Pearling of millets.
9. Determination of yeast activity.
10. Determination of different quality parameters of oils.
11. Determination of efficiency of oil extraction techniques (mechanical expelling and solvent extraction).
12. Preparation of Bread.
13. Preparation of Biscuits.
14. Preparation of Cookies.
15. Preparation of Cake.
16. Preparation of Rusk.
17. Preparation of Crackers.
18. Visit to a Bakery, Confectionery Unit
19. Visit to a working modern roller flour mill and FCI godowns.
20. Visit to working rice mill.

Course Outcomes

- Students are exposed to learn various parameters determination and quantification
- Students will able to prepare and understand the technology involved in foods from grains
- Students will acquire more knowledge by visiting industries

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech – II-I Sem

L	T	P	C
0	0	3	1.5

19A27303P FLUID MECHANICS FOR FOOD PROCESSING LAB

Course Objectives

- To impart knowledge on coefficient of discharge, friction factor, pressure drop on different fluids.
- Importance of pipe fittings and application of various pumps in food industry.

EXPERIMENTS

1. To determine the coefficient of discharge of an orifice (or a mouth piece) of a given shape.
2. To calibrate an orifice meter and study the variation of the coefficient of discharge with the Reynolds number.
3. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
4. To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
5. To study the variation of friction factor, 'f' for turbulent flow in smooth and rough commercial pipes.
6. To determine the loss coefficients for the pipe fittings.
7. To verify Bernoulli's equation experimentally.
8. To determine the flow rate and coefficient of discharge using Venturimeter.
9. To measure discharge through Rotameter.
10. To determine the Reynolds number and types of flow (Laminar or Turbulent), the flow rate and coefficient of discharge using Orifice meter.
11. To determine losses due to pipe fitting, sudden enlargement and contraction.
12. Measurement of viscosity and surface tension of liquids.
13. To determine the characteristics of centrifugal pump and to find out total head, pump efficiency and overall efficiency of pump.
14. Study of various types of pipes and pipe fittings.
15. Study of different types of valves.
16. Study of reciprocating pump.
17. Determination of frictional coefficient of given pipe.

Course Outcomes

By the end of the course the students will be able to

- Know the measurement of fluid pressure, measurement of discharge and measurement of time
- Know how to determine the Coefficient of discharge from the pitot tube experiment
- How to measure the water level from ‘U’ tube manometer.

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B.Tech – II-I Sem

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19A99302 BIOLOGY FOR ENGINEERS

Course Description: To provide basic understanding about life and life Process. Animal an plant systems. To understand what bimolecules, are, their structures are functions. Application of certain bimolecules in Industry.

- Brief introduction about human physiology and bioengineering.
- To understand hereditary units, i.e. DNA (genes) and RNA and their synthesis in living organism.
- How biology Principles can be applied in our daily life using different technologies.
- Brief introduction to the production of transgenic microbes, Plants and animals.

Course Outcomes:

After studying the course, the student will be able to:

- Explain about cells and their structure and function. Different types of cells and basics for classification of living Organisms.
- Explain about biomolecules, their structure and function and their role in the living organisms. How biomolecules are useful in Industry.
- Briefly about human physiology.
- Explain about genetic material, DNA, genes and RNA how they replicate, pass and preserve vital information in living Organisms.
- Know about application of biological Principles in different technologies for the production of medicines and Pharmaceutical molecules through transgenic microbes, plants and animals.

Unit I: Introduction to Basic Biology (8 hours)

Cell as Basic unit of life, cell theory, Cell shapes, Cell structure, Cell cycle. Chromosomes. Prokaryotic and eukaryotic Cell. Plant Cell, Animal Cell, Plant tissues and Animal tissues, Brief introduction to five kingdoms of classification.

Unit Outcomes:

After completing this unit, the student will be able to

- Summarize the basis of life. (L1)
- Understand the difference between lower organisms (prokaryotes) from higher organisms (eukaryotes). (L2)
- Understand how organisms are classified. (L3)

Unit II: Introduction to Biomolecules (8 hours)

Carbohydrates, lipids, proteins, Vitamins and minerals, Nucleic acids (DNA and RNA) and their types. Enzymes, Enzyme application in Industry. Large scale production of enzymes by Fermentation.

Unit Outcomes:

After completing this unit, the student will be able to

- Understand what are biomolecules? their role in living cells, their structure, function and how they are produced. (L1)
- Interpret the relationship between the structure and function of nucleic acids. (L2)
- Summarize the applications of enzymes in industry. (L3)
- Understand what is fermentation and its applications of fermentation in industry. (L4)

Unit III: Human Physiology (8 hours)

Nutrition: Nutrients or food substances. Digestive system, Respiratory system, (aerobic and anaerobic Respiration). Respiratory organs, respiratory cycle. Excretory system.

Unit Outcomes:

After completing this unit, the student will be able to

- Understand what nutrients are (L1)
- Understand the mechanism and process of important human functions (L2 & L3)

Unit IV: Introduction to Molecular Biology and recombinant DNA Technology: (8 hours)

Prokaryotic gene and Eukaryotic gene structure. DNA replication, Transcription and Translation. rDNA technology. Introduction to gene cloning.

Unit Outcomes:
After completing this unit, the student will be able to

- Understand and explain about gene structure and replication in prokaryotes and Eukaryotes (L1)
- How genetic material is replicated and also understands how RNA and proteins are synthesized. (L2)
- Understand about recombinant DNA technology and its application in different fields.(L3)
- Explain what is cloning. (L4)

Unit V: Application of Biology (10 hours)

Brief introduction to industrial Production of Enzymes, Pharmaceutical and therapeutic Proteins, Vaccines and antibodies. Basics of biosensors, biochips, Bio fuels, and Bio Engineering. Basics of Production of Transgenic plants and animals.

Unit Outcomes:

After completing this unit, the student will be able to Understand.

- How biology is applied for production of useful products for mankind.(L1)
- What are biosensors, biochips etc. (L2)
- Understand transgenic plants and animals and their production (L3)

TEXT BOOKS:

1. P.K.Gupta, " Cell and Molecular Biology"
2. U. Satyanarayana. "Biotechnology", 2017

REFERENCE BOOKS:

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A global approach", Pearson Education Ltd, 2018.
2. T Johnson, "Biology for Engineers", CRC press, 2011 "Molecular Biology and Biotechnology" 2nd ed. J.M. Walker and E.B. Gingold. Panima Publications. PP 434.
3. David Hames, "Instant Notes in Biochemistry", 2016
4. Phil Tunner, A. Mctennan, A. Bates & M. white "Instant Notes – Molecular Biology" 2014

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B.Tech – II-II Sem

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19A27401T PROCESSING OF FRUIT AND VEGETABLES

PREAMBLE

This course enables the students to gain a sound knowledge about the processing and preservation technologies of fruits and vegetables.

Course Objectives

At the end of this course the students get a detailed background about

- Various methods used for preserving fruits and vegetables.
- Different operations involved in processing fruits and vegetables
- Technology behind intermediate moisture and minimally processed fruit and vegetable.

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 Outcomes:

At the end of unit, students will be able to

- Acquires the present status and production trends in India and world.
- Have brief idea on overall preservation methods and its principles.
- Know the importance of supply chain in 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; Storage of Fresh Fruits and Vegetables: Containers: Tin, glass and other packaging materials used in fruits and vegetables preservations. Canning and bottling, effect of canning and bottling on nutritive value, spoilage of canned foods, spoilage organisms, detection and control.

Unit Outcomes:

At the end of unit, students will be able to

- Understand the primary processing methods
- Know the storage of fruits and vegetables
- Assess the spoilage factors in canned foods and responsible microorganisms and their control

UNIT – III

Preparation and preservation of Juice, Squash, Syrup, Sherbet, Nectar, Cordial, Crush etc.; FSSAI specifications, Processing and equipment for above products; Preparation, preservation and equipment for manufacture of crystallized fruits and preserves, Jam, Jelly and Marmalades, defects in making, Candies; FSSAI specifications.

Unit Outcomes:

At the end of unit, students will be able to

- Know the preservation of various fruit products like squash, syrup and cordial etc.
- Understand the process equipment used for crystallized fruits and preserves, jam, jelly etc.
- Explain standards given by FSSAI.

UNIT – IV

Preparation, preservation and equipment for manufacture of Chutney, Pickles, Sauce, Puree, Paste, Ketchup; Toffee, Cheese, Lather. Production of Pectin and Vinegar; Commercial processing technology of selected fruits and vegetables for production of various value added processed products; FSSAI specifications.

Unit Outcomes:

At the end of unit, students will be able to

- Gain knowledge on equipment, process for various fruit and vegetable products
- Know the importance of Specifications given by FSSAI

UNIT – V

Minimally processed Fruits and Vegetables: Factors affecting shelf life and the quality of minimally processed fruits and vegetables, physiology and biochemistry of fresh cut fruits. Dehydration of Fruits and Vegetables: Methods; packaging, storage, quality control. Products: Dehydrated, Wafers and Papads, Soup powders; Food additives: Use in fruit and vegetable preservation; Restructured fruits & Vegetables; FSSAI specifications.

Unit Outcomes:

At the end of unit, students will be able to

- Have broad idea on minimally processed fruits and vegetables
- Understand the factors affecting shelf life and their quality of minimally processed fruits and vegetables
- Know the process technology of different value added products from fruits and vegetables

Course Outcomes

By the end of the course, the students will be able to

- Train the students in the field of Fruit and Vegetable Processing.
- Enable the students learn different preservation techniques to curb post-harvest losses in the field of agriculture.
- Learn processing of fruits & vegetables - different preservation techniques to improve the shelf life of seasonal fruits.
- Understand the importance of FSSAI Specifications

TEXT BOOKS

1. Giridharlal, Siddappa and Tandon. ICAR, “Preservation of Fruits and Vegetables”, New Delhi.
2. Srivastava. P.R. and Sanjeev Kumar. “Fruit and Vegetable Preservation”. 3rd Edition, International Publishers, Delhi.

REFERENCES

1. Norman Potter. “Food Science”, CBS publishers and Distributors, New Delhi.
2. Joshi and Pandey, “Biotechnology: Food Fermentation”. Volume-II. Educational Publishing and Distributing Co
3. Namkeen, “Manufacture of Snacks”, Papads and Potato products-EIRI. EIRI Board of Consultants and Engineers.
4. Sudhir Gupta (Compiled). “Fruits and Vegetables Processing”, Hand Book EIRI, Delhi.

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19A27402T MECHANICAL OPERATIONS AND MATERIAL HANDLING

PREAMBLE

The broad idea of this subject mentions about each individual operation and its applicability in food processing.

Course Objectives

- To impart knowledge to the students on principles, operation and maintenance of various food processing equipment namely mixing, forming, size reduction, cutting and grinding equipment. centrifugation, filtration material handling equipment like belt, screw and pneumatic conveyors, bucket elevator.

UNIT – I

Geometrical, physical and mechanical properties of foods. Cleaning, sorting and grading of foods. Peeling, decortications, deseeding of fruits, dehulling of grains, blanching of vegetables. Size Reduction: Principles and types of size reduction equipment, Crushers, Grinders, mills, disintegration of fibrous materials. Energy and power requirement, Mechanical expression of edible oil.

Unit Outcomes:

At the end of unit, students will be able to

- Know the various properties of foods
- Explain the primary processing operations
- Describe the size reduction and principles, equipment

UNIT – II

Sedimentation: Theory and principles of sedimentation, minimum area for continuous sedimentation, applications in food industry. Filtration: Principle of Constant pressure and constant rate filtration and types of filtration equipment, Settling classifiers and Flotation Screening, types of screen. Centrifugation: Principle of settling and centrifugation, devices for

centrifugal separation. Membrane separation processes: Reverse osmosis, Nano-filtration, ultra-filtration, microfiltration, dialysis and pervaporation.

Unit Outcomes:

At the end of unit, students will be able to

- Acquire basic knowledge on sedimentation, filtration and their equipment
- Explain the principles of centrifugation and membrane separation and its applications

UNIT – III

Mixing: Mixing of liquids and solids (powder), mixing equipment, mixing index and mixing time, Agitation and blending, types of agitators, power consumption in mixing. Scope and importance of material handling devices; Study of different material handling systems: Classification, principles of operation, conveyor system selection/design; Separation/Grading: Theory and principles: Types of separators – Disk, Indent cylinder, spiral and specific gravity, stone, inclined belt, pneumatic and aspirator separators- separation based on fluidization techniques – magnetic, cyclone and color separator.

Unit Outcomes:

At the end of unit, students will be able to

- Know the importance of mixing in solid and liquid foods and their equipment
- Applications of material handling equipment
- Various types of separators and its applications

UNIT – IV

Belt conveyor: Principle, characteristics, design, relationship between belt speed and width, capacity, inclined belt conveyors, idler spacing, belt tension, drive tension, belt tripper; Chain conveyor: Principle of operation, advantages, disadvantages, capacity and speed, conveying chain; Screw conveyor: Principle of operation, capacity, power, troughs, loading and discharge, inclined and vertical screw conveyors;

Unit Outcomes:

At the end of unit, students will be able to

- Explain the operation of belt conveyor and its practical applications
- Know the principle of screw conveyor and its types

UNIT – V

Bucket elevator: Principle, classification, operation, advantages, disadvantages, capacity, speed, bucket pickup, bucket discharge, relationship between belt speed, pickup and bucket discharge, buckets types; Pneumatic conveying system: Capacity and power requirement, types, air/product separators; Gravity conveyor design considerations, capacity and power requirement. Storage: Methods of storage, silos and bins, hoppers.

Unit Outcomes:

At the end of unit, students will be able to

- Know the detailed working mechanism of bucket elevator and its parts
- Pros and Cons of using bucket elevator
- Acquires knowledge on pneumatic conveyors and its application
- Explain the various methods of storage and their equipment

TEXT BOOKS

1. R.L Earle. “Unit operations in Food Engineering”.
2. K.M Sahay and Singh “Unit operations of Agricultural Processing”. K.K. Vikas Publishing House Pvt. Ltd. New Delhi.

REFERENCES

1. Mc. Cabe, J.C Smith and P. Harriot. “Unit operations of Chemical Engineering”. McGraw Hill Publishers. New Delhi.
2. N. N. Mohesinin “Physical properties of Plant and Animal materials”.
3. A. Chakraverty, Pulses and Oilseeds. “Post-Harvest Technology of Cereals”, Oxford & IBH Publishers. New Delhi.
4. P.J.Fellows “Food Processing Technology, Principles and Practice”, Wood Head Publishing Ltd., Cambridge, England.
5. R. P Singh and D.R Heldman. “Introduction to Food Engineering”, 3rd Edition.
6. P.G Smith “Introduction to Food Process Engineering”.

Course Outcomes

By the end of the course, the students will be able to

- Understand different food processing equipment that are being used in food industries
- Study about the principles, operation and maintenance of food processing equipment viz., material handling, cleaning, grading, mixing, forming, size reduction, cutting, grinding, centrifugation, filtration, evaporation and drying

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19A27403 PRINCIPLES OF FOOD ENGINEERING

PREAMBLE

The text prescribed for detailed study focuses on basic concepts like units and its conversion, fundamental laws and principles are useful to understand the subject.

Course Objectives

- To familiarize the importance and usage of units.
- To understand the fundamental laws and principles and its application

UNIT – I

Introduction to Food Engineering: Definition of terms, System of measurements, The S.I System, Conversion of Units. Steam Generation & Utilization: Concept of normal boiling point, Properties of Steam, Forms of Steam. Pressure-Enthalpy diagram, Problems; Boilers: Classification, Types, Criteria for selection, Maintenance & Applications.

Unit Outcomes:

At the end of unit, students will be able to

- Basic terminology related to Food Engineering
- Importance of conversion of units
- Basic knowledge on steam properties
- Classify the boilers and their selection

UNIT – II

Basic principles of Physics & Chemistry: Ideal Gas law, Vander Waal's equation, Amagat's law, Dalton's law, Problems; Kinetic Theory of gases. Thermodynamics: Basic concepts, First law of thermodynamics, Second law of thermodynamics, Zero law of thermodynamics Refrigeration: Basic concepts, Joule-Thomson effect, Refrigerants, Problems, Refrigeration types (VCC, VAC), Applications.

Unit Outcomes:

At the end of unit, students will be able to

- Importance and applicability of above laws
- Explain the terminology related to thermodynamics
- Applications of laws of thermodynamics
- Acquires knowledge on Refrigeration and its applications

UNIT – III

Humidity: Humidity & Relative Humidity, Saturation Humidity, Percentage Humidity, Psychrometric chart – Utilization, problems; Humidifiers & Dehumidifiers; Applications. Material balance and Energy balance in various unit operations – Problems, significance in food processing

Unit Outcomes:

At the end of unit, students will be able to

- Know about humidifiers and dehumidifiers and its applications
- Importance of material and energy balances in food processing

UNIT – IV

Dimensional Analysis, Fundamental -derived units. Conversion of Dimensional equations – Uses, Methods (Rayleigh's & Buckingham's) Examples: Nusselts Number, Reynolds number, Prandtl's number, Froude's number. Engineering properties of Food Materials: Mass- volume-area related properties of foods, rheological properties of solid foods, thermal properties of frozen & unfrozen foods, electrical conductivity of foods, dielectric properties of foods.

Unit Outcomes:

At the end of unit, students will be able to

- Have knowledge on dimensional analysis and derivations
- Have idea about engineering properties of foods

UNIT – V

Measurement & Control of Process Parameters: Various Process Parameters, On-line & Off-line parameters, Critical & non-critical parameters, Measurement of various parameters, controlling methods (Manual, Automatic & Computer control)

Unit Outcomes:

At the end of unit, students will be able to

- Basic concepts of process parameters
- Knowledge on measurement and control of these parameters
- Various controlling methods.

Course outcomes

- Students will learn the importance of units.
- Students will understand the basic laws and principles and its application in food engineering

TEXT BOOKS

1. R. Paul Singh and Dennis R. Heldman, "Introduction to Food Engineering", 4th Edition, Academic Press, 2009.
2. P.G. Smith, " Introduction to Food Process Engineering", 2nd Edition, Lincoln, UK, 2010

REFERENCES

1. J.M. Smith, H.C. Van Ness and M.M. Abbott "Introduction to Chemical Engineering Thermodynamics", 7th Edition, McGraw-Hill, Inc., NY, USA. 2005.
2. Z. Berk, "Food Process Engineering and Technology, Food Science and Technology", 1st Edition, International Series, Elsevier, 2009.
3. D. G. Rao, "Fundamentals of food engineering", Prentice-Hall of India, New Delhi, 2010.
4. R.K. Rajput. "Engineering Thermodynamics", 3rd Edition, Laxmi Publications (P) Ltd., Bangalore, 2007.
5. Warren L. McCabe, "Unit Operations of Chemical Engineering", 7th Edition, Julian Smith, Peter Harriott, McGraw-Hill, Inc., NY, USA, 2004.
6. Christie John Geankoplis "Transport Processes and Separation Process Principles" (Includes Unit Operations), 4th Edition, Prentice-Hall, NY, USA. 2003

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19A27404 PROCESSING OF FISH AND MARINE PRODUCTS

PREAMBLE

This subject focus on scope and status of marine industry, various processed products with different preservation techniques, novel methods.

Course Objectives

- To impart knowledge on fisheries and other marine foods, their nutritional composition and processing technologies

UNIT – I

Fisheries resources, global and Indian scenario; Types of fish and other marine products; Classification of fish (fresh water and marine), composition of fish, characteristics of fresh fish and quality assessment, spoilage of fish- microbiological, physiological, biochemical; Relationship between chilling and storage life.

Unit Outcomes:

At the end of unit, students will be able to

- Gain knowledge on present scenario of fisheries in India
- Know the different types of fish and marine products
- Describe the fish composition and characteristics, quality assessment
- Understand the different spoilage parameters
- Know the importance of relation between chilling and storage life.

UNIT – II

Methods of Preservation of fish: Drying, Salting, Smoking and Curing. General aspects of fish freezing, changes in quality during chilled and frozen storage; Principles of canning, effect of heat processing on fish, storage of canned fish, preprocess operations, post-process operations, cannery operations for specific canned products;

Unit Outcomes:

At the end of unit, students will be able to

- Describe the methods of preservation techniques
- Identify the changes in quality during the storage
- Have detailed idea on canning process and its products

UNIT – III

Fish products: Introduction, fish muscle proteins, surimi process, traditional and modern surimi production lines, quality of surimi products, comparison of surimi and fish mince products; Preparation protocols of indigenous products: Fish sauce and paste.

Unit Outcomes:

At the end of unit, students will be able to

- Explain the various products prepared from fish mainly surmi
- Understand the quality of surmi products and comparison with minced products
- Get to know about fish sauce and paste

UNIT – IV

Novel methods; Low dose irradiation; High pressure treatment, MAP, vacuum packaging, gas packaging; Oxygen absorbents and CO_2 generators, ethanol vapour generation, hurdle barrier concept, value added fish products, packaging; Sea food quality assurance, HACCP, EU hygienic regulations and ISO 9000 standards; New kinds of quality and safety problems emerging in sea food processing and preservation.

Unit Outcomes:

At the end of unit, students will be able to

- Know the importance of novel methods like irradiation, high pressure processing, oxygen absorbents and etc.
- Understand the value addition of fish products
- Acquire knowledge on quality assurance and standards for fish processing

UNIT – V

Fish by products - production of fish meal, fish protein extracts, fish protein hydrolysates, fish protein concentrate, fish liver oil and fish sauce and other important byproducts; Quality control of processed fish; Fish processing industries in India.

Unit Outcomes:

At the end of unit, students will be able to

- Understand the byproducts from fish and their processing
- Know the quality control of processed fish
- Get knowledge on fish processing industries in India

Course Outcomes

By the end of the course, the students will be able to

- Gain knowledge in the areas of fish and other marine food preservation and processing technology.

TEXT BOOKS

1. D.P. Sen. “Advances in Fish Processing Technology”. 2005. Allied Publishers Pvt. Ltd., Delhi.
2. “Preservation of Fish and Meat”. Brigitte Maas-van Berkel, Brigiet van den Boogaard and CorlienHeijnen. 2004. Agromisa Foundation, Wageningen.

REFERENCES

1. C.O. Chichester and H.D. Graham “Microbial safety of Fishery products”, Academic Press, New York, 1973.
2. George Borstorm. “Fish as Food - Vol. I, II, III and IV”, Academic Press, New York. 1961.
3. K. Gopakumar. “Textbook of Fish Processing Technology”, ICAR, New Delhi. y Charles L. Cutting. Processing and Preservation of Fish. Agro Bios, New Delhi.
4. Brend W. Rautenstrauss and Thomas Liehr. “Fish Technology:, Springer-Verlag, US, 2002.
5. G.M. Hall. “Fish Processing Technology”, 2nd Edition, Chapman & Hall, London, UK, 1997.

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B.Tech – II-II Sem

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19A05304T PYTHON PROGRAMMING

Course Objectives:

- To learn the fundamentals of Python
- To elucidate problem-solving using a Python programming language
- To introduce a function-oriented programming paradigm through python
- To get training in the development of solutions using modular concepts
- To introduce the programming constructs of python

Unit – I

Introduction: What is a program, Running python, Arithmetic operators, Value and Types.
Variables, Assignments and Statements: Assignment statements, Script mode, Order of operations, string operations, comments.
Functions: Function calls, Math functions, Composition, Adding new Functions, Definitions and Uses, Flow of Execution, Parameters and Arguments, Variables and Parameters are local, Stack diagrams, Fruitful Functions and Void Functions, Why Functions.

Unit Outcomes:

Student should be able to

- List the basic constructs of Python.
- Solve the problems by applying modularity principle.

Unit – II

Case study: The turtle module, Simple Repetition, Encapsulation, Generalization, Interface design, Refactoring, docstring.
onditionals and Recursion: floor division and modulus, Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, Recursion, Infinite Recursion, Keyboard input.
Fruitful Functions: Return values, Incremental development, Composition, Boolean functions, More recursion, Leap of Faith, Checking types,

Unit Outcomes:

Student should be able to

- Apply the conditional execution of the program.
- Apply the principle of recursion to solve the problems.

Unit - III

Iteration: Reassignment, Updating variables, The while statement, Break, Square roots, Algorithms.
Strings: A string is a sequence, len, Traversal with a for loop, String slices, Strings are immutable, Searching, Looping and Counting, String methods, The in operator, String comparison.
Case Study: Reading word lists, Search, Looping with indices.
Lists: List is a sequence, Lists are mutable, Traversing a list, List operations, List slices, List methods, Map filter and reduce, Deleting elements, Lists and Strings, Objects and values, Aliasing, List arguments.

Unit Outcomes:

Student should be able to

- Use the data structure list.
- Design programs for manipulating strings.

Unit – IV

Dictionaries: A dictionary is a mapping, Dictionary as a collection of counters, Looping and dictionaries, Reverse Lookup, Dictionaries and lists, Memos, Global Variables.
Tuples: Tuples are immutable, Tuple Assignment, Tuple as Return values, Variable-length argument tuples, Lists and tuples, Dictionaries and tuples, Sequences of sequences.
Files: Persistence, Reading and writing, Format operator, Filename and paths, Catching exceptions, Databases, Pickling, Pipes, Writing modules.
Classes and Objects: Programmer-defined types, Attributes, Instances as Return values, Objects are mutable, Copying.
Classes and Functions:

Unit Outcomes:

Student should be able to

- Apply object orientation concepts.
- Use data structure dictionaries.
- Organize data in the form of files.

Unit – V

Classes and Functions: Time, Pure functions, Modifiers, Prototyping versus Planning

Classes and Methods: Object oriented features, Printing objects, The init method, The __str__method, Operator overloading, Type-based Dispatch, Polymorphism, Interface and Implementation

Inheritance: Card objects, Class attributes, Comparing cards, decks, Printing the Deck, Add Remove shuffle and sort, Inheritance, Class diagrams, Data encapsulation.

The Goodies: Conditional expressions, List comprehensions, Generator expressions, any and all, Sets, Counters, defaultdict, Named tuples, Gathering keyword Args,

Unit Outcomes:

Student should be able to

- Plan programs using object orientation approach.
- Illustrate the principle of inheritance.

Text books:

1. Allen B. Downey, "Think Python", 2nd edition, SPD/O'Reilly, 2016.

Reference Books:

1. Martin C.Brown, "The Complete Reference: Python", McGraw-Hill, 2018.
2. Kenneth A. Lambert, B.L. Juneja, "Fundamentals of Python", CENGAGE, 2015.
3. R. Nageswara Rao, "Core Python Programming", 2nd edition, Dreamtech Press, 2019

Course Outcomes:

Student should be able to

- Apply the features of Python language in various real applications.
- Select appropriate data structure of Python for solving a problem.
- Design object oriented programs using Python for solving real-world problems.
- Apply modularity to programs.

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19A27405 PROCESSING OF SPICES AND PLANTATION CROPS AND MEDICINAL HERBS

PREAMBLE

The subject covers the importance of spices and processing of major and minor spices, plantation crops and medicinal crops and secondary and tertiary processing.

Course Objectives

- To impart knowledge about spice processing and their marketable standards, plantation crops and their importance in Indian economy, post-harvest technology of spices, value added products of spices, packaging of processed spices, food, medicinal and pharmaceutical uses of different spices.

UNIT – I

Importance and Processing of Spices: Classification, chemical composition and principal constituents, History of usage & Spice trade in India and the world.
Spices – production and importance – stage of harvesting and harvesting methods – processing of major spices – Ginger, Chilli, Turmeric and Garlic, Pepper, Cardamom – Unit operations involved – equipment used- value addition of spices.

Unit Outcomes:

At the end of unit, students will be able to

- Get information on history, classification, chemical composition and principal constituents of spices
- Understand the harvesting stages and methods and their processing, utilization of various major spices like ginger, chilli, turmeric etc.
- Know the equipment used and operations involved, valued added products from spices

UNIT – II

Processing of minor Spices: Herbs, leaves and Spartan seasonings and their processing and utilization – All spice, Annie seed, Sweet basil; Caraway seed, Cassia, Cinnamon; Clove, Coriander, Cumin, Dill seed; Fennel seed, Nutmeg, Mace, Mint, Marjoram. Rosemary, saffron,

sage; Savory, thyme, ajowan; Asafetida, curry leaves – Unit operations involved – equipment used- value addition of spices.

Unit Outcomes:

At the end of unit, students will be able to

- Understand the harvesting stages and methods and their processing, utilization of various minor spices like herbs, leaves, cinnamon, clove, coriander, nutmeg and etc.
- Know the equipment used and operations involved, valued added products from spices

UNIT – III

Processing of Plantation Crops: Tea Processing Composition and production of tea leaves; processing of tea leaves; CTC tea, black tea, green tea and Oolong tea, grading and packaging; processing of instant tea Coffee Processing Production and processing of coffee cherries by wet and dry method; processing technology for coffee; preparation of brew; processing technology for instant coffee and decaffeinated coffee.

Unit Outcomes:

At the end of unit, students will be able to

- Know about the importance of plantation crops, composition, production and processing of tea leaves, different types of tea, grading and packaging
- Understand the production and processing of coffee by wet and dry method
- Get knowledge on processing technology for instant tea, coffee and decaffeinated coffee, brew.

UNIT – IV

Processing of Plantation Crops: Cocoa processing Cocoa bean- introduction, history and composition; processing of cocoa bean; processed products of cocoa. Coconut, Arecanut, Vanilla and Cashew nut– production and importance – harvesting and stages of harvest – drying, cleaning and grading, processing methods, process and equipment – value added products – grading and types – packaging and storage

Unit Outcomes:

At the end of unit, students will be able to

- Know about the history, importance of cocoa, composition and processing of cocoa beans and processed products
- Understand the harvesting and stages like drying, cleaning and grading and various processing methods for coconut, arecanut, vanilla and cashew nut
- Get knowledge on process and equipment used, value added products from above mentioned plantation crops
- Study of grading, types, packaging and storage for above all plantation crops

UNIT – V

Processing of Medicinal Crops: Importance of medicinal crops – production and export status – processing of medicinal crops – equipment used – principles and operations – active components in various medicinal plants – application and uses – extraction methods
Extraction of Principal Constituents in Spices
Spice Oils & Oleoresins: Flavour extraction from Spices by different methods.

Unit Outcomes:

At the end of unit, students will be able to

- Study about the importance, production and export status of medicinal crops
- Understand the processing and equipment used for medicinal crops
- Know about active components in various medicinal plants and their application, uses
- Get knowledge on extraction methods, Extraction of Principal Constituents in Spices, Oils & Oleoresins: Flavour extraction from Spices by different methods

Course Outcomes

By the end of the course, the students will be able to

- Know history of spices, uses of spices, classification of processed spices according to marketing standards, packaging and different grades
- Learn about flavor development during processing, classification of spices according to economic importance, post-harvest technology and treatments, specifications for marketed products

TEXT BOOKS

1. Pandey, P. H, Saroj Prakasam, “Post-Harvest Engineering of Horticultural Crops through Objectives”. Allahabad 2002.
2. Pruthi, J.S, “Major Spices of India – Crop Management and Post-Harvest Technology”. Indian Council of Agricultural Research, Krishi Anusandhan Bhavan, Pusa, New Delhi. PP. 514, 1998

REFERENCES

1. Cardamom, “Chemistry”. Purseglove, J.W., E.G. Brown, G.L. Green and S.R.J. Robbins, Spices, Vol. I, Tropical Agricultural Series”, Longman, London, 1: 605. (1981)
2. J S Pruthi, “Quality Assurance in Spices and Spice Products – Modern Methods of Analysis” Allied Publishers Limited, New Delhi.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech – II-I Sem

L	T	P	C
2	0	0	2

19A52301 UNIVERSAL HUMAN VALUES

(Common to all)

Introduction:

This course discusses the role of human values in one's family. It, very briefly, touches issues related to their role in the society and the nature, which needs to be discussed at length in one more semester for which the foundation course names as"H-102 Universal Human Values 2 : "Understanding Harmony" is designed which may be covered in their III or IV Semester.

In the Induction Program, students would get an initial exposure to human valuesthroughUniversalHumanValues–I.Thisexposureistobeaugmentedby this compulsory full semester foundation course.

Course Objective:

The objective of the course is four fold:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

Unit 1:

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
- Continuous Happiness and Prosperity- A look at basic Human Aspirations
- Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current

scenario

- Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

Unit 2:

Understanding Harmony in the Human Being - Harmony in Myself!

- Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
- Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

Unit 3:

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
- Understanding the meaning of Trust; Difference between intention and competence
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
- Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Unit 4:

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

- Understanding the harmony in the Nature
- Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
- Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
- Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Unit 5:

Implications of the above Holistic Understanding of Harmony on Professional Ethics

- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- Case studies of typical holistic technologies, management models and production systems
- Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
- Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

Text Book

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth"
5. E. FSchumacher. "Small is Beautiful"
6. Slow is Beautiful –Cecile Andrews
7. J C Kumarappa "Economy of Permanence"
8. Pandit Sunderlal "Bharat Mein Angreji Raj"
9. Dharampal, "Rediscovering India"
10. Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule"
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland(English)
13. Gandhi - Romain Rolland (English)

MODE OF CONDUCT (L-T-P-C 2-1-0-2)

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them. Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practicals are how you behave and work in real life.

Depending on the nature of topics, worksheets, home assignments and/or activities are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

OUTCOME OF THECOURSE:

By the end of the course,

- Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would have better critical ability.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech – II-II Sem

L	T	P	C
0	0	3	1.5

19A27401P PROCESSING OF FRUIT AND VEGETABLES LAB

Course Objectives

- Estimation of preservatives like benzoic acid and SO_2, different processed products from fruit and vegetables and each operation importance.

LABORATORY EXPERIMENTS

1. Estimation of benzoic acid & SO_2
2. Pectin determination in fruits and vegetable products.
3. Preparation fruit juices e.g. carambola, orange, pineapple, mango etc.
4. Canning of fruits and vegetables
5. Extraction of Pectin (identification pectin rich foods, chemistry and interaction of pectin with other components)
6. Preparation of jams and jellies, marmalade, crystallized & glazed fruit, preserves and candies (knowledge on selection of fruits)
7. Preparation of Syrup, Squash, Crush
8. Preparation of tuti-fruti
9. Preparation of pickles, chutneys
10. Preparation of tomato products
11. Preparation of Papain
12. Drying of fruit and vegetables (Soup powders, dried products)
13. Visit to a Canning Plant
14. Visit to Fruits and Vegetable processing industries; processing of Mushrooms.

Course Outcomes

- The students will learn the all processing methodology of fruit and vegetable products and significance of each unit operation.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech – II-II Sem

L	T	P	C
0	0	3	1.5

19A27402P MECHANICAL OPERATIONS & MATERIAL HANDLING LAB

Course Objectives

- To impart practical orientation of usage of different mills, concept of terminal and settling velocity.
- Calculation of filter cake resistances.

LABORATORY EXPERIMENTS

1. Particle size distribution using sieve shaker.
2. To find out the screen effectiveness of a given sample by vibratory screen
3. To find out the grading efficiency of a given sample by destoner
4. To find out the grading efficiency of a given sample in specific gravity separator
5. To find out the grading efficiency of a given sample in spiral separator
6. Estimation of work index of material in grinding
7. Mixing experimentation and determination of mixing index.
8. Determination of power consumption in mixing/agitation.
9. Determination of equivalent and specific cake resistance in filtration.
10. Determine the efficiency of Cyclone separator.
11. Settling velocity of a particle by sedimentation.
12. Determination of separation efficiency of suspension by using tubular bowl/nozzle centrifuge

Course Outcomes

By the end of the course, the students will be able to

- Find out screen efficiency, grading efficiency & separation efficiency
- Find out particle size distribution
- Find out grinding index
- How to find out resistances in filtration

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech – II-II Sem

L	T	P	C
3	0	0	0

19A99301 ENVIRONMENTAL SCIENCE

Course Objectives:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life
- To save earth from the inventions by the engineers.

UNIT – I

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 – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

Unit Outcomes

- To know the importance of public awareness
- To know about the various resources

UNIT – II

Ecosystems: Concept of an ecosystem. – Structure 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
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity And Its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Course Outcomes:

- To know about various echo systems and their characteristics
- To know about the biodiversity and its conservation

UNIT – III

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 : Causes**,** 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.

Course Outcomes:

- To know about the various sources of pollution.
- To know about the various sources of solid waste and preventive measures.
- To know about the different types of disasters and their managerial measures**.**

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.

Course Outcomes:

- To know about the social issues related to environment and their protection acts.
- To know about the various sources of conservation of natural resources.
- To know about the wild life protection and forest conservation acts.

UNIT – V

Human Population And The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – 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.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

Unit Outcomes:

- To know about the population explosion and family welfare programmes.
- To identify the natural assets and related case studies.

Course Outcomes:

At the end of the course, the student will be able to

- Grasp multidisciplinary nature of environmental studies and various renewable and nonrenewable resources.
- Understand flow and bio-geo- chemical cycles and ecological pyramids.
- Understand various causes of pollution and solid waste management and related preventive measures.
- About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.
- Casus of population explosion, value education and welfare programmes.

TEXT BOOKS:

1. Text book of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
2. Palaniswamy, “Environmental Studies”, Pearson education
3. S.Azeem Unnisa, “Environmental Studies” Academic Publishing Company
4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd.

REFERENCES:

1. Deeksha Dave and E.Sai Baba Reddy, “Textbook of Environmental Science”, Cengage Publications.
2. M.Anji Reddy, “Text book of Environmental Sciences and Technology”, BS Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice hall of India Private limited
5. G.R.Chatwal, “A Text Book of Environmental Studies” Himalaya Pubilishing House
6. Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.