

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSIY ANANTAPUR COLLEGE OF ENGINEERING (AUTONOMOUS) KALIKIRI-517234, ANNAMAYYA (Dt)., A.P., INDIA.

# B.TECH.-FOOD TECHNOLOGY II YEAR COURSE STRUCTURE & SYLLABI

	B.Tech II-I Semester							
S. No.	Code	Title	L/D	Т	Р	Credit s		
1	23ABS14	Statistical Methods	3	0	0	3		
2	23A5230	Universal Human Values Understanding Harmony	2	1	0	3		
3	23ACS07	Food Biochemistry		0	0	2		
4	23AFT04T	Processing of Cereals, Legumes and Oil Seeds	3	0	0	3		
5	23AFT02T	Fluid Flow in Food Processing	3	0	0	3		
6	23ACSO7P	Principles of Food Preservation Lab	0	0	2	1		
7	23AFT04P	Processing of Cereals, Legumes and Oil Seeds Lab	0	0	3	1.5		
8	23AFT02P	Fluid Flow in Food Processing Lab	0	0	3	1.5		
9	23AFT05	Python Programming	0	1	2	2		
10	23AHS03	Environmental Science	2	0	0	_		
	Total			2	10	20		
		B.Tech II-II Semester						
S. No.	Code	Title	L/D	Т	Р	Credits		
	23AHS05a	Managerial Economics and		0				
1		Financial Analysis	2	0	0			
	23A524020	Diganisational Benaviour		0	0	, 2		
	23A524020	Business Environment	2	0	0	2		
2	23AFT06	Principles of Food Engineering	3	0	0	3		
3	23AFT07T	Food Microbiology and Food safety	3	0	0	3		
4	23AFT08T	Processing of Fruits, Vegetables, Spices and Plantation Crops	3	0	0	3		
5	23AFT09T	Heat And Mass Transfer	3	0	0	3		
6	23AFT07P	Food Microbiology and Food safety Lab	0	0	2	1		
7	23AFT08P	Processing of Fruits ,Vegetables , Spices and Plantation Crops Lab	0	0	3	1.5		
8	23AFT09P	Heat And Mass Transfer Lab	0	0	3	1.5		
9	23AFT10	Extrusion Processing	0	1	2	2		
10	23AHSS3	Design Thinking And Innovation	1	0	2	2		
		Total	15	1	17	 		



### Mandatory Community Service Project of 08 weeks duration during Summer JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR COLLEGE OF ENGINEERING (AUTONOUMS) KALIKIRI-517234, ANNAMAYYA (Dt)., A.P., INDIA. B.TECH.-FOOD TECHNOLOGY (II B. Tech I Semester)

**Course Code** Т Р С L STATISTICAL METHODS 23ABS14 3 0 0 3 Semester II B. Tech I Semester (FDT) **Course Objectives:** To expose to the field of statistics, random variables and their applications in food technology. Course Outcomes (CO): Student will be able to **CO1:** Acquire knowledge in organization of the data. (L1, L2). **CO2:** Acquire the knowledge of probability theory and predictions. (L2, L3). **CO3:** Apply the theoretical probability distributions like binomial, Poisson, and Normal in the relevant applications of Food Technology areas. (L3, L5). **CO4:** Acquire the knowledge of estimating the unknown population parameters in sampling theory. (L2, L3). **CO5:** Apply the testing tool like t-test and able to test the hypothesis in decision making. (L3, L5). **Pre-requisite:** Collection of data and basics of sets. ORGANIZATION AND DESCRIPTION OF DATA Unit - I Diagrams, frequency distribution, graphs of frequency distributions, descriptive measures, quartiles and percentiles, calculation of mean and standard deviation. PROBABILITY Unit - II Sample space and events, axioms of probability, some elementary theorems on probability, conditional probability and Baye's theorem. RANDOM VARIABLE AND PROBABILITY DISTRIBUTIONS Unit - III Random variables (discrete and continuous), probability density functions, properties, mathematical expectation. Probability distributions: Binomial, Poisson and Normal-their properties. Approximation of the binomial distribution to normal distribution. SAMPLING DISTRIBUTIONS AND ESTIMATION Unit - IV Sampling distributions: Population and Sample, the sampling distribution of means ( $\sigma$  known and  $\sigma$  unknown). Estimation: Point estimation and interval estimation of large samples concern to means and proportions. **TESTING OF HYPOTHESIS, LARGE SAMPLE TESTS & SMALL SAMPLE TESTS** Unit - V Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Small Sample Tests: Student t-distribution (test for single mean, two means and paired t-test).

# Learning Resources:

# **Textbooks:**

1. Richard A Johnson, Miller & Freund's Probability and Statistics for Engineers, 7/e, Pearson, 2008.

2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.

# **Reference Books:**

1. S. Ross, a First Course in Probability, 8/e, Pearson Education India, 2002.

2, B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill, 2006, New Delhi.

3. W. Feller, an Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968.

# Web Resources:

- 1. <u>https://onlinecourses.nptel.ac.in/noc21\_ma74/preview</u>
- 2. <u>https://onlinecourses.nptel.ac.in/noc22\_mg31/preview</u>



# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR COLLEGE OF ENGINEERING (AUTONOUMS) KALIKIRI-517234, ANNAMAYYA (Dt)., A.P., INDIA. B.TECH.- FOOD TECHNOLOGY

# (II B. Tech I Semester)

<b>Course Code</b>		т	m		
	UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY	L	I	P	C
23A52301	AND ETHICAL HUMAN CONDUCT	2	1	0	3
	(Common to all Branches)	_	-		
Semester	II B. Tech I Sem (CE, EEE, ME, ECE, CSE & FT)				
Course Objecti	ves:				
<ul> <li>To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.</li> <li>To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.</li> <li>To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct,</li> </ul>					Sure ll as t of ards auct,
Course Outcom	<b>nes (CO):</b> Student will be able to				
CO1: Define th	e terms like Natural Acceptance, Happiness and Prosperity. L1, L2				
CO2: Identify c	one's self, and one's surroundings (family, society nature). L1, L2				
CO3: Apply wh	hat they have learnt to their own self in different day-to-day settings in re	al life	. L3		
CO4: Relate hu	man values with human relationship and human society. L4				
CO5: Justify the	e need for universal human values and harmonious existence. L5				
CO6: Develop a	as socially and ecologically responsible engineers. L3, L6				
Course Topics	$10$ lectures and 14 tyterials in $\Gamma$ modules. The lectures and tyterials are of 1 be	ann da	ration	Tute	
sessions are to b	a used to explore and practice what has been proposed during the lecture session	jui uu ions	Iduon	. 1 utc	/11d1
The Teacher's N	Manual provides the outline for lectures as well as practice sessions. The te	eacher	is ex	necte	d to
present the issue	is to be discussed as propositions and encourage the students to have a dialogu	ie.	10 011	peece	
UNIT I	<b>Introduction to Value Education</b> (6 lectures and 3 tutorials for practice ses	sion)			
Lecture 1: Righ	nt Understanding, Relationship and Physical Facility (Holistic Developme	ent ar	nd the	Role	e of
Education)					
Lecture 2: Unde	rstanding Value Education				
Tutorial 1: Practice Session PS1 Sharing about Oneself					
Lecture 3: self-exploration as the Process for Value Education					
Lecture4: Continuous Happiness and Prosperity – the Basic Human Aspirations					
Tutorial 2: Practice Session PS2 Exploring Human Consciousness					
Lecture 5: Happiness and Prosperity – Current Scenario					
Tutorial 3. Pract	Lecture 6: Method to Fulfill the Basic Human Aspirations Tutorial 3: Practice Session PS3 Exploring Natural Acceptance				
UNIT II	Harmony in the Human Being (6 lectures and 3 tutorials for practice session	on)			
Lecture 7: Unde	rstanding Human being as the Co-existence of the self and the body.				

Lecture 8: Distinguishing between the Needs of the self and the body Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body. Lecture 9: The body as an Instrument of the self Lecture 10: Understanding Harmony in the self Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self Lecture 11: Harmony of the self with the body Lecture 12: Programme to ensure self-regulation and Health Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body				
UNIT III Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)				
Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction Lecture 14: 'Trust' – the Foundational Value in Relationship Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust Lecture 15: 'Respect' – as the Right Evaluation Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect Lecture 16: Other Feelings, Justice in Human-to-Human Relationship Lecture 17: Understanding Harmony in the Society Lecture 18: Vision for the Universal Human Order Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal				
UNITIVHarmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)				
Lecture 19: Understanding Harmony in the Nature Lecture 20: Interconnectedness, self-regulation and Mutual fulfilment among the Four Orders of Nature Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature Lecture 21: Realizing Existence as Co-existence at All Levels Lecture 22: The Holistic Perception of Harmony in Existence				
UNIT     V     Implications of the Holistic Understanding – a Look at Professional Ethics				
(6 lectures and 3 tutorials for practice session)				
Lecture 23: Natural Acceptance of Human Values Lecture 24: Definitiveness of (Ethical) Human Conduct Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order Lecture 26: Competence in Professional Ethics Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies Lecture 28: Strategies for Transition towards Value-based Life and Profession Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order				
Practice Sessions for UNIT I – Introduction to Value Education PS1 Sharing about Oneself PS2 Exploring Human Consciousness PS3 Exploring Natural Acceptance Practice Sessions for UNIT II – Harmony in the Human Being PS4 Exploring the difference of Needs of self and body				
PS5 Exploring Sources of Imagination in the self PS6 Exploring Harmony of self with the body Practice Sessions for UNIT III – Harmony in the Family and Society PS7 Exploring the Feeling of Trust				

PS8 Exploring the Feeling of Respect PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV – Harmony in the Nature (Existence) PS10 Exploring the Four Orders of Nature PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics PS12 Exploring Ethical Human Conduct PS13 Exploring Humanistic Models in Education PS14 Exploring Steps of Transition towards Universal Human Order

# Learning Resources:

# **Textbooks and Teachers Manual**

a. The Textbook

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

b. The Teacher's Manual

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

1.

# **Reference Books:**

- 1. *JeevanVidya: EkParichaya*, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
- 2. *Human Values*, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
- 3. The Story of Stuff (Book).
- 4. The Story of My Experiments with Truth by Mohandas Karamchand Gandhi
- 5. *Small is Beautiful* E. F Schumacher.
- 6. Slow is Beautiful Cecile Andrews
- 7. Economy of Permanence J C Kumarappa
- 8. *Bharat Mein Angreji Raj* PanditSunderlal
- 9. *Rediscovering India* by Dharampal
- 10. Hind Swaraj or Indian Home Rule by Mohandas K. Gandhi
- 11. India Wins Freedom Maulana Abdul Kalam Azad
- 12. Vivekananda Romain Rolland (English)
- 13. Gandhi Romain Rolland (English)

# Web Resources:

1. <u>https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-</u> Introduction%20to%20Value%20Education.pdf

2. <u>https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-</u> <u>Harmony%20in%20the%20Human%20Being.pdf</u>

3. <u>https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-</u> <u>Harmony%20in%20the%20Family.pdf</u>

4. <u>https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf</u>

5. <u>https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf</u>

6. <u>https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching</u>%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf

7. <u>https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-</u>25%20Ethics%20v1.pdf

8. <u>https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-</u>

# understanding-of-harmony-on-professional-ethics/62490385

9. https://onlinecourses.swayam2.ac.in/aic22\_ge23/preview

# Mode of Conduct:

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 practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity 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.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.

Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.



### (II B.Tech I Semester)

#### **Food Biochemistry**

Course objectives:

1. The course aims to give students exposure to the basic role of biomolecules and their chemical interactions inside the cell.

2. It provides deeper insight into the structures, properties, and functions of major biomolecules and metabolic pathways in living systems.

3. To predict the changes during the food processing process.

Course outcomes: Upon the completion of the course, the students will be able to:

COs	Course outcomes	Bloom
		level
CO1	knowledge of primary biochemical pathways leading to the synthesis and catabolism of carbohydrates and lipids	L1, L2
CO2	Classify the structures of proteins. and understand metabolism	L4
CO3	Understand the concepts of lipids and nucleotide metabolism	L2
CO4	Understand about basic concepts of enzymes and Nucleic acids	L2
CO5	predict the changes in food processing	L6

### Unit-I Carbohydrates and its metabolism

Introduction: Biochemistry & its scope; Cellular Biochemistry - Cell-structure – plant and animal, composition and function of cell organelle. Properties of water, weak acids & weak bases, pH & buffers. Introduction to biomolecules. Carbohydrates: outline classification, and structural aspects of monosaccharides. Carbohydrate metabolism: Introduction to metabolism, Biological role of carbohydrates, Glycolysis, TCA Cycle, Electron transport chain, oxidative phosphorylation, calculation of ATP yield during complete oxidation of glucose, Anaerobic glycolysis, gluconeogenesis, metabolism of Glycogen, Pentose phosphate pathway, Glyoxylate pathway. Dietary fibre – absorption & metabolism, glycemic and nonglycemic carbohydrates

### **Unit-II Proteins and its metabolism**

Proteins:- Classification of proteins, classification of amino acids, Properties of proteins, Structure of amino acids, peptides, peptide bond, protein structure-primary, Secondary, Tertiary, and Quaternary structure, Forces stabilize the protein structure, salting out, salting in. Denaturation and renaturation, Amino acid metabolism-transamination, decarboxylation, nitrogen fixation, urea cycle. Metabolism of phenylalanine and tyrosine etc..

### **Unit-III Metabolism of Lipids and Nucleotides**

Lipid metabolism: chemical composition, classification of lipids, role and nutritional signification of fatty acids (SFA, MUFA, PUFA), synthesis and breakdown of triglycerides, phospholipids, ketosis, fatty acids, and trans-fat synthesis. Metabolism of nucleotides: De novo synthesis of purine and pyrimidine nucleotides. Disorders of purine and pyrimidine metabolism.

### Unit-IV Nucleic acids and enzymes

Nucleic acids: - Structure of various components, viz, bases and sugars, Nucleosides, Nucleotides, Structure of Nucleic acid (DNA & RNA), different forms of DNA, hydrolysis of nucleic acids. Enzymes: Introduction to enzymes, classification of enzymes, mechanism of action, factors affecting enzyme activity, Michaelis-Menten equation, the significance of Km, Vmax, and turnover number. Allosteric enzymes, Enzyme inhibition, enzyme kinetics

### Unit-V

Relationship between vitamins and hormones in terms of their biological role. Physicochemical and nutritional changes during processing Changes during food processing treatment – drying and dehydration, irradiation, freezing, fermentation, canning, restoration, enrichment, fortification, and supplementation of foods.

### Textbooks

- 1. Biology for Chemist by Agrawal & amp; Agrawal.
- 2. Biochemistry by Albert L Lehninger.
- 3. Biochemistry by U Satyanarayana & U Chakrapani
- 4. Fundamentals of Biochemistry by J L Jain, Sunjay Jain & amp; Nitin Jain.



### (II B.Tech I Semester)

### Processing of Cereals, Legumes and oilseeds

### **Course Objectives:**

L	Т	Р	С
3	0	0	3

- 1. To provide basic understanding of cereals, pulses and oilseeds after harvesting.
- 2. To make student aware on various types of processing methods of cereals, pulses and oilseeds
- 3. To make student aware on various products and by-products of cereals, pulses and oilseeds
- 4. To make students able to implement their knowledge about detailed manufacturing technologies of cereals, pulses and oilseeds consumed in daily life in food industries.

### **Course Outcomes:**

COs	Statement	Level
CO 1	Understand the composition, structure and storage of food grains	L2
CO 2	Understand the technology of cereal processing and its products	L2
CO 3	Understand the traditional and modern milling operations of wheat and technology of bakery and extruded products	L2
CO 4	Understand the processing of coarse cereals and legume and their value-added products	L2
CO 5	Understand the processing of oil & oilseeds and utilization of their by products	L2

### UNIT - I

Status, Production and major growing areas of cereals in India and world. Importance of Cereals Pulses and Oilseeds, Composition, Structure and processing characteristics of Cereal grains, Legumes and Oilseeds. Rice: Structure, types, composition, quality characteristics and physicochemical properties of Rice. Milling machines: traditional rice milling machinery – hand pounding equipment, single huller, battery of hullers, sheller-cum-huller mill, sheller mill and engleberg huller. Modern rice milling machinery – paddy cleaner, destoner, thickness grader, paddy husker and husk aspirator, paddy

#### **B.Tech-FDT**

separator, abrasion type and friction type polishers, pressure type, indented cylinder grader and color sorter. Milling efficiency: determination of milling efficiency – solving numerical on milling efficiency, Parboiling: principle - physico-chemical changes during parboiling – steps in parboiling – effect of parboiling on milling.

#### UNIT - II

Nutritional and cooking quality of rice Processed rice products (flaked, expanded and puffed rice), Byproducts. 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.

#### 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 - IV

Legumes: Chemical composition and nutritive value of legumes, types, Anti-nutritional compounds in legumes, Methods of removal of anti-nutritional compounds developments in pre-milling treatment. Pulses milling: wet milling and dry milling, milling equipment, Problems in dhal milling industry. Nutritional changes during soaking and sprouting of pulses, secondary processing of pulses, processed products, fermented products, traditional products, Value addition; effect of processing on nutritive value.

### UNIT - V

Chemical composition and nutritive value of oilseeds. Processing of oil seeds for direct use and

consumption, Oil extraction methods- mechanical (Ghani and Expellers) and chemical methods (solvent extraction), New technologies in oilseed processing: supercritical fluid extraction - membrane processing. Processing of extracted oil: Refining, Hydrogenation, Inter esterification. Processing of deoiled cake into protein concentrates and isolates, Texturized vegetable protein, Functional protein preparations. Peanut butter, Margarine and Spread.

### Text books

1. K. Kulp and J. G. Ponte. Jr., "HandBook of Cereal Science and Technology", 2nd Edition, CRC, 2000.

2.Guriqbal Singh, Harbhajan Singh Sekhon, Jaspinder Singh Kolar and Masood Ali. 2005. Pulses. Agrotech Publishing Academy, Udaipur.

3. Chakraverty. 2008. Post-Harvest Technology of Cereals, Pulses and Oilseeds, 3rd Ed. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

4. Amalendu Chakraverty, Arun S. Mujumdar, G. S. Vijaya Raghavan and Hosahalli S. Ramaswamy. 2003. Handbook of Post-Harvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices. Marcel Dekker, Inc., NY, USA.

5. K. M. Sahay and K. K. Singh. 2001. Unit Operations of Agricultural Processing, 2nd Ed. Vikas Publishing House Pvt. Ltd., Noida

### **Reference books**

- 1. Practical Manual on Post-Harvest Engineering of Cereals Pulses and Oilseeds, Sangani V P, Davara P R
- 2. FSSAI Manual of Methods of Analysis of Foods Cereal and Cereal Products -2nd edition



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B.TECH.- FOOD TECHNOLOGY (II B.Tech I Semester)

Fluid Flow in Food processing

L	Т	Р	С
3	0	0	3

### **Course Objectives:**

- 1. Understanding concepts and application related to behaviour of fluids with respect to foods.
- 2. Handling various pressure, flow and viscosity measuring devices.
- 3. The engineering principles to understand the fluid dynamics-

### **Course Outcomes**

COs	Statement	Blooms Level
CO1	Students are able to implement the basic concepts of fluid-flow phenomena in food processing.	L4
CO2	Students are able to discuss various fluid flow theorems and implement them in various flow measuring devices.	L2
CO3	Students can explain the laminar viscous fluid flow behavior in pipes	L3
CO4	Know the applications and usage of Bernoulli's theory, Euler's theorem, Hagen- Poiseuille equation and Moody chart	L3
CO5	Describe the requirements, working principle and construction of various pumps.	L3

### Unit-I

Introduction and Properties of Fluids Properties of Fluids: Concept of fluid mechanics, definition of fluid, fluid continuum, 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. Fluid Mechanics Pressure Measurement: Static pressure of liquids, absolute and gauge pressures, mechanical pressure gauges, pressure measurement by manometers Forces on plane surfaces, forces on curved surfaces, Buoyant forces (Archimedes' Principle), stability of floating and submerged bodies.

### **B.Tech-FDT**

#### Unit II

Kinematics of Fluid Motion 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, path-line and streak-line Acceleration equations, continuity equations, circulation and vorticity, flow net. Dynamics of Fluid Flow Euler's equation of motion, application of Euler's equation, Bernoulli's equation, applications of Bernoulli's equation, cavitation, momentum. Navier-Stokes Equations of Motion Navier-Stokes equations in cylindrical co-ordinates, boundary conditions Simple application of Navier-Stokes equation: Laminar flow between two straight parallel boundaries

#### Unit III

Friction Factor: Definition of Friction Factor; relationship between Friction factor and Reynolds Number by using Dimensionless analysis, concept of Friction Factor: Derivation of friction factor for Laminar Flow, Hagen-Poiseuille equation; Friction Factor for Turbulent Flow, Moody Chart. Pressure Losses in Pipes & Flow Measurement: Energy equation for steady flow of fluids: Pressure, Kinetic & Potential Energy. Major Losses: Frictional Losses; Minor losses: Energy Losses due to sudden expansion, contraction & energy losses due to pipe fittings.

#### Unit IV

Flow Measurements Measurement of Flow in Pipes, Venturi meter, flow nozzle, sharp edged, concentric orifice meter, Pitot tube, Rotameter. Measurement of Velocity, Pitot tube, hot wire, an emometer, current meter. Flow through Orifices, Determination of hydraulic coefficient of orifice, large orifice, standard orifice, mouthpieces or short tubes. Fluid Machines Turbines and pumps: Types of pumps and classification criteria, Theory and working of centrifugal pump, reciprocating pumps, external gear pump (rotary pump), Lobe pump, Vane pump etc.

#### Unit V

Physical properties of particles like size, shape, sphericity, porosity, superficial and interstitial velocity, hydraulic radius, equivalent diameter etc. Mechanism of fluidization, characteristics of gas – solid fluidized systems, Fanning friction factor for porous media; minimum porosity, bed weight, pressure drop in fluidized bed, theory and analysis of fluidization process; particulate fluidization; aggregative (or bubbling) fluidization; principle of fluidized bed drying equipment; pneumatic conveyors. Numerical problems.

#### **Text books**

- 1. A Textbook of Hydraulics Khurmi RS S. Chand Publication, 1983
- 2. A Textbook of Fluid Mechanics and Hydraulics Bansal RK Firewell Media, 2005

- 3. Hydraulics Jagdish Lal Metropolitan Publisher, Delhi 1963
- 4. Unit Operations in Food Engineering Albert Ibarz, Gustavo V. Barbosa-Canovas, CRC Press 2002
- 5. Fluid Mechanics Fox, Mcdonanld and Pritchard 8 th Edition, Wiley Publishers, 2013

### **Reference books**

- 1. Fluid Mechanics Frank M. White. 7 th Ed. McGraw-Hill Book Co., Inc., Boston, USA. 2010.
- 2. Fluid Mechanics: Fundamentals and Applications. Yunus A. Çengel and John M. Cimbala.
- McGraw-Hill, Inc., New York, USA. 2006.
- 3. Fundamentals of Fluid Mechanics Bruce R. M., Donald F. Y. and Theodore H. O. 4 th Ed. John
- Wiley & amp; Sons, Inc., New York, USA. 2002

4. Fluid Mechanics with Engineering Applications E. John Finnemore and Joseph B. Franzini.10th Ed. McGraw-Hill,



# COLLEGE OF ENGINEERING (AUTONOMOUS) KALIKIRI-517234, ANNAMAYYA (Dt)., A.P., INDIA.

### **Processing of Cereals, Legumes and oilseeds Lab**

L	Т	Р	С
0	0	0	1.5

### **Course Objectives:**

- 1. To provide basic understanding of cereals, pulses and oilseeds
- 2. To make student aware on various analysis of cereals, pulses and oilseeds
- 3. To make student aware on various products and by-products of cereals, pulses and oilseeds
- 4. To make students able to learn manufacturing technologies of cereals, pulses and oilseeds consumed in daily life.

#### **Course Outcomes**

COs	Statement	Blooms
		Level
CO1	Student can be able to determine the physico-chemical properties cereal, pulses and oil seeds	L3
CO2	Student can be able to relate the pre-treatments used in pulse milling process to achieve high grade pulses	L4
CO3	Student can be able to understand various processing techniques for cereals	L2
CO4	Student can be able to understand various processing techniques for primary and secondary products from cereals, pulses	L2
CO5	Student can be able to analyse the quality parameters of oils.	L4

### **List of Practicals**

**1.** Determination of physical properties (Bulk Density, Porosity, Sphericity, Angle of repose, Test weight, Particle size, Sieve analysis) of different grains.

2. Determination of proximate composition of selected cereals, pulses and oilseeds

3. Estimation of Gluten content, sedimentation value, alcoholic acidity, water absorption capacity and Polenske value of wheat flour.

- 4. Experiment on parboiling of paddy
- 5. Processing of value-added products from millets
- 6. Experiment on preparation of sorghum malt

- 7. Removal of anti-nutritional compounds from selected pulses and oilseeds.
- 8. Study on preconditioning of pulses before milling
- 9. Study of mini rice mill, dhal mill, oil mill
- 10. Estimation of different quality parameters of oils.
- 11. Study on milling quality of rice
- 12. Study of cooking quality of dhal
- 13. Products of soyabean- tofu, milk
- 14. Visit to a working modern roller flour mill and FCI godowns.
- 15. Visit to working rice mill.

# Text books

- 1. D. G. Rao, "Fundamentals of food engineering", Prentice-Hall of India, New Delhi, 2010.
- 2. Food science, handbook by srilakshmi.
- 3. Handbook of millet processing, quality, and nutrition status by C. Anandaramakrishnan, Ashish Rawson, C.K. Sunil

# **Reference books**

- 1. Practical Manual on Post-Harvest Engineering of Cereals Pulses and Oilseeds, Sangani V P, Davara P R
- 2. FSSAI Manual of Methods of Analysis of Foods Cereal and Cereal Products -2nd edition



# COLLEGE OF ENGINEERING (AUTONOMOUS) KALIKIRI-517234, ANNAMAYYA (Dt)., A.P., INDIA.

### Fluid Flow in Food Processing Lab

L	Т	Р	С
0	0	0	1.5

### **Course Objectives:**

- 1. To introduce the students to the important engineering properties of fluids.
- 2. To demonstrate the flow of different types of fluids.
- 3. To demonstrate the behavior of fluids at rest and under motion.
- 4. To demonstrate the measurement of fluid flow using different measuring apparatus.

Course Outcomes: On successful completion of the subject, the students will be able to

COs	Statement	Blooms Level
CO1	Distinguish the fundamental and derived units, derived dimensional formula of various physical quantities	L1
CO2	Understand and explain between fluid statics and fluid dynamics	L4
CO3	Solve problems on flow measurement, Bernoulli's equation etc.	L2
CO4	Acquaint themselves with various kinds of pumps, blowers & fans	L2
CO5	Understand various fluid properties like density, viscosity and critical velocity, Reynolds number etc.	L4
CO6	Acquire problem solving skills and improvisation of the process.	L5

### **List of Practicals**

- 1. Plotting flow rate versus pressure drop with U-tube manometer
- 2. Verification of Bernoulli's theorem
- 3. Determination of discharge coefficient for Venturi
- 4. Determination of discharge coefficient for Orifice
- 5. Determination of discharge coefficient for V-Notch.
- 6. Determination of critical Reynold's number of laminar, transition and turbulent flow by Reynold's apparatus.
- 7. Calibration of Rotameter.
- 8. Determination of frictional coefficient of the pipeline
- 9. Determination of minor head losses in fluid flow

- 10. Study of reciprocating pump
- 11. Study of centrifugal pump and determination of performance characteristics
- 12. Study of submersible pumps
- 13. Study of gear pumps
- 14. Study of positive displacement pump

# Text books

- 1. Unit operations in food processing by 2n edition by R L Earle
- 2. Introduction to the food engineering 6 th edition by R Paul Singh, dennis R Heldmen Feerruh

### **Reference books**

- 1. Concepts of Food process engineering by sanjaya k dash, nihar ranjan sahoo
- 2. Computational fluid dynamics application in food processing. C Ananda ramakrishnan

1.



# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR COLLEGE OF ENGINEERING (AUTONOMOUS) KALIKIRI-517234, ANNAMAYYA (Dt)., A.P., INDIA.

**Principles of Food preservation Lab** 

L	Т	Р	С
0	1	2	2

# **Course Objectives:**

- To provide hands on training of processing and preservation of various foods and food products.
- To understand processing and preservation of foods by sugar, by salt & acid by fermentation.
- Emphasis on importance of food technology into reduce the spoilage and improve the quality
- To explore the various preservation methods.

**Course Outcomes:** On successful completion of the subject, the students will be able to:

- 1. To develop the skill to analyze the quality like sugar such as jam, jelly etc.
- 2. To explain the fermentation process such as wine, beer.
- 3. To analyze technologies in food preservation.
- 4. To discuss preservation of foods by salt and acid.
- 5. To evaluate the novel technologies in food preservation.

# **List of Practicals**

- 1. Demonstration of various Machineries used in Food Processing
- 2. Demonstration of various perishable food items and degree of spoilage
- 3. Demonstration of Effect of Blanching on Food Quality Characteristics
- 4. Preservation by Application of Heat (Boiling of Milk/ Pasteurization)
- 5. Preservation by Low Temperature (Effect of Refrigeration and Freezing on milk)
- 6. Preservation by High Concentration of Sugar (Jam)
- 7. Preservation by High Concentration of Sugar (Jelly)
- 8. Preservation by High Concentration of Sugar (Fruit Preserve / Crystallized Fruit)
- 9. Preservation by using Salt (Pickling)
- 10. Preservation by using Chemical Preservatives (Sodium Benzoate)
- 11. Preservation by using chemical Preservatives (Calcium Propionate)
- 12. Preservation of food by using acidulants i.e. pickling by acid, vinegar or acetic acid
- 13. Drying and Dehydration of Fruit
- 14. Drying and Dehydration of Vegetables
- 15. Reconstitution Test for Dried Vegetable Samples
- 16. Preservation of Coconut Shreds using Humectants

- 17. Spray Drying of Milk
- 18. Preparation of Fermented Products (Sauerkraut)
- 19. Preparation of Fermented Beverage (Grape wine)
- 20. Visit to food processing industry

# **Text books**

1. Norman N. Potter and J.H. Hotchkiss, Chapman and Hall, "Food Science", 5th Edition, 2098.

2. P. J. Fellows, "Food processing technology: Principles and Practice", 3rd Edition, Taylor and Francis, 2009.

### **Reference books**

**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 COLLEGE OF ENGINEERING (AUTONOUMS) KALIKIRI-517234, ANNAMAYYA (Dt)., A.P., INDIA. B.TECH.- COMPUTER SCIENCE & ENGINEERING

<b>Course Code</b>		т	T	п	C
	<b>PYTHON PROGRAMMING</b>	L	1	Р	C
23ACS07	(Common To CSE, ECE, EEE, MECH, FDT)	0	1	2	2
Semester	II B.Tech				L
Course Objec	tives: The main objective of the course is to				
Introdu	ce core programming concepts of Python programming language.				
Demon	strate about Python data structures like Lists, Tuples, Sets and dictional	ries			
<ul> <li>Implem</li> </ul>	ent Functions, Modules and Regular Expressions in Python Program	ming	and	to cre	eate
practica	al and contemporary applications using these				
Course Outco	mes: After completion of the course, students will be able to				
<b>CO1:</b> Showcas	se adept command of Python syntax, deftly utilizing variables, data type	es, coi	ntrol	tions	
(1.4)	cuons, modules, and exception nandring to engineer robust and enricien		solu	uons.	
<b>CO2:</b> Apply P	ython programming concepts to solve a variety of computational proble	ems (l	L3)		
CO3: Understa	and the principles of object-oriented programming (OOP) in Python, in	cludir	ng cla	sses,	
objects, inherit	ance, polymorphism, and encapsulation, and apply them to design and	imple	ment	Pythe	on
programs (L3)					
CO4: Proficien	nt in using commonly used Python libraries and frameworks such as JS	ON, X	KML,		
NumPy, panda	s (L2)				
CO5: Exhibit	competence in implementing and manipulating fundamental data struct	ures s	uch a	s lists	5,
tuples, sets, die	ctionaries (L3)				
Unit - I					
History of Pyth	on Programming Language, Thrust Areas of Python, Installing Anacor	nda Py	ython		
Distribution, Ir	stalling and Using Jupyter Notebook.				
Parts of Pytho	<b>n Programming Language</b> : Identifiers, Keywords, Statements and Ex	press	ions,	-	
Variables, Ope	rators, Precedence and Associativity, Data Types, Indentation, Comme	nts, R	leadin	ig Inp	out,
Print Output, 1	ype Conversions, the type () Function and Is Operator, Dynamic and S	trong	ly Ty	ped	
Language.			. 1	•1	
Control Flow	Statements: If statement, If-else statement, ifelifelse, Nested if stat	temen	it, wh	ile	
Loop, for Loop	, continue and break Statements, Catching Exceptions Using try and ex	cept	Stater	nent.	
1 JATrito	mients.				
<ol> <li>write a program to display all prime numbers within an interval</li> </ol>					
2. Write	2. Write a program to swap two numbers without using a temporary variable				
4. Demo	4. Demonstrate the following Operators in Python with suitable examples				

- i) Arithmetic Operators ii) Relational Operators iii) Assignment Operators iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators
- 5. Write a program to add and multiply complex numbers
- 6. Write a program to print multiplication table of a given number.

# Unit - II

**Functions:** Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, \*args and \*\*kwargs, Command Line Arguments.

**Strings**: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings. Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

# Sample Experiments:

- 7. Write a program to define a function with multiple return values.
- 8. Write a program to define a function using default arguments.
- 9. Write a program to find the length of the string without using any library functions.
- 10. Write a program to check if the substring is present in a given string or not.
- 11. Write a program to perform the given operations on a list: i. additionii. insertioniii. slicing
- 12. Write a program to perform any 5 built-in functions by taking any list.

# Unit - III

**Dictionaries:** Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

**Tuples and Sets:** Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

# Sample Experiments:

- 13. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
- 14. Write a program to count the number of vowels in a string (No control flow allowed).
- 15. Write a program to check if a given key exists in a dictionary or not.
- 16. Write a program to add a new key-value pair to an existing dictionary.
- 17. Write a program to sum all the items in a given dictionary.

# Unit - IV

**Files**: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os. path Modules.

**Object-Oriented Programming**: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

# **Sample Experiments:**

- 18. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
- 19. Python program to print each line of a file in reverse order.
- 20. Python program to compute the number of characters, words and lines in a file.
- 21. Write a program to create, display, append, insert and reverse the order of the items in the array.
- 22. Write a program to add, transpose and multiply two matrices.
- 23. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

# Unit - V

**Introduction to Data Science**: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

# Sample Experiments:

- 24. Python program to check whether a JSON string contains complex object or not.
- 25. Python Program to demonstrate NumPy arrays creation using array () function.
- 26. Python program to demonstrate use of ndim, shape, size, dtype.
- 27. Python program to demonstrate basic slicing, integer and Boolean indexing.
- 28. Python program to find min, max, sum, cumulative sum of array
- 29. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
  - a) Apply head () function to the pandas data frame
  - b) Perform various data selection operations on Data Frame
- 30. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

# **Learning Resources:**

# **Reference Books:**

- 1. Gowri shankar S, Veena A., Introduction to Python Programming, CRC Press.
- 2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2<sup>nd</sup> Edition, Pearson, 2024
- 3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

# **Online Learning Resources:**

- 1. https://www.coursera.org/learn/python-for-applied-data-science-ai
- 2. <u>https://www.coursera.org/learn/python?specialization=python#syllabus</u>



# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR COLLEGE OF ENGINEERING (AUTONOMOUS) KALIKIRI-517234, ANNAMAYYA (Dt)., A.P., INDIA. B.TECH -FOOD TECHNOLOGY (II-I Semester)

### **ENVIRONMENTAL SCIENCE**

(Common to All Branches of Engineering)

### **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.
- To understand the problems related to social issues and Wild life protection acts.
- To know the importance of value education and welfare programs.

### **Course Outcomes:**

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

- Grasp multidisciplinary nature of environmental studies and various renewable and non-renewable 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.
- Cause of population explosion, value education and welfare programs.

### <u>UNIT — I</u> 10 hrs

**<u>Multidisciplinary Nature of Environmental Studies</u>:** — Definition, Scope and Importance — Need for Public Awareness.

<u>Natural Resources</u> : 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, fertilizerpesticide problems, water logging, salinity, case studies. — Energy resources:

L	Т	Р	С
2	0	0	0

# **B.Tech-FDT**

### Learning outcomes:

At the end of this unit, the students will be able to

- To know the importance of public awareness
- Explain how natural resources should be used.

### <u>UNIT — II</u> 10 hrs

**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 — Biogeographical 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.

### Learning outcomes:

At the end of this unit, the students will be able to

- To get a clear picture of echo systems and their characteristics.
- To get awareness about land degradation, soil erosion and desertification.

### <u>UNIT — III</u> 8hrs

**Environmental Pollution:** Definition, Cause, effects and control measures of:

- a. Air Pollution.
- b. Water pollution
- c. Soi1 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.

### Learning outcomes:

At the end of this unit, the students will be able

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

#### 

<u>Social Issues and the Environment</u>: 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.

### Learning outcomes:

At the end of this unit, the students will be able to

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

### 

<u>**Human Population and The Environment:</u>** Population growth, variation among nations. Population explosion — Family Welfare Programs. — 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.</u>

**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...

### Learning outcomes:

At the end of this unit, the students will be able

• To understand population explosion and family welfare programs. To identify the natural assets and related case studies.

### Textbooks:

- Text book of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press, 2<sup>nd</sup> Edition, 2013.
- 2. Palaniswamy, "Environmental Studies", Pearson education, 2<sup>nd</sup> Edition. 2014.
- 3. K.Raghavan Nambiar, "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", Scitech Publications (India), Pvt. Ltd., 2010.

### **<u>Reference Books</u>**:

- 1. Deeksha Dave and E.Sai Baba Reddy, "Textbook of Environmental Science", Cengage Publications, Revised Edition, 2023.
- 2. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications, 3<sup>rd</sup> Edition, 2009.
- 3. J. G. Henry and G. W. Heinke, "Environmental Sciences and Engineering", Prentice hall of India Private limited, 2<sup>nd</sup> Edition 2007.
- 4. G.R.Chatwa1, "A Text Book of Environmental Studies" Himalaya Publishing House, 1<sup>st</sup> edition, 2004.
- 5. G. M. Masters and W. P. Ela, "Introduction to Environmental Engineering and Science, Prentice hall of India Private limited, 3<sup>rd</sup> Edition, 2008.



# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR COLLEGE OF ENGINEERING (AUTONOMOUS) KALIKIRI-517234, ANNAMAYYA (Dt)., A.P., INDIA. B.TECH -FOOD TECHNOLOGY (II B. Tech II Semester )

**Course Code** Т Р С L **Managerial Economics and Financial Analysis** 23A52402a 0 2 2 0 Semester II B. Tech II Semester Common to CE, EEE, CSE, ECE & FT **Course Objectives:** To inculcate the basic knowledge of microeconomics and financial accounting ٠ To make the students learn how demand is estimated for different products, input-output ٠ relationship for optimizing production and cost • To Know the Various types of market structure and pricing methods and strategy To give an overview on investment appraisal methods to promote the students to learn how to ٠ plan long-term investment decisions. To provide fundamental skills on accounting and to explain the process of preparing ٠ financial statements. Course Outcomes (CO): Student will be able to • Define the concepts related to Managerial Economics, financial accounting and management(L2) Understand the fundamentals of Economics viz., Demand, Production, cost, • revenue and markets (L2) Apply the Concept of Production cost and revenues for effective Business decision (L3) • • Analyze how to invest their capital and maximize returns (L4) Evaluate the capital budgeting techniques. (L5) ٠ Develop the accounting statements and evaluate the financial performance of business entity (L5) UNIT - I MANAGERIAL ECONOMICS Introduction – Nature, meaning, significance, functions, and advantages. Demand-Concept, Function, Law of Demand - Demand Elasticity- Types - Measurement. Demand Forecasting- Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management PRODUCTION AND COST ANALYSIS UNIT - II Introduction - Nature, meaning, significance, functions and advantages. Production Function Least- cost combination- Short run and long run Production Function- Iso-quant's and Iso-costs, Cost & Break-Even Analysis - Cost concepts and Cost behavior- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems). **UNIT - III** 

# **BUSINESS ORGANIZATIONS AND MARKETS**

Introduction – Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public

Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition– Oligopoly-Price-Output Determination - Pricing Methods and Strategies

# UNIT - IV CAPITAL BUDGETING

Introduction – Nature, meaning, significance. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals, Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems)

# UNIT - V FINANCIAL ACCOUNTING AND ANALYSIS

Introduction – Concepts and Conventions- Double-Entry Bookkeeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Introduction to Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

# Learning Resources:

**Textbooks:** 

- 1. Varshney & Maheswari: Managerial Economics, Sultan Chand.
- 2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH.

# **Reference Books:**

- 1. Ahuja Hl Managerial economics Schand.
- 2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International.
- 3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
- 4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage.



# COLLEGE OF ENGINEERING (AUTONOUMS) KALIKIRI-517234, ANNAMAYYA (Dt)., A.P., INDIA. B. TECH. II Year II Semester

Course Code		L	Т	Р	С
23A52402c	BUSINESS ENVIRONMENT	2	0	0	2
Semester	II B. Tech II Semester Common to CE, EEE, CSE, EC	E &	FT		I
Course Object	tives:				
• To	make the student to understand about the business environment				
• To	<ul> <li>To enable them in knowing the importance of fiscal and monitory policy</li> </ul>				
• To facilitate them in understanding the export policy of the country					
• To	Impart knowledge about the functioning and role of WTO				
• To	Encourage the student in knowing the structure of stock markets				
Course Outcom	es (CO): Student will be able to				
Det	ine Business Environment and its Importance. (L2)				
• Un	derstand various types of business environment. (L2)				
• Ap	bly the knowledge of Money markets in future investment (L3)				
• And	alyze India's Trade Policy (L4)				
• Eva	luate fiscal and monitory policy (L5)				
• De	velop a personal synthesis and approach for identifying business				
opp	ortunities (L5)				
UNIT - I	OVERVIEW OF BUSINESS ENVIRONMENT				
Introduction -	meaning Nature, Scope, significance, functions and advantages	. Typ	es- I	ntern	al
&External, Mie	cro and Macro. Competitive structure of industries -Environmental and	alysis	- adva	antag	es
& limitations o	f environmental analysis.	U		0	
UNIT - II	FISCAL & MONETARY POLICY				
Introduction –	Nature, meaning, significance, functions and advantages. Public R Evaluation of recent fiscal policy of COL Highlights of Budget.	Reven	ues -	Publ	lic
Demand and Si	uply of Money – RBL-Objectives of monetary and credit policy - Rece	ont tre	onds_	Role	of
Finance Commission					
UNIT - III	INDIA'S TRADE POLICY				
Introduction – Nature, meaning, significance, functions and advantages. Magnitude and direction of					
Indian International Trade - Bilateral and Multilateral Trade Agreements - EXIM policy and role of					
EXIM bank -Balance of Payments– Structure & Major components - Causes for Disequilibrium in					
Balance of Pay	ments - Correction measures.				
<u> </u>					

UNIT - IV	WORLD TRADE ORGANIZATION
Introduction –	Nature, Significance, Functions And Advantages. Organization And Structure - Role
And Functions	Of WTO In Promoting World Trade - GATT -Agreements In The Uruguay Round -
TRIPS, TRIM	S - Disputes Settlement Mechanism - Dumping And Anti-Dumping Measures.
Unit - V	MONEY MARKETS AND CAPITAL MARKETS
Introduction –	Nature, meaning, significance, functions and advantages. Features and components of
Indian financia	l systems - Objectives, features and structure of money markets and capital markets -
Reforms and r	ecent development – SEBI – Stock Exchanges- Investor protection and role of SEBI,
Introduction to	international finance.
Learning Res	ources:
Textbooks:	
1. Francis	Cherunilam, International Business: Text and Cases, Prentice Hall of India.
2. K. Asw	athappa, Essentials of Business Environment: Texts and Cases & Exercises 13th
Revised	Edition.HPH
Reference Bool	۲S:
1. K. V.	Sivayya, V. B. M Das, Indian Industrial Economy, Sultan Chand
Publish	iers, New Delhi, India.
2. Sundar	am, Black, International Business Environment Text and Cases, Prentice
Hall of	India, New Delhi, India.
3. Chari.	S. N, International Business, Wiley India.
4. E. Bha	ttacharya, International Business, Excel Publications, New Delhi.



# KALIKIRI-517234, ANNAMAYYA (Dt)., A.P., INDIA. B. TECH. II Year II Semester

Course Code	L	Т	Р	С	
23A52402b	2	0	0	2	
Semester II B. Tech II Semester Common to CE, EEE, CSE, ECE & FT			_		
Course Objectives:	Course Objectives:				
<ul> <li>To enable student's comprehension of organizational behavior</li> </ul>					
To offer knowledge to students on self-motivation, leadership and manage	emen	t			
<ul> <li>To facilitate them to become powerful leaders</li> </ul>					
<ul> <li>To Impart knowledge about group dynamics</li> </ul>					
To make them understand the importance of change and development					
<b>Course Outcomes (CO):</b> Student will be able to					
• Define the Organizational Behaviour, its nature and scope. (L2)					
• Understand the nature and concept of Organizational behaviour (L2)					
• Apply theories of motivation to analyse the performance problems (L3)					
• Analyse the different theories of leadership (L4)					
• Evaluate group dynamics (L5)					
• Develop as powerful leader (L5)					
UNIT - I INTRODUCTION TO ORGANIZATIONAL BEHAVIOUR					
Meaning, definition, nature, scope and functions - Organizing Process – Making orga	nizin	g eff	ective	- ć	
Understanding Individual Behavior – Attitude - Perception - Learning – Personality.		0			
UNIT - II MOTIVATION AND LEADING					
Theories of Motivation- Maslow's Hierarchy of Needs - Hertzberg's Two Factor T	heory	v - V	room	's	
theory of expectancy – Mc Cleland's theory of needs–Mc Gregor's theory X and th equity theory.	leory	′Y− A	Adam	'S	
1 5 - 5					
UNIT - III ORGANIZATIONAL CULTURE					
Introduction – Meaning, scope, definition, Nature - Organizational Climate - Leadership - Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of good Leader - Conflict Management -Evaluating Leader.					
JNIT - IV GROUP DYNAMICS					
Introduction – Meaning, scope, definition, Nature- Types of groups - Determinants of	grou	p Beh	avio	ır -	
Group process – Group Development - Group norms - Group cohesiveness - Small Groups - Group					
decision making - Team building - Conflict in the organization– Conflict resolution	decision making - Team building - Conflict in the organization – Conflict resolution				
UNIT - V ORGANIZATIONAL CHANGE AND DEVELOPMENT					

Introduction –Nature, Meaning, scope, definition and functions- Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization's change and development

# **Learning Resources:**

Textbooks:

- 3. Luthans, Fred, OrganisationalBehaviour, McGraw-Hill, 12 Th edition
- 4. P Subba Ran, OrganisationalBehaviour, Himalya Publishing House.

# **Reference Books:**

- 1. McShane, Organizational Behaviour, TMH
- 2. Nelson, OrganisationalBehaviour, Thomson.
- 3. Robbins, P. Stephen, Timothy A. Judge, OrganisationalBehaviour, Pearson.
- 4. Aswathappa, OrganisationalBehaviour, Himalaya.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR COLLEGE OF ENGINEERING (AUTONOMOUS) KALIKIRI-517234, ANNAMAYYA (Dt)., A.P., INDIA. B.TECH -FOOD TECHNOLOGY (II B. Tech II Semester )

# JNTUACEK(A) R23 Regulations

#### **Principles of Food Engineering**

L	Т	Р	С
3	0	0	3

### **Course Objectives:**

- 1. To familiar the students to the concept of SI system and the conversion from one system to another.
- 2. To familiar the students to the theory and application of basic engineering operations.
- 3. To familiar the students to the thermodynamic properties of the atmospheric air and its application to the drying and air conditioning processes.

#### **Course Outcomes:**

COs	Statement	Blooms Level
CO1	Students will be able to apply the principles of mass and energy balance to food processing systems.	L3
CO2	Students will be able to determine heat loads and heat losses in heating and cooling food process systems.	L4
CO3	The students will be able to use psychometric charts to analyze the thermodynamic properties of the atmospheric air and its applications in drying, humidification etc	L4
CO4	Students will be to solve the problems related to material and energy balances, freezing, evaporation, drying etc. used in the food processing.	L3
CO5	Students will be able to understand the Measurement & Control of Process in food industry	L2

# 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 - II

Introduction to engineering properties of food and biomaterials, structure and chemical composition of foods, physical properties (size, shape, surface area, volume, density, sphericity, porosity, specific gravity). Properties of powdery materials. Moisture in food and biological materials, water activity, food stability, sorption and desorption isotherms. Mechanical properties (strain and stress), theological

properties (viscosity, elasticity, visco-elasticity), textural properties.

### UNIT - III

Frictional properties of food materials (angle of repose, coefficient of friction, rolling resistance), aero and hydrodynamic characteristics, optical properties, electrical and dielectric properties. 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. Humidity: Humidity & Relative Humidity, Saturation Humidity, Percentage Humidity, Psychometric chart – UtiliZation, problems; Humidifiers & Dehumidifiers; Applications.

#### UNIT - IV

Material balance and Energy balance in various unit operations – Problems, significance in food processing. 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.

#### 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).

#### **Text books**

- 1. D. G. Rao, "Fundamentals of food engineering", Prentice-Hall of India, New Delhi, 2010.
- Warren L. McCabe, Julian Smith, Peter Harriott. 2004. Unit Operations of Chemical Engineering, 7th Ed. McGraw-Hill, Inc., NY, USA.
- 3. A Textbook of refrigeration and air conditioning. R.S Khurmi and J K Gupta

#### **Reference books**

- 1. P. K. Nag. 2005. Engineering Thermodynamics, 3rd Ed. Tata-McGraw-Hill Education, New Delhi.
- 2. J. M. Smith, H. C. Van Ness and M. M. Abbott. 2005. Introduction to Chemical Engineering

Thermodynamics, 7th Ed. McGraw-Hill, Inc., NY, USA.

3. Christie John Geankoplis. 2003. Transport Processes and Separation Process Principles (Includes Unit Operations), 4th Ed. Prentice-Hall, NY, USA.



# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR COLLEGE OF ENGINEERING (AUTONOMOUS) KALIKIRI-517234, ANNAMAYYA (Dt)., A.P., INDIA. B.TECH -FOOD TECHNOLOGY (II B. Tech II Semester )

Food Microbiology and Food Safety

L	Т	Р	С
3	0	0	3

### **Course objectives**

- 1. To learn the structure and reproduction of various microbes
- 2. To learn the isolation, cultivation, and preservation of microbes
- 3. To understand the role of microbes in spoilage of various food products
- 4. To understand the role of pathogens in food-borne diseases
- 5. To identify the microbes associated with fermentation

Course outcomes: On successful completion of the subject, the students will be able to

COs	Course outcomes	Bloom
		level
CO1	To understand the field of food microbiology	L1, L2
CO2	Describe the ways for enumeration of microbes and methods of preserving food	L1, L2
CO3	Determine genera of the microbes associated with food spoilage	L4
CO4	To categorize the food-borne illnesses. and Food allergens	L4, L5
CO5	To determine the microbiology of fermented foods	L4

### **Unit-I Introduction to Microbiology**

History of Microbiology, Terminology used in Microbiology, Classification of microbes (morphology and reproduction of bacteria, fungi, yeast, algae, protozoans and virus) Introduction to food microbiology, History, Development and scope of food microbiology, Microorganisms in food. Microscopy Techniques (Simple, compound, Dark filed microscope, phase contrast, Electron microscope-SEM and TEM).

### Unit-II Cultivation and enumeration of microbes

Components of culture media, Types of media, Growth of bacteria, Growth kinetics. Factors affecting microbial growth and survival in food (extrinsic and intrinsic). Isolation and enumeration of microbes in food (direct microscopic count electronic enumeration of cell numbers, plate count method and membrane filter count, Turbidometric methods, determination of nitrogen content, determination of dry weight of cells). Preservation of microbes.

# Unit-III Introduction to food spoilage and preservation

Microbial spoilage- Spoilage and its types, factors responsible for the spoilage, chemical changes in food due to spoilage, causative agents and process of spoilage in fruits, vegetables, dairy products, meat, sea foods and miscellaneous products. Methods for controlling the spoilage of the food. Preservation of food (Physical, chemical and biological)

### **Unit-IV Food-borne diseases and Food allergens**

Types- Food-borne illnesses and Foodborne intoxication. Organism, occurrence, incubation period, symptoms and prevention of food poisoning or foodborne intoxication (Botulism, Staphylococcus), Food borne illnesses (Campylobacteriosis, Shigellosis, Giardiasis, Yersiniosis, Listeriosis, Cholera, Gastroenteritis, botulism) Food borne viruses (Hepatitis A&B, norovirus, poliovirus, Spongiform encephalopathy) and preventive measures. Food allergens: causes and symptoms

### **Unit V Microbiology of fermented foods**

Definition and Types of fermentation, Microorganisms used in Food fermentation. Probiotics: importance, role in fermented foods, organisms involved, beneficial effects. lactic fermentation in food, Starter cultures for food fermentation, Fermented milk and milk products, Fermented beverages, microbial production of enzymes (Amylases, proteases, microbial production of vitamins (B12), production of single cell proteins from bacteria, Mushroom production – history – types of mushroom – edible mushroom – spawn production – cultivation.

Food safety: Definition, Types of hazards, biological, chemical, physical hazards, Factors affecting Food Safety, Importance of Safe Foods, Good Manufacturing Practices.

### Textbooks

- 1. Gerard J. Tortora, Berdell R. Funke, Christine L. Case. 2014. Microbiology: An Introduction, 12th Ed. Prentice-Hall, NY, USA.
- 2. Johanne M. Willey, Linda M. Sherwood and Christopher J. Woolverton. 2013. Prescott's Microbiology, 9th Ed. McGraw-Hill Higher Education, NY, USA
- 3. Michael J. Pelczar Jr., E. C. S. Chan and Noel R. Krieg. 1998. Microbiology, 5th Ed. Tata McGraw-Hill Education, New Delhi.
- 4. Banwart, G.J, "Basic Food Microbiology" Van No Strand Reinhold Publishers, New York 1989.
- 5. Jay, J.M., "Modern Food Microbiology". CBS Publishers & Distributors, New Delhi 2000.
- 6. S.C. Prescott and C.G. Dunn, "Industrial Microbiology Agrobios (India)", 1st Edition, 2007.
- 7. A. H. Patel, "Industrial Microbiology", 2nd Edition, McMillan India Ltd., 2009.

# **Reference books**

1. Fundamentals of Food Microbiology by Bibek Ray and Arun Bhunia

2. Food Microbiology: Fundamentals and Frontiers, Third Edition, ASM Press Doyle, M. P. and Beuchat, L. R. 2007.

3. Food microbiology: fundamentals and frontiers. 2nd ed. Washington (DC): American Society for Microbiology. *MP*, *Beuchat LR*, *Montville TJ*, *editors*. 2001.

4. Food Microbiology: An introduction. 4th edition, ASM Press. Matthews KR, Kniel KE, and Montville TJ. 2017.

5. Microbiology: An Introduction. 9th edition. Pearson Education. Tortora GJ, Funke BR, and Case CL. (2008).



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR COLLEGE OF ENGINEERING (AUTONOMOUS)

# KALIKIRI-517234, ANNAMAYYA (Dt)., A.P., INDIA. B.TECH -FOOD TECHNOLOGY (II B. Tech II Semester )

### Processing of Fruits, Vegetables, Spices and Plantation crops

### **Course Objectives**

L	Т	Р	С
3	0	0	3

**1.** At the end of this course the students get an outline about various methods intended for preserving fruits and vegetables.

2. Different operations inferred in processing fruits and vegetables

**3.** Technology behind intermediate moisture and minimally processed fruit and vegetables.

# **Course Outcomes (CO):**

COs	Statement	Blooms Level
CO1	Students can be able to train in the field of Fruit and Vegetable Processing and enable the students to learn different preservation techniques to avoid post-harvest losses in the agriculture field.	L3
CO2	Learn processing of fruits & vegetables - different preservation techniques to improve the shelf life of seasonal fruits.	L4
CO3	Students can be able to understand the history of spices, uses of spices, classification of processed spices according to marketing standards, packaging and different grades.	L2
CO4	Student can be able to understand various processing techniques for primary and secondary products from spices & plantation crops	L2
CO5	Student can be able to understand flavor development during processing of spices and plantation crops	L2

### **UNIT – I Fruit and Vegetables Processing**

Pack house operations including methods to reduce the post-harvest losses, Precooling, In-house packing, cold storage etc. **Canning of fruits and vegetables:** Canning unit operations and machinery, precautions in canning, Spoilage of canned foods. **Blanching:** Method and its Importance, Preservation by hurdle technology.

# UNIT – II Fruit and Vegetables Products

Processing of Osmotic products like Jams, Jellies, Marmalades, Fruit Bars, fruit Candies, Preserves, Crystallized fruit, Pickling process and its types, Processing of Fruit based beverages, Fruit Powders and different techniques involved in it. **Fruit juice concentrates:** Methods of concentration, aroma recovery. Products from Jamun, Tamarind, Jackfruit, Tomato, Potato and Mushroom.

### UNIT - III Plantation crops & Food colorants

Primary and secondary processing of Coffee, Tea, Cocoa, Cashew nut, Areca nut & Vanilla, Occurrence, chemistry of constituents; harvesting; types, grades, Value added products.

**Food Colors:** classification of the food colours (natural, synthetic etc.) Extraction techniques, chemistry and sources (Red beet, Safflower, blue grapes, Red chilies, Turmeric, Annatto etc) of natural colorants like Anthocyanins, betalanines, carotenoids, paprika, curcumin etc., Food application and Stability studies of flavoring & colorants.

### UNIT - IV Spices

**Spices:** Classification of Spices, Primary and secondary processing of spices like Pepper, Ginger, Turmeric, Cardamom, Chilies, Cinnamon, Coriander, Saffron, principal constituents, production.

**Quality control;** fumigation and irradiation and Sterilization of spices, Adulteration and detection of adulteration in spices.

**Essential oil & Oleoresins:** Different methods of extraction, distillation, solvent extraction, Advanced extraction methods Cryogenic extraction, supercritical fluid extraction.

# UNIT - V Herbs

**Herbs:** Classification of herbs, Processing, types of Mint, Coriander, Curry leaves, Rosemary, Basil, Oregano, Thyme, application areas, health benefits.

### Textbooks

1. A.K. Thompson., Fruit and Vegetables: Harvesting, Handling and Storage, Blackwell publishing, 2003.

2. Pandey, P. H, Saroj Prakasam "Post-Harvest Engineering of Horticultural Crops through Objectives" Allahabad 2002

3. 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, 1998.

4. ASTA, "Official analytical methods of the American Spice Trade Association", Fourth Edition 1997.

5. R.P. Srivastava & Sanjeev Kumar., Fruit and Vegetable Preservation, 3rd revised & enlarged

edition, IBDC, 2010.

6. Mathew attakaran, Natural food flavours & colorants by wiley - black well, IFT press, 2017.

7. HANDBOOK OF FOOD ANALYTICAL CHEMISTRY PIGMENTS, COLORANTS, FLAVORS, COMPONENTS, TEXTURE, AND BIOACTIVE FOOD, Edited by

Ronald E. Wrolstad, Terry E. Acree, Eric A. Decker, Michael H. Penner, David S. Reid, Steven J. Schwartz, Charles F. Shoemaker, Denise Smith, Peter Sporns by wiley interscience publications.

### **Reference books**

1. Pruthi J S, "Quality Assurance in Spices and Spice Products – Modern Methods of Analysis" Allied Publishers Limited, New Delhi, 1999.

2. Banerjee B, "Tea Production and Processing", Oxford University Press, 2002.

3. Minifie BW. "Chocolate, Cocoa and Confectionery Technology" 3rd Edition, Aspen Publishers, 1999.

4. D.K. Salunkhe & S.S. Kadam., Handbook of Fruit Science and Technology: Production,

Composition, Storage and Processing, 1st Edition, CRC Press, 2013.

5. J. W. Parry., Spices: Morphology, History, Chemistry, Volume II, 2nd Edition, Chemical

Publishing Co., New York 1969.



# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR COLLEGE OF ENGINEERING (AUTONOMOUS) KALIKIRI-517234, ANNAMAYYA (Dt)., A.P., INDIA. B.TECH -FOOD TECHNOLOGY (II B. Tech II Semester )

L	Т	Р	С
3	0	0	3

### Heat and Mass Transfer

### **Course Objectives:**

- For understanding of various modes of heat transfer, mechanisms of boiling and condensation which are involved in food processing operations.
- Understanding of unsteady and steady state heat transfer in food processing.
- To design heat exchangers for a given heat load used in food industry.
- To understand concepts of steady and unsteady mass transfer in food processing operations.
- To understand unit operations like Distillation, absorption, Crystallization in Food processing.

### **Course Outcomes:**

COs	Statement	Blooms Level
CO1	Students are able to interpret the principle of conduction and convection heat transfer in food processing.	L4
CO2	Students can describe the principle of radiation heat transfer.	L2
CO3	Students can execute the knowledge of heat transfer to design heat exchanger	L3
CO4	Learn mass transfer through various bodies and their application	L3
CO5	Understand steady state and unsteady state mass transfer	L2

### UNIT I

Introduction: Basic modes of heat transfer. Conduction heat transfer Modes of heat transfer, Steady state unidirectional heat transfer with and without internal heat generation through slab, cylinder, spheres and composite geometries; insulation and its purposes, critical thickness of insulation for cylinders and spheres, Unsteady state heat transfer in simple geometry; Use of Heisler charts, Gaussian error function to solve transient heat transfer problems.

# UNIT II

### **B.Tech-FDT**

Convection Heat Transfer 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. Boiling and condensation Boiling phenomenon, hysteresis in boiling curve, nucleate and forced convection boiling; condensation phenomenon, condensation on vertical surface, outside a tube and inside horizontal tube.

### UNIT III

Radiation heat transfer Characteristics of black, grey and real bodies in relation to thermal radiation, Stefan Boltzmann law; Kirchhoff's law; Wein displacement law, Emissive power for a black body and real body, intensity of radiation, radiation between two bodies. Heat Exchanger Classification, overall heat transfer coefficient, fouling factors, log mean temperature difference (LMTD) for parallel and counter flow heat exchangers, effectiveness of parallel and counter flow heat exchanger by NTU method, Types of heat exchangers: shell and tube heat exchanger, plate type heat exchanger, Scraped Surface Heat Exchanger, NTU, Fins in heat exchangers. Selection of heat exchangers for the food industry.

### UNIT IV

Mass Transfer Introduction to mass transfer, different modes of mass transfer, Mass flux and molar flux for a binary system, Fick's law of diffusion of mass transfer, Derivation of general diffusion mass transfer equation.

#### UNIT V

Molecular diffusion in gases, liquids and solids having steady state equimolar counter diffusion and through non diffusing body. Steady state equimolar counter diffusion, convective mass transfer coefficient, natural and forced convective mass transfer, dimensional analysis for free and forced convective mass transfer, important correlations of convective mass transfer; permeability of films and laminates. Unsteady state diffusion in slabs, cylinders and spheres, transient mass transfer in semi-infinite medium.

#### **Text books**

- 1. Heat Transfer, by Holman, J.P., 8th Ed., McGraw-Hill, New York.
- 2. Heat Transfer, by A.J.Chapman, Maxwell Macmillan, 1984.
- 3. Unit Operation of Chemical Engineering by Mc Cabe, Smith & Harriot, McGraw Hill Inc.
- 4. Chemical Engineering (Vol. I & II) by Coulson, J. M. & Richardson, J. F.

#### **Reference books**

- 1. Process Heat Transfer, by Hewitt, G.F., Shires, G.L. and Bott, T.R., CRC Press, 1994.
- 2. Fundamentals of Engg. Heat & Mass Transfer by R.C. Sachdeva New Age

# B.Tech-FDT

- 3. Fundamental of Heat and Mass Transfer by G.K. Roy Khanna Pub
- 4. Transport Processes and Unit Operations by Geankoplish,
- 5. Introduction to Chemical Engineering by Badger, W. L. & Bachero, J. T.
- 6. Chemical Engineering Handbook by Perry, A. S. and Wenzel, L. A.



# COLLEGE OF ENGINEERING (AUTONOMOUS) KALIKIRI-517234, ANNAMAYYA (Dt)., A.P., INDIA. B.TECH -FOOD TECHNOLOGY (II B. Tech II Semester )

### Food Microbiology and Food safety lab

L	Т	Р	С
0	0	3	1.5

### **Course objectives**

1. Methods of isolating and characterizing various microbes associated with foods

2. Using various microbiological techniques for the study of foods.

Course outcomes: By the end of the course, the students will be able to

COs	Course outcomes	Blooms level
CO1	To familiarise the laboratory equipment	L1, L2
CO2	To isolate pure culture and preserve it.	L3
CO3	Operate microscope and use it for detection of microbes.	L3
CO4	Isolate, identify and enumerate microbes in food.	L4
CO5	Detect the presence of extracellular enzymes producing the microbes.	L4

# List of experiments

1. Laboratory safety rules and precautions

2. Familiarization with Instruments used in Microbiological Lab, their principles and working: Microscope, Autoclave, Laminar Flow Bench, Hot air Oven, Incubator, BOD incubator, Centrifuge, pH meter,

3. Preparation of media –broth, slant and Agar; and sterilization of culture media

- 4. Screening and isolation of microbes from Milk, groundnut and bread
- 5. Isolation of pure culture by serial dilution-pour plate, spread plate, streak plate method
- 6. Microbial Staining Techniques

(i) Simple direct staining technique (ii) Differential staining technique-Gram staining technique

7. Biochemical tests for the identifying of the microbes IMViC Tests: Indole, Methyl red, Vogus Prausker, Citrate utilization test.

- 8. Screening of extracellular enzymes producing microbes.
- 9. Determination of coliforms from water by MPN method (MPN).
- 10. Detection of salmonella from food samples.
- 11. Microbiological quality of milk.

# B.Tech-FDT

12. Single cell protein production – yeast & spirillunia

13. Starter activity of baker's yeast/mushroom production

### Textbooks

1. Harrigan, W.F. "Laboratory Methods in Food Microbiology" Academic Press, 2011

2. Practical Food Microbiology 1 January 2003 Print ISBN:9781405100755 |Online ISBN:9780470757512 DOI:10.1002/9780470757512.

3. Food Microbiology And Laboratory Practice by Anthony P Williams Chris Bell, Paul Neaves (Author).

### **Reference books**

1. Practical Book Food Microbiology - Food Microbiology, Kamlesh Kumar Meena, Narendra Kumar Jain, Dinesh Kumawat.

2. Food Microbiology: Basic and Applied With Laboratory Exercises Hardcover Rita Narayanan &

B.Dhanalakshmi.

3. Laboratory Manual of Food Microbiology, Neelima Garg, K. L. Garg, K. G. Mukerji



# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR COLLEGE OF ENGINEERING (AUTONOMOUS) KALIKIRI-517234, ANNAMAYYA (Dt)., A.P., INDIA. B.TECH -FOOD TECHNOLOGY (II B. Tech II Semester )

Processing of Fruits, Vegetables, Spices and Plantation Crops Lab

L	Т	Р	С
0	0	3	1.5

### **Course Objectives:**

**1.** Working on preservation techniques of spices, fruits and vegetables and each operations importance.

# **Course Outcomes COs:**

COs	Statement	Bloom Level
CO1	Able to develop different processed products	L2
CO2	Able to know standard formulation to meet the standards	L2
CO3	Able to standardize formulation of products	L2
CO4	Able to extract the bioactive components	L3
CO5	Development of byproduct from waste	L4

# List of Experiments

- 1. Drying of fruit, vegetables, spices and herbs for preparation of Soup powders, dried products.
- 2. Estimation of Moisture and volatile oil content of spices.
- 3. Pectin determination in fruits and vegetable products.
- 4. Preparation of pickles, chutneys.
- 5. Preparation of fruit juices e.g. lemon, grapes, orange, pineapple, mango etc.
- 6. Extraction of Pectin (identification pectin rich foods, chemistry and interaction of pectin with other components)
- 7. Canning of fruits and vegetables.
- 8. Preparation of spice powder and curry powder, masalas.
- 9. Preparation of Syrup, Squash, Crush.
- 10. Identification and characterization of flavoring compounds of spices.

- 11. Preparation of tutti-frutti
- 12. Preparation of jams and jellies, marmalade (knowledge on selection of fruits)
- 13. Preparation of tomato products (ketchup, sauce)
- 14. Visit to a Canning Plant
- 15. Visit to Fruits and Vegetable processing industries; processing of Mushrooms.

# **Online Learning Resources/Virtual Labs:**

- 1. http://vmt-iitg.vlabs.ac.in/Binary\_vapour\_liquid\_equilibrum(theory).html
- 2. http://vmt-iitg.vlabs.ac.in/Rotary\_dryer(theory).html
- 3. http://vmt-iitg.vlabs.ac.in/Forced\_draft\_tray\_dryer(theory).htm

4.http://ceiitb.vlabs.ac.in/exp8/Aim.html?domain=Chemical%20Engineering&lab=Chemical%20Engineering %20Lab

5. https://vlab.amrita.edu/?sub=1&brch=194&sim=802&cnt=1

https://vlab.amrita.edu/?sub=1&brch=194&sim=354&cnt=1



# COLLEGE OF ENGINEERING (AUTONOMOUS) KALIKIRI-517234, ANNAMAYYA (Dt)., A.P., INDIA. B.TECH -FOOD TECHNOLOGY (II B. Tech II Semester )

Heat and Mass Transfer Lab

L	Т	Р	С
0	0	3	1.5

### **Course Objectives:**

- The theory of heat transfer mechanisms during the heating/cooling of bio-materials.
- The concepts of unsteady heat transfer for determination of process time and temperature profiles in various geometries of the biomaterials.
- Designing calculations for various types of heat exchangers and their comparison in terms of effectiveness.
- The concepts of steady and unsteady mass transfer operations in practical form.

Course Outcomes: On successful completion of the subject, the students will be able to

- 1. Demonstrate the different modes of heat transfer in various processing operations.
- 2. Experiment to calculate various parameter in steady state heat transfer,
- 3. Demonstrate to the examine rate of heat transfer and effectiveness for the various heat transferring equipments like heat exchangers, HTST pasteurizer etc
- 4. Experiment the application of mass transfer in various processing operations
- 5. Conclude the findings of experiments

### **List of Practicals:**

- 1. To determine coil side overall heat transfer coefficient (h) for different agitation speeds in given agitation vessel.
- 2. To find out the heat transfer coefficient of vertical cylinder in natural convection.
- 3. To find the surface heat transfer coefficient for a pipe flowing heat by forced convection to air flowing through it, for different air flow rate and heat flow rate.
- 4. To determine the total thermal resistance and thermal conductivity of composite wall.
- 5. To find out the Stefan Boltzmann Constant.
- 6. To find out the emissivity of a test plate.
- 7. To study the heat transfer in shell and tube heat exchanger.
- 8. To determine the overall efficiency of single and multiple effect evaporator

- 9. To study the extraction of benzoic acid from toluene (dispersed phase) by water (continuous phase) using packed bed
- 10. To study the effect of various parameters like solvent rate and particle size on the percentage of recovery of oil from seeds for Solid-liquid extraction in a Packed Bed Type.
- 11. To study the performance of packed bed during absorption process
- 12. To determine the conductivity of unknown solution.
- 13. Determination of the diffusion coefficient of an organic vapour (e.g. CCl4) in air.
- 14. To study operation of Sieve Plate Distillation Column.
- 15. Study of heat and mass transfer in water cooling tower for different flow and thermodynamic conditions.
- 16. To calculate the mass transfer coefficient for vaporization of naphthalene in air using a packed bed of spherical particles of naphthalene
- 17. To determine the liquid diffusion co-efficient of NaCl solution in distilled / de-ionized water
- 18. To study the characteristics of steam distillation using turpentine oil as a feed stock.

### **Text books**

- 1. D. G. Rao, "Fundamentals of food engineering", Prentice-Hall of India, New Delhi, 2010.
- 2. Unit operations in food processing by 2n edition by R L Earle

### **Reference book**

- 1. Christie John Geankoplis. 2003. Transport Processes and Separation Process Principles (Includes Unit Operations), 4th Ed. Prentice-Hall, NY, USA.
- J. M. Smith, H. C. Van Ness and M. M. Abbott. 2005. Introduction to Chemical Engineering Thermodynamics, 7th Ed. McGraw-Hill, Inc., NY, USA.



# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR COLLEGE OF ENGINEERING (AUTONOMOUS) KALIKIRI-517234, ANNAMAYYA (Dt)., A.P., INDIA. B.TECH -FOOD TECHNOLOGY (II B. Tech II Semester )

**Extrusion processing** 

L	Т	Р	С
0	0	0	1.5

### **Course Objectives**

To impart knowledge to the students about extrusion technology, principle of working, classification of extruders according to process and construction, extruded products and their processing.

### **Course Outcomes:**

By the end of the course, the students will

Learn different methods of extruders in the food industry, factors affecting the extrusion process.

Develop practical skills in Flour properties for extrusion, counter rotating and co-rotating twin

screw extruder.

### UNIT I

Extrusion: definition, introduction to extruders, principles and types, Uses of extruders in the food Industry. Preconditioning of raw materials used in extrusion process, Extruder Selection, Design, and Operation for Different Food Applications.

Single screw extruder: Principle of working, Net Flow, Operations, manufacturing of pasta and vermicelli. Twin screw extruder: counter rotating and co-rotating twin screw extruder, Process characteristics of the twin screw extruder, Advantages of Twin Screw Extruder.

### UNIT II

Breakfast cereals by extrusion technology: Classification of Breakfast cereals: Raw materials, process and quality testing for Ready to eat breakfast cereals.

Texturized vegetable protein: Definition, Manufacturing process, types and quality parameters of TVP. Recent Advances in extrusion technology: Carbon dioxide or Nitrogen assisted extrusion technology, Extrusion in confectionery technology, pet food application, Non-thermal Extrusion of Protein Products.

# **List of Practicals**

- 1. Types of extruders, application in different food sectors (sketches of extruders, parts, figure of different extruded products, including pet foods)
- 2. Physical properties of extruded foods (expansion, piece density, bulk density, porosity, water absorption index, etc)
- 3. Preparation of noodles/ vermicelli (rehydration ratio, moisture, ash determination)
- 4. Preparation of extruded flake cereals (with corn, wheat, rice etc)
- 5. Determination of oil absorption capacity of extruded products (pasta, expanded products)
- 6. Determination of water absorption capacity of noodles (Wheat flour, millet flour, refined wheat flour sources)
- 7. Effect of extrusion cooking on antinutritional factors.
- 8. Studies on development of weaning food by extrusion technology (germination, drying, pre-gelatinization, drying, reconstitution)
- 9. Studies on properties of texturized vegetable protein (Water-Holding Capacity (WHC), Oil Holding Capacity (OHC), Viscosity, Bulk Density, Rehydration Capacity, Cooking Properties)
- 10. Studies on Textural Profile Analysis of extruded products (extruded snacks, confectionery products, pet foods).

### Text books

- 1. Extruded foods by S. Matza Publisher Springer
- 2. Technology of Extrusion Cooking by N.D. Frame Publisher Springer

# **References books**

- 1. Extruders in Food Application by Riaz M.N. Publisher CRC Press
- 2. Extrusion of Foods by J.M. Harper Publisher CRC Press
- 3. Advances in Food Extrusion Technology by Maskan and Altan Publisher CRC Press



# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR COLLEGE OF ENGINEERING (AUTONOMOUS) KALIKIRI-517234, ANNAMAYYA (Dt)., A.P., INDIA. B.TECH -FOOD TECHNOLOGY (II B. Tech II Semester )

Course Code	Course Code     Design Thinking for Innovation     L		T	Р	C	
23AHSS3S Pre-requisite	NIL	Semester IV	2	0	0	2
Trefquiste	1111	Schiester IV				
Course Objectives:						
The objective of th	is course is to familiarize students	s with design think	king pro	ocess a	s a	tool for
breakthrough innova	tion. It aims to equip students with des	sign thinking skills a	nd ignit	e the m	inds	to create
Innovative ideas, dev	CO:	•	Bloo	me Ι Δυ	م	
Course Outcomes (			DIUU			
Define the co	oncepts related to design thinking.			L1, l	2	
Explain the f	fundamentals of Design Thinking and	innovation		L1, I	.2	
<ul> <li>Apply the de</li> </ul>	esign thinking techniques for solving	problems in various	sectors	L3		
<ul> <li>Analyse to w</li> </ul>	vork in a multidisciplinary environme	nt		L4		
Evaluate the	value of creativity			L5		
<ul> <li>Formulate sp</li> </ul>	pecific problem statements of real tim	e issues		L3, I	.6	
UNIT - I	Introduction to Design Thinking				1	0 Hrs
Introduction to element design components. I materials in Industry	Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.					
UNIT - II	Design Thinking Process				1	0 Hrs
Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brain storming, product development Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.						
UNIT - III	Innovation				8	Hrs
Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity.						
Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.						
UNIT - IV	Product Design				8	Hrs

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies

Activity: Importance of modelling, how to set specifications, Explaining their own product design.UNIT - VDesign Thinking in Business Processes10 Hrs

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs- Design thinking for Startups-Defining and testing Business Models and Business Cases- Developing & testing prototypes

Activity: How to market our own product, About maintenance, Reliability and plan for startup.

### **Textbooks:**

1. Tim Brown, *Change by design*, Harper Bollins (2009)

2. Idris Mootee, *Design Thinking for Strategic Innovation*, 2013, John Wiley & Sons.

### **Reference Books:**

- 1. David Lee, *Design Thinking in the Classroom*, Ulysses press
- 2. Shrutin N Shetty, Design the Future, Norton Press
- 3. William Lidwell, Universal Principles of Design- Kritinaholden, Jill Butter.
- 4. Chesbrough.H, The Era of Open Innovation 2013

# **Online Learning Resources:**

https://nptel.ac.in/courses/110/106/110106124/ https://nptel.ac.in/courses/109/104/109104109/ https://swayam.gov.in/nd1\_noc19\_mg60/preview