DEPARTMENT OF FOOD TECHNOLOGY
SCHOOL OF ENGINEERING AND TECHNOLOGY

SYLLABUS

FOR

B. TECH FOOD TECHNOLOGY

(SEMESTER I – VIII)

Choice Based Credit System

[2023]

ISLAMIC UNIVERSITY OF SCIENCE AND TECHNOLOGY, KASHMIR

Vision of the Department

- To be a leader in all domains of Food Technology, through teaching, research, outreach, innovation and entrepreneurship

Mission of the Department

- To impart complete education employing advanced technology and infrastructure so as to shape the students into qualified professionals
- To develop the personality of students, instilling in them a sense of belonging and responsibility towards society
- To work for the production of trained manpower well equipped to serve both the food industry and society as a whole
- To establish integration with industry and address issues of practical importance
- To cater to the emerging needs and concerns of consumers, by providing thrust in the areas of food engineering, technology and research innovations with continuous upgradation.

Program Educational Objectives

- To produce professionals imbibing both theoretical and practical know how of food processing and related areas to serve academia, industry as well as the society.
- To disseminate the knowledge of current foods issues socially and globally, and enable the students to address them employing latest techniques in food processing.
- To provide learning opportunities in multidisciplinary fields involving chemistry, biochemistry, engineering, microbiology, biochemical and other aspects of food along with its preservation, processing, quality and packaging.
- To provide a thorough industrial exposure to students so as to enable them to be capable enough to serve in national and multinational organizations.

Program Outcomes

- On successful completion of the program
- Graduates will be able to apply knowledge of Food Science, Engineering and Mathematics.
- Graduates will be able to demonstrate identification, formulation and problem solving related to Food sector.
- Graduates will be able to generate mass awareness on the importance of safe, wholesome and nutritious foods.
- Graduates will be able to design new food products as per societal demand.
- Graduates will be in a position to apply their up-to-date knowledge practically within food industries.
- Graduates will be able to work in food industries, research organizations and academics.
- Graduates will be able to demonstrate knowledge with professional ethics.

1st Semester

Course Code	Course Title	Hours Per Week			Total Contact Hours	Credits
		L	T	P		
PHY101F	Applied Physics	3	0	0	3	3
CHM101F	Applied Chemistry	3	0	0	3	3
MTH104C	Applied Mathematics	3	0	0	3	3
EVS101F	Environmental Science	3	0	0	3	3
DFT101F	Introduction to Microbiology & Biochemistry	3	0	0	3	3
CSE101F	Introduction to Computer Programming	3	0	0	3	3
ENG101F	Communicative English	3	0	0	3	3
MEC101F	Engineering Graphics & Design	2	0	0	2	2
PHY141F	Applied Physics Laboratory	0	0	2	2	1
CHM141F	Applied Chemistry Laboratory	0	0	2	2	1
DFT141F	Introduction to Microbiology & Biochemistry Laboratory	0	0	2	2	1
CSE141F	Introduction to Computer Programming Laboratory	0	0	2	2	1
				TOTAL	**31**	**27**

2nd Semester

Course Code	Course Title	Hours Per Week			Total Contact Hours	Credits
		L	T	P		
MTH151F	Engineering Mathematics-I	3	0	0	3	3
DFT152C	Fundamentals of Food Processing and Preservation	3	0	0	3	3
DFT153C	Thermodynamics	3	0	0	3	3
DFT154C	Food Chemistry	3	0	0	3	3
DFT156C	Food Microbiology	3	0	0	3	3
DFT157C	Food Analytical Techniques	4	0	0	4	4
DFT191C	Food Chemistry Laboratory	0	0	2	2	1
DFT193C	Basic & Food Microbiology Laboratory	0	0	2	2	1
DFT194G	Manufacturing Process Laboratory	0	0	6	6	3
DFT195C	Food Analytical Techniques Laboratory	0	0	2	2	1
				TOTAL	**31**	**25**

3rd Semester

Course Code	Course Title	Hours Per Week			Total Contact Hours	Credits
		L	T	P		
MTH201F	Engineering Mathematics-II	3	0	0	3	3
DFT202C	Fluid Mechanics	3	0	0	3	3
DFT203C	Unit Operations in Food Processing	3	0	0	3	3
DFT205E	Food Plant Hygiene & Sanitation	2	0	0	2	2
DFT206C	Fruits & Vegetable Technology	3	0	0	3	3
DFT241C	Fluid Mechanics Laboratory	0	0	2	2	1
DFT242C	Unit Operations in Food Processing Laboratory	0	0	2	2	1
DFT244C	Fruits & Vegetables Technology Laboratory	0	0	2	2	1
	Elective				2	2
				TOTAL	**22**	19

4th Semester

Course Code	Course Title	Hours Per Week			Total Contact Hours	Credits
		L	T	P		
DFT251C	Mass Transfer Operations	3	0	0	3	3
ELE252G	Basic Electrical & Electronics	3	0	0	3	3
DFT256C	Dairy Processing Technology	3	0	0	3	3
DFT254C	Food Process Engineering	3	0	0	3	3
DFT255E	Food Biotechnology	2	0	0	2	2
DFT291C	Mass Transfer Operations Laboratory	0	0	2	2	1
DFT292G	Basic Electrical & Electronics Laboratory	0	0	2	2	1
DFT293C	Food Process Engineering Laboratory	0	0	2	2	1
DFT294E	Food Biotechnology Laboratory	0	0	4	4	4
Elective					**2**	**2**
				TOTAL	**26**	**23**

5th Semester

Course Code	Course Title	Hours Per Week			Total Contact Hours	Credits
		L	T	P		
DFT301C	Heat Transfer Operation	3	0	0	3	3
DFT302C	Engineering Properties of Food Materials	2	0	0	2	2
DFT307C	Milk and Milk Products Technology	2	0	0	2	2
DFT304C	Food Additives & Ingredients	2	0	0	2	2
DFT306C	Cereal, Pulses & Oil Seed Technology	3	0	0	3	3
DFT341C	Heat Transfer Operation Laboratory	0	0	2	2	1
DFT342C	Engineering Properties of food Materials Laboratory	0	0	2	2	1
DFT343C	Food Additives & Ingredients Laboratory	0	0	2	2	1
DFT347C	Milk and Milk Products Technology Laboratory	0	0	2	2	1
DFT346C	Cereal, Pulses & Oil Seed Technology Laboratory	0	0	2	2	1
	Elective				2	2
	Total				**24**	**19**

6th Semester

Course Code	Course Title	Hours Per Week			Total Contact Hours	Credits
		L	T	P		
Course Code	**Course Title**	**Hours per Week**	**Total Contact hour**	**Credits**		
DFT352C	Packaging Technology	3	0	0	3	3
ELE353G	Process Control & Instrumentation	3	0	0	3	3
DFT354C	Food Safety and Standards	3	0	0	3	3
DFT355E	Waste Management in Food Industry	2	0	0	2	2
DFT356C	Technology of Spices, Flavors and Plantation Crops	2	0	0	2	2
DFT392C	Packaging Technology Laboratory	0	0	2	2	1
ELE393G	Process Control & Instrumentation Laboratory	0	0	2	2	1
DFT394C	Technology of Spices, Flavors and Plantation Crops Laboratory	0	0	2	2	1
	Elective				2	2
				TOTAL	**21**	**18**

7th Semester

Course Code	Course Title	Hours Per Week			Total Contact Hours	Credits
		L	T	P		
DFT401C	Meat Fish & Poultry Technology	3	0	0	3	3
DFT402C	Bakery & Confectionary Technology	3	0	0	3	3
DFT406C	Post Harvest Technology of Fruits and Vegetables	3	0	0	3	3
DFT404F	Credit Seminar	2	0	0	2	1
DFT407G	Food Plant Layout and Management	3	0	0	3	3
DFT441C	Meat Fish & Poultry Technology Laboratory	0	0	2	2	1
DFT442C	Bakery & Confectionary Technology Laboratory	0	0	2	2	1
DFT444C	Advanced Instrumentation Laboratory	0	0	2	2	1
DFT445C	Post Harvest Technology of Fruits and Vegetables Laboratory	0	0	0	2	1
	TOTAL				**22**	**17**

8th Semester

Course Code	Course Title	Credits
DFT450C	In-Plant Training, Project Report, Seminar & Group Discussions	20
	Total	**20**

Semester Wise Credits

Semester	Credits
1st	27
2nd	25
3rd	19
4th	23
5th	19
6th	18
7th	17
8th	20
Total	168

List of Foundation Courses

Course Code	Course Title	Hours Per Week			Total Contact Hours	Credits
		L	T	P		
PHY101F	Applied Physics	3	0	0	3	3
CHM101F	Applied Chemistry	3	0	0	3	3
MTH104C	Applied Mathematics	3	0	0	3	3
EVS101F	Environmental Science	3	0	0	3	3
CSE101F	Introduction to Computer Programming	3	0	0	3	3
ENG101F	Communicative English	3	0	0	3	3
MEC101C	Engineering Drawing	0	0	4	4	2
PHY141F	Applied Physics Laboratory	0	0	2	2	1
CHM141F	Applied Chemistry Laboratory	0	0	2	2	1
CSE141F	Introduction to Computer Programming Laboratory	0	0	2	2	1
MTH151F	Engineering Mathematics-I	3	0	0	3	3
MTH201F	Engineering Mathematics-II	3	0	0	3	3
DFT404F	Credit Seminar	2	0	0	2	1
					Total credits	**30**

List of Core Courses

Course Code	Course Title	Hours Per Week			Total Contact Hours	Credits
		L	T	P		
DFT101F	Introduction to Microbiology & Biochemistry	3	0	0	3	3
DFT141F	Introduction to Microbiology & Biochemistry Laboratory	0	0	2	2	1
DFT152C	Fundamentals of Food Processing and Preservation	3	0	0	3	3
DFT154C	Food Chemistry	3	0	0	3	3
DFT157C	Food Analytical Techniques	4	0	0	4	4
DFT156C	Food Microbiology	3	0	0	3	3
DFT191C	Food Chemistry Laboratory	0	0	2	2	1
DFT195C	Food Analytical Techniques Laboratory	0	0	2	2	1
DFT193C	Food Microbiology Laboratory	0	0	2	2	1
DFT202C	Fluid Mechanics	3	0	0	3	3
DFT203C	Unit Operations in Food Processing	3	0	0	3	3
DFT206C	Fruits and Vegetable Technology	3	0	0	3	3
DFT241C	Fluid Mechanics Laboratory	0	0	2	2	1
DFT242C	Unit Operations in Food Processing Laboratory	0	0	2	2	1
DFT244C	Fruits and Vegetable Technology Laboratory	0	0	2	2	1
DFT251C	Mass Transfer\Operations	3	0	0	3	3
DFT256C	Dairy Processing Technology	3	0	0	3	3
DFT254C	Food Process Engineering	3	0	0	3	3
DFT291C	Mass Transfer Operations Laboratory	0	0	2	2	1
DFT293C	Food Process Engineering Laboratory	0	0	2	2	1

Course Code	Course Title	Hours Per Week			Total Contact Hours	Credits
		L	T	P		
DFT301C	Heat Transfer Operation	3	0	0	3	3
DFT302C	Engineering Properties of Food	2	0	0	2	2
DFT307C	Milk and Milk Products Technology	2	0	0	2	2
DFT304C	Food Additives & Ingredients	2	0	0	2	2
DFT356C	Technology of Spices, Flavours and Plantation Crops	2	0	0	2	2
DFT341C	Heat Transfer Operation Laboratory	0	0	2	2	1
DFT342C	Engineering Properties of Food Laboratory	0	0	2	2	1
DFT343C	Food Additives & Ingredients Laboratory	0	0	2	2	1
DFT347C	Milk and Milk Products Technology	0	0	2	2	1
DFT394C	Technology of Spices, Flavours and Plantation Crops Laboratory	0	0	2	2	1
DFT306C	Cereal, Pulses & Oil Seed Technology	3	0	0	3	3
DFT352C	Packaging Technology	3	0	0	3	3
DFT354C	Food Safety and Standards	3	0	0	3	3
DFT346C	Cereal, Pulses & Oil Seed Technology Laboratory	0	0	2	2	1
DFT392C	Packaging Technology Laboratory	0	0	2	2	1
DFT401C	Meat Fish & Poultry Technology	3	0	0	3	3
DFT402C	Bakery & Confectionary Technology	3	0	0	3	3
DFT406C	Post Harvest Technology of Fruit & Vegetable	3	0	0	3	3
DFT441C	Meat Fish & Poultry Technology Laboratory	0	0	2	2	1
DFT442C	Bakery & Confectionary Technology Laboratory	0	0	2	2	1
DFT445C	Post Harvest Technology of Fruit & Vegetable Laboratory	0	0	2	2	1
DFT444C	Advanced Instrumentation Laboratory	0	0	2	2	1
					Total Credits	**83**

List of Elective Courses (Generic)

Course Code	Course Title	Hours Per Week			Total Contact Hours	Credits
		L	T	P		
Course Code	**Course Title**	**Hours Per Week**	**Total Contact Hours**	**Credits**		
DFT194G	Manufacturing Process Laboratory	0	0	6	6	3
ELE252G	Basic Electrical & Electronics	3	0	0	3	3
ELE292G	Basic Electrical & Electronics Laboratory	0	0	2	2	1
ELE353G	Process Control & Instrumentation	3	0	0	3	3
ELE393G	Process Control & Instrumentation Laboratory	0	0	2	2	1
DFT407G	Food Plant Layout and Management	3	0	0	3	3
					Total Credits	**14**

List of Elective Courses (Discipline Centric)

Course Code	Course Title	Hours Per Week			Total Contact Hours	Credits
		L	T	P		
Course Code	**Course Title**	**Hours Per Week**	**Total Contact Hours**	**Credits**		
DFT153E	Thermodynamics	3	0	0	3	3
DFT205E	Food Plant Hygiene & Sanitation	2	0	0	2	2
DFT255E	Food Biotechnology	2	0	0	2	2
DFT294E	Food Biotechnology Laboratory	0	0	4	4	2
DFT355E	Waste Management in Food Industry	2	0	0	2	2
					Total Credits	**11**

SEMESTER-I

PHY101F APPLIED PHYSICS **CREDITS: 3-0 (3)**

COURSE OBJECTIVES

• To acquaint the students with the fundamentals of physics and its application to the disciplines of Engineering and Technology.

UNIT- I

Fluid Mechanics:

Streamline and Turbulent flow, Viscosity, Bernoulli's theorem, Euler's equation, Poiseuille's equation for the flow of liquid through a narrow tube, Stoke's law, Terminal velocity, Surface tension and its determination, Surface energy, Angle of contact, capillary rise, Excess of pressure inside a spherical surface.

UNIT- II

Material Science and Semiconductor Physics:

Classification of solids as conductors, semiconductors and insulators on the basis of bands theory, Semiconductors and its types, Qualitative description of PN-junction, Light emitting and photo diodes, Hall effect: theory and its applications.

UNIT- III

Vectors, Electrostatics and Electrodynamics:

Vectors, Vector analysis, Gradient of a scalar field, Divergence and Curl of the vector field in Cartesian coordinates only, Gauss's divergence theorem and Stokes's theorem (statement only), Overview of Coulomb's law, Gauss's law, dielectric polarization, Forces on moving charges, Biot-Savart's law, Ampere's circuital law, Faraday's Laws of electromagnetic induction.

Unit- IV:

Spectroscopy:

Laser: Introduction, characteristics of Laser, Spontaneous and stimulated emission, Einstein's Coefficients, population inversion, pumping mechanism, Types of lasers, He-Ne laser, Application of Lasers.Atomic Spectra, Zeeman Effect, Stark Effect, Pachen-Back effect, Raman Spectroscopy

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Acquire knowledge of basic electrostatics and electrodynamics and material sciences
- Understand mechanics of fluid flow
- Gain knowledge on the concepts of modern physics

Books Recommended:

1. *Griffith, D.J. Introduction to Electrodynamics, Prentice Hallof India Private Limited, New Delhi.*
2. *Jordan, C and Balmain, K.G. Electromagnetic Waves and Radiating System, Prentice Hall of Ind. Pvt. Ltd., New Delhi.*
3. *Kraus, J.D. Electrodynamics, McGraw Hill, New York.*
4. *Feynman, R.P., Leighton, R.B. & Sands, M.The Feynman Lectures on Physics Vol. I, II, III, Narosa Publishing House, New Delhi.*
5. *H.C.,Ohanian, Modern Physics, Prentice Hall of India (P) Ltd., New Delhi.*
6. *Beiser, A; Mahajan S; Choudary, S.R. Concepts of Modern Physics, McGraw Hill Education (India) Private Limited.*
7. *Takwale, R.G., Puranik, P.S. Introduction to Classical Mechanics, McGraw Hill Education (India) Private Limited.*
8. *Omar M. A., Elementary Solid-State Physics, Prentice Hall of India.*

CHM101F APPLIED CHEMISTRY **CREDITS: 3-0 (3)**

COURSE OBJECTIVES:

- To make the students conversant with thermodynamics and the concepts involved.
- To develop an understanding of chemistry pertaining to environment.
- To acquaint students with the concepts of biomolecules, their classification and development of molecular models.
- To provide the knowledge of various spectroscopic and chromatographic techniques.

Unit-I

Chemical Thermodynamics:

Introduction and Importance, First Law of Thermodynamics, Work done in Isothermal and Adiabatic Conditions. Heat capacities, Relation between Cp and Cv relations, Second Law of Thermodynamics, Concept of Entropy, Carnot engine, Gibbs free energy. Free Energy Changes as Criteria of Reversible and Irreversible process, Gibbs-Helmholtz's equation, Clausius- Clapeyron equation.

Unit-II

Environmental Chemistry:

Introduction to Environmental Chemistry, Concept and Scope of Environmental Chemistry, of the Atmosphere, Global Warming, Greenhouse effect, Acid Rain: Mechanism of Formation and Effects and Depletion of Ozone Layer, Chemistry of Water and Waste Water, Measurement of acidity, Alkalinity, Hardness, BOD, COD, and Treatment of Water for Domestic and Industrial Purpose. Toxic Chemicals in the Environment, Biochemical Effects of Arsenic, Lead, Mercury and, Pesticides.

Unit-III

Bio-Organic and Bio-Inorganic Chemistry:

Introduction, Nutrients and their classification, concept of biomolecule and bioconjugation, classification of biomolecules, design and development of molecular models of biological relevance, simple introduction towards enzyme catalysis, protein denaturation, food poisoning.

Unit-IV

Instrumental Techniques:

Introduction, Advantages and Disadvantages of Instrumental and Non-Instrumental Methods, Electromagnetic Radiation, Electromagnetic Spectrum, Light Absorption (Beers Lambert Law) UV-Vis spectroscopy (Types of Transition, Chromophores, Auxo-chromes and Applications) Infrared Spectroscopy (Modes of vibration, IR bands corresponding to different functional groups and Applications). Concept of chromatography and its types.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Better understand the engineering processes involving chemistry and their applications relevant to the discipline.

Books Recommended:

1. *.C. Kuriacose and J. Rejaraman: Chemistry in Engineering and Technology Volumes I & II(Tata McGraw Hill publishing company Limited, New Delhi)*
2. *P.C. Jain. Engineering Chemistry, (DhanpatRai& Sons, NaiSarak; New Delhi).*
3. *Physical Chemistry – Puri Sharma and Patharua.*
4. *Inorganic Chemistry (J.D. Lee).*
5. *Physical Chemistry by Peter Atkins, Juliodepaula*
6. *Electrochemistry and Corrosion Science by N.Perez*
7. *A Textbook of Organic Chemistry, V. K. Ahluwalia and MadhuriGoyal*
8. *Organic Chemistry: Stereochemistry, I. L. Finar, Pearson Education*
9. *Environmental chemistry by A. K. De, New Age International*
10. *C.V. Agarwal - Chemistry of Engineering Materials (Tata publishing Works, Varanasi)*
11. *L.A.Munro – Chemistry in Engineering (Prentice Hall, New York)*
12. *Chemistry of Engineering Materials, C.P. Murthy, C.V. Agarwal and A. Naidu BS*
13. *O.P.Vermani and A.K. Narula – Applied Chemistry Theroy and Practive, (Wiley EasternLimited, New Delhi).*
14. *R. M. E. Diamand: Applied Chemistry for Engineers, (Pitman)*
15. *Laboratory Manual on Engineering Chemistry by S.K. Bhasin and Sudha Rani, DhanpatRaiPublishing Company, New Delhi (2004).*

MTH104C APPLIED MATHEMATICS **CREDITS: 3-0 (3)**

COURSE OBJECTIVES:

- This course would cover the concepts of matrix algebra, calculus and derivatives. These concepts are important tools to solve the problems arising in the field of engineering.

UNIT-I

MATRIX THEORY 1

Algebra of matrices, types of matrices, transpose and determinant, inverse of a matrix,system of linear equations and solution by using echelon form.

Unit 2

Calculus I

Sets, relations and functions. limits, indeterminate forms and L'Hospitals rule, continuity and differentiability, methods of finding derivative, product rule and quotient rule Increasing and decreasing functions, maxima and minima, derivative tests, Rolle's theorem and Lagrange's mean value theorem (without proof).

Unit 3

CALCULUS -II

Integration as inverse of differentiation, integration of various functions by substitutionmethod, integration by parts, Evaluation of simple integrals, Definite integrals, evaluation and their properties, introduction of double and triple integrals.

Unit 4-

COMPLEX VARIABLE I

Review of complex numbers, polar representation, algebra andproperties of complex numbers, functions of complex variables, limits, continuity, differentiability.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Apply matrix algebra, calculus and derivatives as problem solving tools.

Books Recommended:

1. *James Stewart, Calculus, Early Transcedentals.*
2. *Hari Arora, A Textbook of Engineering Mathematics Vol I, II. (Calculus and Linear Algebra).*
3. *N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,Reprint, 2010.*
4. *D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.*
5. *Advanced Engineering Mathematics by Jain, R.K. and Iyengar SRK, Narosa, 200.*

EVS101F ENVIRONMENTAL SCIENCE **CREDITS: 3-0 (3)**

COURSE OBJECTIVES:

- To study the facts about environment, natural resources and their interrelationship with living organisms.
- To study the impact of global warming and pollution on the ecosystem.
- To understand the concepts of biodiversity conservation.

Unit-I

Introduction to Environmental Science:

Scope and importance. Public environmental awareness and methods of its propagation. Consumerism and green consumerism. Environmental movements (Greenbelt, Chipko and Narmada bachao andolan).

Unit-II

Introduction to Ecosystem and Ecology:

Food chain and food Web. Ecological pyramids**.** Energy flow in an ecosystem. Ecological succession: Types and its processes. Types, characteristics feature and function of following ecosystem; Lakes ecosystem, forest ecosystem, grassland ecosystem and desert ecosystem.

Unit-III

Natural resources classification and their conservation:

Growing energy needs. Use of alternate energy source. Case studies. Biodiversity: Definition, values, threats and its conservation approaches. India as a mega diversity nation. Classification of species as per IUCN. Ecological footprint and sustainability.

Unit-IV

Introduction to global climate change:

Greenhouse effect. Acid rain. Ozone layer depletion. Food security, Water conservation and Rain water harvesting. Definition, cause, effects and control measures of air pollution, water pollution, soil pollution, noise pollution and solid waste pollution. Constitutional provisions for environmental protection (Article 21, 48A, 51A (g)).

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Understand interrelationship between components of ecosystem.
- Familiarize with the approaches of biodiversity conservation.
- Gain knowledge on various types of pollution and their impact on global climate change.

Books Recommended:

1. *Ecology and Environment by P.D. Sharma (Rastogi Publications).*
2. *Environmental Studies by ErachBarucha (Oxford Publications).*
3. *Environmental Studies from Crises to Cure authored by R. Rajagopalan; Published by Oxford University Press.*
4. *Environmental Management by Oberoi.*
5. *Principles of Environmental Science: Inquiry & Applications (Special Indian Edition) authored by William Cunningham & Mary Cunningham; Published by Tata McGraw*
6. *Perspectives of environmental studies by AP Kaushik and CP kaushik. New age international publications.*
7. *Environment by Shankar IAS academy.*

DFT101F INTRODUCTION TO MICROBIOLOGY & BIOCHEMISTRY CREDITS: 3-0(3)

COURSE OBJECTIVES:

- To study the basic concepts of microbial world evolution.
- To study the characteristics and reproduction of various microbes.
- To understand the basic concepts of biochemistry.
- To understand the structural organization and functions of different biomolecules.

UNIT-I

Introduction:
Discovery of microbial world, theory of spontaneous generation, Germ theory of disease, Koch's postulates, Pure culture concept, Nature and properties of prokaryotic and eukaryotic micro-organisms.

UNIT-II

General characteristics and Nutritional requirements:
General characteristics of bacteria, yeast, mold, viruses, algae. Types of bacteria, nutritional classification of bacteria. Reproduction of micro-organisms: Brief account of bacteria, yeast and mold reproduction.

UNIT-III

General introduction and importance of Biochemistry:
Different nutrients of food. Proteins - Introduction, classification, sources, structural organization and biochemical functions, amino acids and their importance.

UNIT-IV

Carbohydrates:
Introduction, sources, classification, structure and biochemical functions. Lipids - Introduction, classification, sources, structure and biochemical functions, a brief introduction to fatty acids. Vitamins and Minerals: Introduction, classification and biochemical functions.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Grasp the basic knowledge of microbial world.
- Explain the importance & uses of biomolecules in relation to their structural organization.

Books Recommended:

1. *Book of Biochemistry by Rama Rao AVSS, 1999, LK and S Publishers, Visakhapatanm, Indian.*
2. *Text Book of Biochemistry by Satyanarayan,*
3. *Dubey, R.C., and Maheshwari, D. K. (2001). A text book of microbiology, S. Chand and Co., New Delhi.*
4. *Pelezar, M. J., Chan, E. G. S. and Krieg, N.R. (2002). Microbiology 5th edition, Tata McGraw Hill and Co, New Delhi.*

CSE101F INTRODUCTION TO COMPUTER PROGRAMMING CREDITS: 3-0 (3)

COURSE OBJECTIVES:

- To understand the basic concepts of programming.
- To know the basics of algorithmic and recursion as a tool of problem solving.

Unit-I

Introduction:

Introduction to computers, block diagram of a basic computer system, characteristics of computers, generations of computers, central processing unit, input and output devices, memory and its types.

Unit-II

Basic Computer Organization:

Software and its types – system, application, utility software; licensed and open source software.
Internet, World Wide Web (WWW), how the internet works, benefits and drawbacks of using internet, email, computer networks - LAN, MAN, WAN.

Unit-III

Microsoft Word:

Creating and formatting documents, use of styles, inserting table of content, inserting and formatting images, text manipulation with scientific notations, table creation, mail merge, macro, printing documents.

Microsoft Excel: Storing data, using mathematical equations, graphical representation of data - plotting charts and graphs.

Microsoft PowerPoint: Creating and formatting slides, inserting images, audio and videos, using transitions and animations.

Unit-IV

Introduction to Programming:

Introduction to problem solving, flowcharts, algorithms, the compilation process, features of C language, structure of C program, data types, constants and variables, arithmetic, relational and logical operators, type conversion, increment and decrement operators, assignment operator and expressions, conditional expressions, precedence and associativity, I/O functions, basic C program examples.

Unit V-

Branching, Loops, and Arrays:

Introduction to conditional branching, loops, arranging things: arrays. C program examples.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Apply various programming skills for solving discipline-centric problems.

Books Recommended:

1. *E. Balaguruswamy, Programming in ANSI C, McGraw Hill Education India.*
2. *YashavantKanetkar, Let Us C, BPB Publications*

Reference Books:

1. *Gottfried, Schaum's Outline of Programming with C, McGraw Hill Education India.*
2. *Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.*

ENG101F COMMUNICATIVE ENGLISH **CREDITS: 3-0 (3)**

COURSE OBJECTIVES:

- To develop effective writing skills among students, enhance their ability to read and comprehend engineering and technology texts.
- To enable students to use various communication tools for developing eloquent speaking, presentations and group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialization.

UNIT-I

Vocabulary Building:

The concept of Word Formation. Root words from foreign languages and their use in English. Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations.

UNIT-II

Basic Writing Skills:

Sentence Structure. Use of phrases and clauses in sentences. Importance of proper punctuation, creating coherence, organizing principles of paragraphs in documents, Techniques for writing precisely.

UNIT-III

Identifying Common Errors in Writing:

Subject-verb agreement, Noun-pronoun agreement. Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés.

Nature and Style of sensible Writing:

Describing, Defining, Classifying, Providing examples or evidence, writing introduction and conclusion.
Writing Practices: Comprehension, Precis Writing, Essay Writing.

UNIT-IV

Oral Communication (This unit involves interactive practice sessions in Language Lab): Listening Comprehension, Pronunciation, Intonation, Stress and Rhythm, Common Everyday Situations: Conversations and Dialogues, Communication at Workplace, Interviews, Formal Presentations.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Comprehend technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialization successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

Books Recommended:

1. *Michael Swan, Practical English Usage, OUP, 1995.*
2. *Wood F.T. Remedial English Grammar, Macmillan, 2007.*
3. *William Zinsser, On Writing Well, Harper Resource Book, 2001.*
4. *Liz Hamp-Lyons and Ben Heasly, Study Writing, Cambridge University Press, 2006.*
5. *Sanjay Kumar and PushpLata, Communication Skills, Oxford University Press, 2011.*
6. *Exercises in Spoken English,Parts, I-III, CIEFL, Hyderabad, Oxford University Press.*

MEC101C ENGINEERING GRAPHICS & DESIGN **CREDITS: 2-0 (2))**

COURSE OBJECTIVES:

- To develop graphic skills for representation of concepts, ideas, and design of engineering products.
- To provide an overview of computer graphics, customization and drawing using CAD.

UNIT-I

Introduction to Engineering Drawing:

Drawing instruments and their uses, Conventional lines and signs used in Engineering Drawing, Dimensioning, Scales, Four quadrant system, Projection of points: in first, second, third and fourth quadrant. Projection of lines: lines parallel, perpendicular and inclined to single and both reference planes. Finding of true length, True inclinations. Projections of planes: parallel, inclined and perpendicular to one and both reference plane.

UNIT-II

Projections of solids:
Types of solids, projections of solids with axis parallel, perpendicular and inclined to one of the reference plane.

Sections of solids: Sectional views of Prism, Cylinder, Pyramid, Cone, Auxiliary Views and true shape of the sections. Development of Surfaces: Classification of surfaces, Methods of development-Straight line method and Radial line method. Development of lateral surfaces of a prism, cylinders, pyramids and cone.

Orthographic Projections: Orthographic projections of simple blocks in First and Third quadrant.
Isometric projections and Isometric views of different planes and simple solids, Conversion of Isometric Views to Orthographic Views and Vice-versa.

UNIT-III

Introduction to Computer Aided Drafting (CAD):
Applications of CAD, Introduction to the softwares such as SOLIDWORKS and AutoCAD.
The Menu System, Toolbars, Standard, Object Properties, Draw, Modify and Dimensioning, Coordinate System, Dialog boxes and windows, Shortcut menus, Different commands used in CAD.

UNIT-IV

Creating a basic drawing on AutoCAD/SolidWorks, invoking different commands. Exercises on drawing of Line, Circle, Arc, Ellipse, Polygon and simple solid blocks etc.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Perform freehand sketching of basic geometrical constructions and multiple views ofobjects.
- Draw projections and solids and development of surfaces.

Books Recommended:

1. *Gill P. S., Engineering Drawing, S. K. Kataria and sons.*
2. *Bhatt N. D., Engineering Drawing, Charotar Book Stall.*
3. *James D. Bethune, Engineering Graphics with Auto CADD, Pearson Education.*

Reference Books:

1. *Shah M. B., Rana B. C., Engineering Drawing and Computer Graphics, Pearson Education.*
2. *Agrawal B., Agrawal C. M., Engineering Graphics, TMH Publication.*

PHY141F APPLIED PHYSICS LABORATORY **CREDITS: 0 2 (1)**

COURSE OBJECTIVES

- To provide a practical insight about the concepts of physics centering on materials, electricity, magnetism and momentum.

Practicals:

1. To determine the value of e/m of an electron by Thomson Method.
2. To determine the value of Acceleration due to gravity (g) by using the Bar Pendulum.
3. To determine the value of Acceleration due to gravity (g) by using the Kater's Reversible Pendulum.
4. To determine the value of Young's Modulus of a rectangular steel bar by Bending of Beam Method.
5. To verify Stefan's Law by Electrical Method.
6. To determine the value of moment of inertia of a fly wheel.
7. To study V-I characteristics of a diode.
8. To study the Hall Effect and hence calculate Hall coefficient, carrier density and charge mobility.
9. To verify Biot-Savart's law.
10. To determine the value of Planck's constant using LED Method.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Apply principles of materials' elasticity, electrical and magnetic properties for engineering applications.

Books Recommended:

1. *Practical Physics by SL Gupta,*
2. *Advanced Practical Physics, SP Singh, Pragati Prakashan*

CHM141F APPLIED CHEMISTRY LABORATORY **CREDITS: 0-2 (1)**

COURSE OBJECTIVES

- To make the student to acquire practical skills in the determination of strength of solutions
- To enable students undertake spectroscopic analysis of samples.
- To separate and identify functional groups using chemicals.

Practicals:

1. Determination of normality and molarity of some solutions using acid base titration method.
2. PH determination of some solution employing universal indicators.
3. Determination of acid value of a given oil sample.
4. UV-Vis. study of some commercially available metallic compound having biological relevance.
5. FT-IR study of glucose and glucosamine-HCl.
6. Separation and identification of functional groups using some chemical reagents.
7. Comparative analysis of transference number of two metal-ions chromatographically (paper chromatography).

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Use basic experiments for chemical analysis involved in engineering and technology.
- Identify the functional groups and composition of substances.

DFT141F INTRODUCTION TO MICROBIOLOGY & BIOCHEMISTRY LABORATORY

CREDITS: 0-2 (1)

COURSE OBJECTIVES

- To make the student to acquire practical skills pertaining to microbiology.
- To make the student to acquire practical skills of preparing different standard solutions.

Practicals:

1. To study different parts of a microscope.
2. Study of instruments (Autoclave, Hot air oven, Incubator, Laminar flow, pH meter, and spectrophotometer) of microbiology laboratory.
3. Preparation of nutrient agar and MacConkey's Agar plates, slants and broth.
4. To stain the given bacteria by monochrome and Gram's staining method.
5. Preparation of standard solutions of acid and alkali.
6. Determination of pH using indicators and with pH meter.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Perform basic microbiology and biochemistry-related experiments.

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CSE141F INTRODUCTION TO COMPUTER PROGRAMMING LABORATORY

CREDITS: 0-2 (1) COURSE

OBJECTIVES:

- To learn the implementation and execution of programs.
- To employ arithmetic expressions for computational problems.
- To learn the application of recursive functions, simple functions and pointers.

1. Identify the different parts of a computer system, Know how each and every part of a computer system works, Learn how different parts **OUTCOMES** of the computers work together to produce a desirable output.
2. Create a document using a suitable word processing package, with at least three paragraphs and perform editing operations to understand document creation and Text manipulation with Scientific Notations
3. Create a formal letter using a suitable word processing package, to place a purchase order for procurement of books. Use mail merge feature
4. Table creation, Table formatting and Conversion. Use tables for list of books.
5. Cereal subjects.
6. Create a Power-point presentation with at least 6 slides.
7. Using simple mathematical formulas in excel.
8. CHARTS – Line, XY, Bar and Pie.
9. Familiarization with the programming environment
10. Simple computational problems using arithmetic expressions
11. Problems involving if-then-else structures
12. Simple programs on loops and arrays

COURSE :

After completion of course, the students will be able to:

- Write, test and execute programs using various programming tools.
- Implement programming in the discipline centric problems.

SEMESTER-II

MTH151F ENGINEERING MATHEMATICS-I **CREDITS: 3-0 (3)**

COURSE OBJECTIVES:

- To understand the use of differential calculus, derivatives and functions.
- To learn the various theorems and rules for numerical analysis.

UNIT-I

Matrix Theory-II

Eigen values and Eigen vectors: Eigen values, Eigen vectors and their properties, Cayley Hamilton theorem, special types of matrices and their Eigen values.

UNIT-II

ORDINARY DIFFERENTIAL EQUATIONS (O.D.E.)

First order O.D.E. (linear and non-linear), formation and solution of O.D.E. , methods of finding solution of O.D.E. (variable separable, linear and exact), Higher order linear differential equations with constant coefficients, complementary solution and particular integrals.

UNIT-III

Partial Differential Equations (P.D.E.)

Introduction to P.D.E., classification of second order linear P.D.E., methods of separation of variables, Laplace equation's, solution of one dimensional wave and heat equations.

UNIT-IV

COMPLEX VARIABLES II

Analytic functions, C-R equations, line integrals, Cauchy integral theorem and integral formula (without proof), singularity, types of singularity and residues.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Implement the mathematical solution to problems of engineering and technology.

Books Recommended:

1. *G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.*
2. *Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.*
3. *Engineering mathematics Vol I-II, Sastry, Prentice Hall of India.*
4. *J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc- Graw Hill, 2004.*
5. *B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.*

DFT152C FUNDAMENTALS OF FOOD PROCESSING & PRESERVATION CREDITS: 3-0 (3)

COURSE OBJECTIVES:

- To provide a general understanding of the concept of food preservation, processing and its historical background. Preservation using heat. Introduction to basic thermal processing.
- Awareness regarding low-temperature preservation, drying and dehydration
- Know-how of Bio-preservatives comprising organic acids and antibiotics.
- Basic understanding of advanced processing techniques with accent on principles, mechanism of action, equipments and impact on food attributes.

UNIT-I

Introduction and Historical Development of Food Preservation. Principles of heat preservation, Preservation by heat: boiling, steam under pressure, pasteurization, canning; Heat penetration studies, heat resistance of microorganisms and their spores. Thermal death time, D, z and F value, spoilage probability.

UNIT-II

Preservation by low temperature- Refrigeration and cold storage, Changes in food during refrigeration, freezing, changes during freezing, nucleation, freezing methods, Calculation of freezing time.

UNIT-III

Preservation by drying; Phenomenon, methods and equipments of drying, drying curve, food dehydration, dehydration by air drying, sun drying and freeze drying. Intermediate and high moisture foods. Preservation by food additives

UNIT-IV

Preservation by non-thermal method- Microwave heating, hydrostatic pressure technology, ohmic heating, ultrasounds, pulsed electric field and irradiations.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Have the basic understanding of concepts of Food Preservation and Processing. Comprehension of principles and equipments used in thermal processing.
- Comprehension of techniques of Low Temperature Preservation. Understanding the phenomena of Drying and Dehydration with stress on varied techniques, principles and equipments.
- Knowledge regarding biopreservatives, antibiotics and organic acids, their efficacy as preservatives. Have the understanding of Irradiation as processing technique and its effects and safety issues.
- Basic understanding of advanced processing techniques, acquaintance regarding principles, equipments and food implication.

Books Recommended:

1. *Desrosier (2006). The Technology of Food Preservation, 4th edition, CBS Publishers & Distributers, New Delhi.*
2. *Potter and HotchKiss (2006). Food Science, 5th edition, CBS Publishers & Distributers, New Delhi.*
3. *Zueth (2005). Food Preservation Techniques, CBS Publishers & Distributers, New Delhi.*
4. *Manay, N. S., &Shadaksharaswamy M. (2002). Foods, facts and principles (second edition). New age international publishers, New Delhi.*
5. *Fellows, P. (2004). Food processing Technology: Principles & Practices, 2nd edition, CRC Press USA.*

DFT153E THERMODYNAMICS **CREDITS: 3-0 (3)**

COURSE OBJECTIVES:

- To understand the fundamental thermodynamic principles.
- To understand the law of thermodynamics.
- To understand the different phases of pure substances.
- To familiarize students with steam and steam boilers.

UNIT-I

Introduction to thermodynamics: Macroscopic and microscopic approach; thermodynamic system, surroundings and boundary; energy and its forms. Zeroth law of thermodynamics. Joules experiments, equivalence of heat and work. First law of thermodynamics. Limitations of first law. Heat effects: sensible heat; latent heat; standard heat of reaction, formation and combustion.

UNIT-II

Kelvin Plank and Clausius statements of second law and their equivalence; heat pump and heat engines. Carnot cycle and Carnot heat engine, Clausius inequality, concept of entropy, entropy change during various processes. Third law of thermodynamics.

UNIT-III

Volumetric properties of pure fluids: PVT behavior of pure substances, critical behavior, virial equation, compressibility factor, ideal gas. Vapor liquid equilibrium: phase rule, PT xy, P xy and

T xy diagram, Raoult's Law and Henry's Law.

UNIT-IV

Steam generator: properties of steam, formation of steam, steam table, steam throttling. Classification of boilers, fire tube boiler, Cochran boiler, Lancashire boiler, Cornish boiler, water tube boiler, Babcock & Wilcox boiler. Guidelines for the choice of a new boiler. Essentials of a good boiler. Various boiler mountings & accessories.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Apply the understanding of the laws and application of thermodynamics.
- Define the working and essentials of different boilers.

Books Recommended:

1. *Nag, P. K. (2005). Engineering Thermodynamics (3rd edition). Tata Mc Graw Hill Publishing Company Limited.*
2. *Smith, J. M., Van Ness, H. C. & Abbott, M. M., Introduction to Chemical Engineering Thermodynamics. McGraw Hill Education (India) Private Limited.*
3. *Vasandani, V.P., and Kumar, B.S. (1998). Heat Engineering, Metropolitan Book Company Pvt. Ltd., 1, Netaji Subhash Marg, New Delhi.*

DFT154C FOOD CHEMISTRY **CREDITS: 3-0 (3)**

COURSE OBJECTIVES:

- To study and understand the physico-chemical properties of foods.
- To study and understand the nature of chemical reactions in the foods.

UNIT-I

Introduction importance of food chemistry: Composition of food. Physico-chemical and nutritional changes occurring during food processing treatment. Pigments: structure and their role in foods

UNIT-II

Carbohydrate: Functional properties of sugars and polysaccharides in foods, chemical reactions of carbohydrates– Gel Formation, Hydrolysis, Enolization, Mutarotation, Dehydration, Browning reactions. Starch- structure, gelatinization and retrogradation of starch. Structure and functional properties of Gums, pectin, pentosans, cellulose dietary fiber and β–glucan.

UNIT-III

Lipids: Physical characteristics of lipids (melting, softening, specific gravity, refractive index smoke, flash and fire point, turbidity point), chemical properties of fats (reichert meissel value, polenske value, iodine value, peroxide value, saponification value), Edible fats and oils, Changes in fats and oils-rancidity, lipolysis, flavour reversion. Auto-oxidation and its prevention, Technology of edible fats and oils-Refining, Hydrogenation and Interesterification.

UNIT-IV

Proteins: Common Food proteins, Functional properties of Proteins, Denaturation, renaturation, Gelation, and Hydrolysis of proteins Enzymes: Introduction, classification, General characteristics, Enzymes in food processing, Industrial uses of Enzymes, Immobilized enzymes Nomenclature, Definition, mechanism of enzyme action, factors affecting enzyme action, Enzyme Kinetics and inhibition, enzymes important in foods.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Recognize, distinguish and describe the molecular structures and properties of major food components.
- Relate molecular structure to properties of components found in food.
- Analyze and predict how the composition & conditions within a food influence functional properties of food molecules.
- Describe major chemical reactions in foods and their mechanism.

Books Recommended:

1. *Fennema, O.R. Food Chemistry, 4thEdn. CRC Press USA.*
2. *Meyer, L.H. Food Chemistry, CBS Publishers and Distributors, New Delhi.*
3. *Nelson and Cox, Lehninger Principles of Biochemistry.*
4. *Richardson and Finely. Chemical Changes in Food during Processing. CBS Publishers and Distributors, New Delhi.*

DFT156C FOOD MICROBIOLOGY **CREDITS: 3-0 (3)**

COURSE OBJECTIVES:

- To introduce students to the world of microorganisms (Prokaryotes).
- To teach students how different microorganisms can be grown *in-vitro*.
- To teach students how bacterial growth (spoilage) can be controlled.
- To teach students isolation and preservation of microbial cultures.

UNIT-I

Microbial growth and reproduction: Definition of growth, growth curve, growth rate, generation time, measurement of growth, effect of environmental factors such as temperature, moisture, salt, pH, and radiation on growth. Control of micro-organisms by physical, chemical and biological agents, thermal death time, Z, F and D values.

UNIT-II

Microbial techniques: Isolation and development of axenic cultures, Serial dilution, Spread plate method, Pour plate method and streak plate method. Preservation of microbial cultures. Methods of genetic improvement.

UNIT-III

Food Spoilage: Microbial and biochemical aspect of food spoilage, role of bacteria, yeast and molds in food spoilage, Spoilage of cereal and cereal products, fruits and vegetables, meat and meat products, milk and milk products, fish and fish products, spoilage of egg and poultry and heated canned foods. Food intoxication and food infection, poisoning, causative microorganisms, and prevention

UNIT-IV

Methods for microbial examination of foods (traditional methods): Total plate count, coliform count, yeast and mold count. Rapid methods: Antibody assay methods (Fluorescent antibody technique, radio immune assay, ELISA), Molecular methods like PCR and RT PCR.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Morphologically characterize bacteria.
- Carry out culturing of bacteria.
- Control the spoilage causing micro organisms
- Isolate and preserve microbial cultures.

Books Recommended:

1. *Dubey, R.C., and Maheshwari, D. K. (2001). A text book of microbiology, S. Chand and Co., New Delhi.*
2. *Pelezar, M. J., Chan, E. G. S. and Krieg, N.R. (2002). , Microbiology 5th edition, Tata McGraw Hill and Co, New Delhi.*
3. *Purohit, S. S. (2001). Microbiology, Fundamentals and applications.*
4. *Sharma, P.D. (2000). Microbiology, A text book for university students.*
5. *Frazier, W. C. &Westhoff, D. C. (1996). Food Microbiology, Tata McGraw Hill and Co.* 6. *James, M.J. (1997). Modern Food Microbiology, 4th Edition, CBS Publishers, New Delhi* 7. *Barnart, G.J. (1997). Basic Food Microbiology, CBS Publishers, New Delhi.*
6. *Stainer, R.Y. (1996). General Microbiology, 5th edition, Mac Millan Publishers, New Delhi.*

DFT157C FOOD ANALYTICAL TECHNIQUES **Credits: 4-0 (4)**

COURSE OBJECTIVES:

- To study and understand the Proximate composition of foods.
- To study and understand the various food laws and Regulations.

UNIT-I

Introduction: Classification, Chemical composition and nutritional value of common food stuffs, Properties of foods. Sampling methods - Sample preparation for analysis, General methods for the determination of components: Carbohydrates, Proteins, Amino Acids, Fats, Mineral Matter, Moisture, Crude Fiber, Synthetic Dyes. Principles of Proximate Analysis- Moisture, Ash, Crude Fat, Crude Fibre, Crude Protein and Carbohydrates by Difference

UNIT-II

Food adulteration: Types of adulterants, intentional adulterants, adulteration of food with colors, incidental adulterants, Food Regulations and Standards, food laws, voluntary standards and certification systems

UNIT-III

Definition and importance of sensory evaluation. Sensory evaluation: Requirements and methods. Quality attributes –appearance, flavor, texture and additional quality factors, Testing area, testing set up, lighting, testing schedule. Subjective and Objective test of sensory parameters. Differential test, Descriptive test, Rating test, Sensitivity threshold test.

UNIT-IV

Permitted food additives and their role: Antioxidants, coloring agents, flavors, emulsifiers, curating agents, non-nutritive sweeteners, flour improvers, leavening agents, stabilizers, thickeners and preservatives.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Recognize, distinguish and describe composition of food components.
- Describe antioxidant properties of foods
- Analyze and predict how adulteration affect the properties of foods.
- Describe major chemical reactions in foods and their mechanism.

Books Recommended:

1. Fung, D.Y.C. and Matthews, R. (1991): Instrumental Methods for Quality Assurance in Foods, Marcel Dekker, Inc. New York.
2. Skoog, D.A., Holler, F.H. and Nieman (1998): Principles of Instrumental Analysis Saunders College Publishing, Philadelphia. Department of Food Science and Technology 14

3. Gruenwedel, D.W.; Whitaker, J.R. (editors) (1984): Food Analysis Principles and techniques, Volumes 1 to 8, Marcel Dekker, Inc., New York.
4. Herschdoerfer, S.M. (ed) (1968 – 1987): Quality Control in the Food Industry, Vols. 1 to 4, Academic Press, London.
5. Pomeranz, Y. and MeLoan, C.E. (1996): Food Analysis: Theory and Practice; 3rd Edition, CBS Publishers and Distributors, New Delhi.
6. Wilson and John Walker ,Principles and Techniques of Biochemistry and Molecular Biology (2010), Keith Wilson and John Walker, Cambridge University Press.

DFT191C FOOD CHEMISTRY LABORATORY **CREDITS: 0-2 (1)**

COURSE OBJECTIVES:

- learn and understand the principles behind the qualitative and quantitative estimation of various To food components.
- To learn and understand the preparation of various reagents.

Practicals:

1. General Introduction to food chemistry lab-Cleaning and handling of glassware, use and handling of chemicals, safety in the lab.
2. Preparation of distilled water by double distillation.
3. Determination of moisture on dry matter basis.
4. Determination of ash content.
5. Preparation and Standardization of different reagents.
6. Qualitative analysis of carbohydrates by colour reactions.
7. Determination of reducing sugars by Nelson-Somogyi Method
8. Estimation of sugars by Lane and Eyon method.
9. Quantitative determination of starch in cereal grains.
10. Determination of Amylose and amylopectin.
11. Determination of protein by Kjeldhal method.
12. Saponification value, Iodine value.
13. Acid value, peroxide value.
14. Estimation of crude fat content by soxhlet method.
15. Determination of crude fibre.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Understand and identify the food groups: nutrient components and proximate composition.
- Analyze and predict how composition of foods with regard Carbohydrates, lipids, proteins and H_2O influence their stability.
- Understand the role of food components and their interaction in food products in terms of color, texture, flavor.

DFT193C BASIC & FOOD MICROBIOLOGY LABORATORY CREDITS: 0-2 (1)

COURSE OBJECTIVES:

- To teach students the working and principles of various instruments of Microbiology lab.
- To familiarize students with the morphology of bacteria.
- To teach students the culturing of bacteria on different culturing media.

Practicals:

1. Instruments of microbiology laboratory and their functions.
2. Preparation of nutrient medium.
3. Demonstration of serial dilution method and techniques of isolation and enumeration of microorganisms.
4. Microscopy.
5. Preparation of bacterial smear.
6. Monochrome staining.
7. To stain the given bacteria by Gram's staining method.
8. To demonstrate acid fast staining.
9. To measure the size of given microorganisms by ocular micrometer.
10. To determine the number of microorganisms by Haemocytometer.
11. To determine the motility of bacteria by hanging drop method.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Operate various instruments of Microbiology Lab.
- Carryout morphological characterization of bacteria.
- Carry out culturing of bacteria.

DFT194G MANUFACTURING PROCESS LABORATORY **CREDITS: 0-6 (3)**

COURSE OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in mechanical engineering.

Practicals:

1. Study of Machine Tools (Lathe, Shaper, Spotter, Planner) – Study the types of cutting tools available and relative motions between cutting tool and workpiece on each machine tool.
2. Study of Machine Tools (G
3. rinding, Milling, Drilling) – Study the types of cutting tools available and relative motions between cutting tool and work piece on each machine tool.
4. Job making on Lathe machine.
5. Job making on shaper/spotter machine.
6. Job making on milling machine.
7. Job making on drilling machine.
8. Job making on grinding machine.
9. Study of various types of cutting tools and measurement of tool geometry (Model making of single point/multi point cutting tools by rubber/plastic/wood etc.).
10. Basic understanding of Different Manufacturing Processes: concepts, application, advantage and future aspects.
11. Study of SMAW/MMAW process.
12. Making of Lap joints/ T-Joints at different welding parameters.
13. Study of TIG/ MIG welding processes.
14. Making of Butt Joint at different welding parameter by TIG.
15. Making of Butt Joint at different welding parameter by MIG.
16. Making of Butt Joint (16 mm MS rod) by friction welding at different speed.
17. Making of various jobs using carpentry

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Use welding equipments to join the structures, carry out the basic machining operations.

DFT195C FOOD ANALYTICAL TECHNIQUES LABORATORY **CREDITS: 0-2 (1)**

Practicals

1. Determination of Moisture by Air and Vacuum Oven Method
2. Estimation of Crude Fat [Soxhlet Extraction Method].
3. Determination of Crude Protein [Micro Kjeldhal method]
4. Determination of Total and Acid insoluble Ash
5. Estimation of Crude Fiber in Foods [Gravimetric Method]
6. Measurement of pH and Preparation of Buffers.
7. Free fatty acids in fats and oils
8. Determination of Reducing and Total Sugars [Volumetric Method].
9. Determination of Vitamin C [Volumetric]
10. Estimation of Rehydration Ratio and Peroxidase test in Dehydrated Vegetables
11. Sensory Testing

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Understand and identify the food groups: nutrient components and proximate composition.
- Analyze and predict how composition of foods with regard Carbohydrates, lipids, proteins and H_2O influence their stability.
- Understand the role of food components and their interaction in food products in terms of color, texture, flavor.

SEMESTER-III

MTH201F ENGINEERING MATHEMATICS-II **CREDITS: 3-0 (3)**

COURSE OBJECTIVES:

- To understand the different concepts involved in statistical analysis.
- To provide an insight of probability and numerical analysis techniques.

UNIT-I

Statistics a conceptual frame work, Diagrammatic and Graphical representation of data, Measures of central tendency: Mean, median, mode geometric mean and harmonic mean. Characteristics of a good Average. Measures of dispersion: Range, mean deviation, Quartile deviation, standard deviation, variance, coefficient of variation, Characteristics of good dispersion.

UNIT-II

Probability: Axioms of probability, conditional probability, Baye's Theorem, Discrete and continuous random variables, Binomial, Poisson and Normal distributions.

UNIT-III

Measures of Skewness - Karl Pearson's and Bowley's method, Measures of Kurtosis, Sheppard's corrections. Correlation: Karl Pearson's coefficient of correlation, Spearman's Correlation, Properties of correlation. Regression Analysis: Method of Least squares, Fitting of Straight line and parabola of degree, Properties of Regression.

UNIT-IV

Index Numbers: Definition, construction of index numbers and problems there of for weighted and un weighted index numbers including Laspeyre's, Paasche's, Edgeworth Marshall and Fisher's. Chain index numbers.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Apply various statistical tools and numerical analysis techniques for data analysis in engineering field.

Books Recommended:

1. *Hari Arora, A Textbook of Engineering Mathematics Vol. I , II.*
2. *SC Gupta and V.K Kapoor Fundamentals of Mathematical Statistics*
3. *Meyer: Data Analysis for Scientists & Engineers, John Wiley & Sons.*
4. *Brownlee: Statistical Theory and Methodology in Science and Engineering, John Wiley & Sons.*
5. *N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.*
6. *B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.*
7. *Advanced Engineering Mathematics by Jain, R.K. and Iyengar SRK, Narosa, 2001.*

DFT202C FLUID MECHANICS **CREDITS: 3-0 (3)**

COURSE OBJECTIVES:

- To introduce the students to the important engineering properties of fluids.
- To describe the behavior of static and moving fluids under different conditions.
- To explain the measurement of fluid flow and different flow measuring apparatus.

UNIT I

Fluid and their Properties; Difference between solids, liquids and gases, ideals and real fluids. Continuum concept of a fluid; density; specific gravity and relative density; viscosity and its dependence on temperature; surface tension and capillarity, vapour pressure and cavitations; classification of fluids: Newtonian and non-Newtonian fluids. Pascals law, simple manometer, differential manometer.

UNIT II

Fluid Statics: Action of fluid pressure on a plane (horizontal, & vertical) submerged surface, resultant force and center of pressure force on a curved surface due to hydrostatic pressure. Buoyancy and floatation, stability of floating and submerged bodies, metacentric height and its determination.

UNIT III

Fluid Kinematics and Dynamics;Classification of fluid flows, Flow regimes and Reynolds number. Continuity equation in cartesian coordinates, Euler's equation, Bernoulli's equation and steady flow energy equation.

UNIT IV

Flow & Flow Measurements: flow losses in pipes, Darcy equation, minor head losses in pipes and pipe fittings. Venturimeter, orificemeter and rotameter. Pumps: types of pumps & characteristics, typical performance curve. Fans, blowers & compressors.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Understand the various important fluid properties and classification of fluids.
- Understand the flow behavior of fluids in rest and movement.
- Comprehend the basics of fluid flow measurement and principle of measuring devices.

Books Recommended:

1. *Kumar D.S, (2004). Fluid Mechanics and Fluid Power Engineering by Kataria& sons.*
2. *Bansal R.K (2005). A textbook of Fluid Mechanics & Hydraulic Machines, Laxmi Publication (P) Ltd.*

DFT206C FRUIT & VEGETABLE TECHNOLOGY **CREDITS: 3-0 (3)**

COURSE OBJECTIVES:

- To make the students aware about the recent production and global scenario of the fruit and vegetable processing.
- To train students to manufacture different fruit and vegetable products according to FPO specification.
- To enable students to learn different preservation techniques to overcome the problems of Post harvest losses.

UNIT-I

Indian and global scenario of Fruit and Vegetable production and processing: Primary processing and handling of fruits and vegetables. Infrared Blanching, Ultrasound processing. Heat processing of fruits and vegetables: principles and considerations and the defects thereof.

UNIT-II

Fruit products: Definition, formulation, preparation and FPO/FSSAI standards of fruit juices, Tomato Products, Pickles,.and their Spoilage. Jams, Jellies and Marmalades: Preparation of Fruits, Processing Steps involving Pectin, its Extraction and Requirement, Theories of Jelly Formation. Preserve, candied and Crystallized Fruits and Vegetables.

UNIT-III

General methods of freezing of fruits and vegetables, their packaging and storage: Changes during storage of frozen products.; NIR freezing storage of fruits and Vegetables, Cold Plasma,
Low temperature conditioning technology of fruits and Vegetables, Refractance window drying of fruits and vegetables
Dehydration of fruits and vegetables by Osmo-dehydration and Freeze drying Examples of dried and frozen products. Technology of Fresh-cut fruits and vegetables.

UNIT-IV

Important Enzymes in Fruit and Vegetable Technology: Use of Preservatives in fruit and vegetable products and their mode of action.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Gain the knowledge of canning of different fruit and vegetable products and understand the problems faced with retorting and overcome the problems with the spoilage of canned products.
- Manufacture different fruit and vegetable products and their quality assessment.
- Understand different preservation techniques for shelf life enhancement of products.
- Understand role of enzymes in food industry and their application.

Books Recommended:

1. Girdhari Lal &Sidappa, (1996). Fruits and vegetable preservation, ICAR (New Delhi).
2. Srivastava, (2000). Preservation of fruits and vegetable, IBD Co. Lucknow.
3. KhaderVijaya, (2000). Preservation of fruits and vegetable, Kalyani Publication.
4. Verma. L. R. & Joshi. V. K., (1994). Post harvest technology of fruits and vegetables – Handling, Processing, Fermentation and Waste management

DFT203C UNIT OPERATIONS IN FOOD PROCESSING CREDITS: 3-0 (3)

COURSE OBJECTIVES:

- To understand the preliminary operations involved in food processing.
- To familiarize the students with the industrial processes involving size reduction, sieving, mixing and agitation.
- To provide the students with insight of various separation and crystallization processes, their principles and equipments.

UNIT-I

Preliminary unit operation: physical properties of food materials. Cleaning, sorting and grading – aims, methods and applications. Different conveying systems: belt conveyors, chain conveyors, screw conveyors, pneumatic conveyors, vibrating and oscillating conveyors, bucket elevators – their selection and operation.

UNIT-II

Size reduction and sieve analysis: Theory of comminution, size reduction laws- calculation of energy required during size reduction, size reduction equipment: Crushers – grinders, ultrafine grinders, cutters, size enlargement. Effects of size reduction on sensory characteristics and nutritive value of food. Sieving, separation based on size (mesh size), Types of screens: stationary screens – grizzlies, gyrating screens, vibratory screens, and effectiveness of screens.

UNIT-III

Mixing & Agitation: Types, measurement and rate of mixing, mixing equipment-liquid mixer, powder & particle mixer, dough & paste mixer, jet mixer, static mixer, purpose of agitation, agitated vessels – impellors, propellers & turbines, kneading, Homogenization - Principle & equipment.

UNIT-IV

Separation Process: Filtration-principle of filtration; types of filtration. Equipment- filter press, rotary drum, shell & leaf filter, vacuum filter, centrifugal filter, filter media, filter aid, and filter cake. Ultrafiltration, membrane filtration, reverse osmosis. Sedimentation- Stoke's law. Free and hindered settling. Equipment for sedimentation. Crystallization, nucleation, crystal growth. Crystallization equipment.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Develop the understanding of material handling.
- Understand the processing of foods in terms of common unit operations like size reduction, mixing, and separation.
- Implement his computational skills in calculating the energy required in size reduction, mixing.
- Understand the construction, working and applicability of various size reduction, mixing and separation equipments.

Books recommended:

1. Sahay, K.M. and Singh.K . K (1998).Unit Operations of Agricultural Processing byKalya Publishers, Ludhiana.
2. Mcabe W. L. and Smith J. C. (7thEdition). Unit operations of chemical engineering. Mc Graw Hill Publication.
3. GeanKoplis C. J. (3rd Edition). Transport processes in unit operations. Prentice Hall of India.
4. P.Fellows.(2000) Food processing technology. Principles and practice. Ellis Horwood England and V C H publishers Germany
5. Earl, P. (1994). Unit operation in Food Processing, Elsevier Science UK.

DFT205E FOOD PLANT HYGIENE & SANITATION Credits: 2-0 (2)

COURSE OBJECTIVES:

- Introduction to Food Hygiene and Sanitation and its significance in Food Industries.
- Understanding general principles of Food Hygiene in relation to food preparation.
- Microbial contamination of food and various physical and chemical techniques used for their control.
- Understanding sanitary aspects of water supply with emphasis on kind of impurities, purification and disinfection techniques
- Basic knowledge of physical and chemical factors in cleaning.

UNIT-I

General principle of food hygiene, Hygiene in rural and urban areas in relation to food preparation, personal hygiene and food handling habits. Sanitary aspects of building and processing equipment. Establishing and maintaining sanitary practices in food plants.

UNIT-II

Physical and chemical control, Food contamination by microorganisms, effective control of microorganisms, importance in food sanitation, micro-organisms as indicator of sanitary quality.

UNIT-III

Sanitary aspects of water supply: Source of water, quality of water, water supply and its uses in food industries. Purification and disinfection of water preventing contamination of potable water supply.

UNIT-IV

Effective detergency and cleaning practices: Importance of cleaning technology, physical and chemical factors in cleaning, classification and formulation of detergents and sanitizers, cleaning practices. Role of sanitation, general sanitary consideration and sanitary evaluation of food plants.

COURSE OUTCOMES:
After completion of course, the students will be able to:

- Understand the significance of Food Hygiene and sanitation in Food industries. Various Hygiene principles employed during food preparation. Hygiene design of buildings and process equipments.
- Microbial contamination of food and various physical and chemical techniques used for mitigation.
- Know-how of sanitary aspects of water supply and purification and disinfection techniques.
- Basic knowledge of chemical and physical factors in cleaning. Acquaintance regarding detergents and sanitizers with stress on their chemistry and antimicrobial spectrum.
- Understanding procedures employed for sanitary evaluation of food plants.

Books Recommended:

1. Principles of Food Sanitation by Marriott and Norman, G.
2. Hygiene and Sanitation in Food Industry by S. Roday, TMH 3. Guide to Improve Food Hygiene by Gaston and Tiffney, TMH.
3. Practical Food Microbiology & Technology by Harry H. Weiser, Mountney, J. and Gord, W.W.
4. Food Poisoning and Food Hygiene by Betty C. Hobbs, London publication.

DFT241C FLUID MECHANICS LABORATORY **CREDITS: 0-2 (1)**

COURSE OBJECTIVES:

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

Practicals:

1. Calibrate the given rotameter.
2. Observe various pressure measurement devices.
3. Study the transition from laminar to turbulent flow and determine the Reynolds number for a flow through a pipe.
4. Determine the co-efficient of discharge through venturi meter and orifice meter.
5. Determine the hydrostatic thrust acting on a plane immersed in water.
6. Determine the head loss in a pipeline due to sudden expansion, sudden contraction and bends in a pipe.
7. Study the flow through a variable area duct and verify Bernoulli's energy equation.
8. To verify Stoke's law and to study the variation of the drag co-efficient with Reynolds number (Re) for sphere.
9. Determine the losses due to friction in pipes.
10. Study of pressure drop in a packed bed.
11. Study centrifugal pump characteristics.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Understand and verify fluid characteristics under different conditions.
- Understand the properties of fluid important for measurement of their flow.
- Comprehend the principle fluid flow measurement applied in different pressure measuring devices.

DFT242C UNIT OPERATIONS IN FOOD PROCESSING LABORATORY

CREDITS: 0-2 (1)

OBJECTIVES:

- To develop knowledge in handling various unit operation equipments related to size reduction, sieving and mixing.

Practicals:

1. Study the working and performance of a given cyclone.
2. Crushing of rock salt in the Jaw Crusher, and Determination of average size by sieving.
3. To study the jaw crusher and determination the actual capacity, reduction ratio and Verification of Rittinger's law of Crushing.
4. To determine and analyze the size distribution of a fixed granular solid by using a Test Sieve Stack.
5. To determine and analyze the size distribution of a fixed granular solid by using a RoTap sieve Shaker.
6. To study the effect of grinding with grinding time in Ball mill.
7. To study the effect of grinding with frequency (RPM) in Ball mill.
8. Understand the operations of a plate and frame filter press and verify cake filtration laws at constant flow rate and at constant pressure.
9. Understand the working of ribbon mixer.
10. Determination of the capacity of a screw conveyor and power loss for different angle of inclination.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Understand the basic principles of various engineering equipments and its applications.
- Be able to apply the skill of material balance and energy balance in unit operations processes.

DFT244C FRUIT & VEGETABLE TECHNOLOGY LABORATORY CREDITS: 0-2 (1)

OBJECTIVES:

- Preservation and analytical techniques in fruit and vegetable products.
- Use of various techniques and additives for fruit and vegetable processing and quality Analysis.
- Preparation of different fruit and vegetable products according to FPO/FSSAI specification.
- Give industrial exposure to students.

Practicals:

1. Preparation of fruit juices and determination of TSS, ^{o}brix and acidity of fruit Juices.
2. Determination of Vitamin C content by titration method.
3. Determination of Beta carotene content of juices by HPLC and spectrophotometric method.
4. Preparation of jams and determination of its sugar content.
5. Preparation of fruit products by using Pearson Square method.
6. Preparation of pickles and its quality assessment.
7. Adequacy of blanching using guaicol and hydrogen peroxide.
8. Preparation of tomato puree, paste and ketchup
9. Organoleptic evaluation of fruit and vegetable products prepared in class practicals.
10. Visit to a local fruit processing plant.

COURSE OUTCOMES:

- On the completion of the course, the students will able to get Practical experience on fruit and vegetable process technology and will be fit for adjustment in Fruit and Vegetable industry.

SEMESTER-IV

DFT251C MASS TRANSFER OPERATION **CREDITS: 3-0 (3)**

COURSE OBJECTIVES:

- To study and learn the basic mass transfer operations used in food processing and preservation.
- To develop the analytical skills to calculate mass transfer in food system.
- To possess the Knowledge of properties of air–water vapor mixture imperative in designing of systems such as air- conditioning equipment for storage of fresh produce, dryers for drying cereal grains, and cooling towers in food processing plants.

UNIT I

Units Dimensions: System of Units, Conversion of units, Mole Fraction and Mole percent, Mass Fraction and Mass percent, Concentration in different forms, Mass balancing, Principles of molecular diffusion and diffusion between phases, Fick's Law, Diffusivity, Diffusion in solids, Knudsen diffusion.

UNIT II

Extraction: Liquid-liquid extraction, selectivity & choice of solvent, liquid-liquid extraction equipment. Leaching-Introduction, leaching equipment. electrodialysis system, reverse osmosis, Ultrafiltration, types of reverse osmosis and ultrafiltration systems. Membrane performance, concentration polarization

UNIT III

Distillation–Vapour liquid equilibrium, relative volatility, flash &batch distillation, steam distillation, vacuum distillation, T-xy & xy curves for distillation, azeotrophic mixtures, and distillation tower. Dehydration, moisture diffusion, drying rate curves, dehydration systems

UNIT IV

Absorption Introduction to absorption, the mechanism of absorption, Absorption equipment, Limiting gas-liquid ratio, Flooding, different packings in packed column. Desorption or stripping. Principles of humidification & dehumidification, wet and dry bulb temperature, psychrometric chart, cooling tower.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- To be able to understand all the basic mass and energy consumption systems in food processing unit operations.
- To understand the fundamentals of basic mass transfer operations.
- To be able to efficiently design and optimize various process flow operations used in food Industries.
- To understand the procedures used in computations involving psychrometric properties useful in design and analysis of various food processing and storage systems.

Books Recommended:

1. *GeanKoplis C. J. Transport processes and separation process principles, 4th Edition. Prentice Hall of India.*
2. *McCabe. Warren L., Smith. Julian C., Peter Harriott, Unit Operations of Chemical Engineering, 7th Edition. McGraw-Hill, Inc., New Delhi.*
3. *Treyball R.E, Mass Transfer Operation, 3rd Edition-McGraw Hill Publication.*
4. *Singh, R.P., & Heldman. Introduction to Food Engineering, 3rd Edition, Academic Press, London, UK.*
5. *Humelblau D.M.& Riggs, J. B., Basic principles and Calculation in Chemical Engineering, 7thEdition.Prentice-Hall of India Pvt. Ltd.*

ELE252G BASIC ELECTRICAL & ELECTRONICS **CREDITS: 3-0 (3)**

COURSE OBJECTIVES:

- To acquaint the students with concepts of current, electromagnetism, and working of motors.
- To provide an understanding of various transformers and their working.
- To familiarize the students with semiconductor devices and transistors.

UNIT I

DC Circuits: Basic Terminology including voltage, current, power, resistance, emf; Resistances in series and parallel; Current and Voltage Division Rules; Capacitors & Inductors: V-I relations and energy stored. Ohms Law and Kirchhoff's laws-Problems, Superposition, Thavenin and Norton Theorems.

UNIT II

AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor.
Basic principle ,construction and working of transformers , DC generators and DC Motors.

UNIT III

Semiconductor Diode Characteristics.
Diode circuits: Clipper; Clamper circuits. Zener diode, DC power supply: Rectifier; Half wave, Full wave(center-tapped, bridge), Zener-regulated power supply.

UNIT IV

Transistor: Bipolar junction Transistor, transistor as a switch, transistor circuit configuration, transistor characteristics. Field Effect Transistor.
Operational Amplifiers: Virtual ground concept; Inverting Amplifier, Non-inverting Amplifier, Integrator, Differentiator, Summing Amplifier and their applications. Instrumentation system: Transducer, Strain Gauge, Cathode Ray oscilliscope (CRO) ,
Introduction to Analog and Digital meters.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Explain the working and operation of transformers and motors
- Apply theorems of electrical circuits in engineering.

Books Recommended:

1. *D.P. Kothari and I.J. Nagrath, Basic Electrical Engineering, Tata McGraw Hill, 2010.*
2. *D.C. Kulshreshtha, Basic Electrical Engineering, McGraw Hill, 2009*
3. *V.D. Toro, Electrical Engineering Fundamentals, Prentice Hall India, 1989*

Reference Books:

1. *E. Huges, Electrical and Electronics Technology, Pearson, 2010.*
2. *Charles K. Alexander, Mathew N.O. Sadiku, Fundamentals of Electric circuits, McGraw Hill.*
3. *Jack E. Kemmerly William H. Hayt, Engineering Circuit Analysis, Mc Graw Hill, 2012.*
4. *L.S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011.*

DFT256C DAIRY PROCESSING TECHNOLOGY **CREDITS: 3-0 (3)**

COURSE OBJECTIVES:

- To provide students a simple and good overview of dairy technology.
- To introduce students to dairy industry in India and abroad.
- To develop knowledge of students about properties and processing of liquid milk.
- To introduce students to various milk processing operations applied to liquid milk.

UNIT I

Introduction: Present milk industry scenario in India, cooperative dairying and dairy development programmes in India.

Liquid milk: Definition, detailed chemical composition, physical structure and nutritional profile. Colloidal calcium phosphate and milk enzymes. Factors affecting milk composition, milk formation/secretion. National and international milk standards.

UNIT II

Milk properties: Solution properties, milk acidity and pH, redox potential, specific gravity and density, optical properties, viscosity and fluid milk rheology.Production, collection, procurement, reception and storage of milk in dairy processing plants. Milk microbiology: microbial spoilage of milk, hydrolytic rancidity in milk and auto-oxidation of milk fats.

UNIT III

Milk processing operations: Homogenization- objectives, operation of homogenizer, effects of turbulence, factors affecting fat globule size, surface layers and homogenization clusters. Pasteurization- definition, different methods, operation of HTST pasteurizer and UHT processing. Milk sterilization. Effect of processing on milk components and their functional properties.

UNIT IV

Standardization of milk and cream separation, formula composition and manufacture of infant foods, good hygienic practices in milk processing, HACCP. Cleaning and disinfection in dairy industry.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- The students will gain knowledge about dairy industry scenario in India and abroad.
- The students will gain knowledge about the composition and properties of liquid milks.
- The students are expected to know about the different processing techniques applied to liquid milk.
- The students will know the knowledge of good hygienic practices in liquid milk processing.

Books Recommended:

1. *Smit, Gerrit (2003). Dairy processing: improving quality, Woodhead publishing limited, England.*

2. *De, Sukumar (1991). Outlines of dairy technology, Oxford university press, Delhi.*
3. *Varnam, A.H., Sutherland, J.P. (1994). Milk and milk products, Chapman and Hall, New York, USA.*
4. *Walstra, P., Geurts, T.J., Noomen, A., Jellema, A., Boekel, M.A.J.S (1999). Dairy Technology: Principles of milk properties and processes, Marcel Dekker, Inc, New York.*

DFT254C FOOD PROCESS ENGINEERING **CREDITS: 3-0 (3)**

COURSE OBJECTIVES:

- To introduce the students to the basics of food process engineering.
- To teach the principle and applications of drying and thermal processing in food processing.
- To teach the basic principle of refrigeration and freezing of food materials.
- To describe the basic concepts of extrusion process and its application in food processing.

UNIT I

Drying: Theory of drying, bound moisture, free moisture, equilibrium moisture content, critical moisture content, drying rate curves, Engineering aspects of different types of dryers including bin dryer, tray drier, drum drier, tunnel drier, spray drier, fluidized bed drier, freeze drier

UNIT II

Thermal processing: Microbial survival curves, Kinetics of microbial death and concept of F, D and Z values, Evaluation of processing time in canned foods by general and mathematical method, Different types of sterilizers

UNIT III

Refrigeration: Introduction to refrigeration, Refrigerants and their selection, Components of refrigeration systems, Types of different Refrigeration systems, Pressure enthalpy charts and tables, Analysis of vapor compression refrigeration system (Cooling load, Coefficient of performance, Refrigerant flow rate).

UNIT IV

Freezing: Introduction to freezing, Different types of freezing system, Indirect and direct contact systems, Freezing curve, Freezing rate and freezing point, Freezing time calculations, different types of freezers including plate freezers, blast freezer cryogenic freezing. Vacuum freezing

UNIT V

Extrusion: Introduction to extrusion process of food, Classification of extrusion process, Types of extruders-single screw and twin screw extruder, Design features and operational characteristics, Effect of extrusion parameter on product quality and optimization.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Understand various basic aspects of food process engineering
- Comprehend the inactivation of micro-organisms during thermal processing and its calculations.
- Understand the processing of foods by high temperature, low temperature and extrusion processes.

Books Recommended:

1. *Smith, P.G. (2010). Introduction to Food Process Engineering (2nd edition). Springer New York Dordrecht Heidelberg London*
2. *Berk, Z. (2009). Food Process Engineering and Technology (1st edition). Academic press publications, Elsevier.*
3. *Singh, R.P. and Heldmann, D.R. (2009). Introduction to Food Engineering (4th edition). Academic press publications, Elsevier.*

DFT255E FOOD BIOTECHNOLOGY **CREDITS: 2-0 (2)**

COURSE OBJECTIVES:

To acquaint students about the following knowledge:

- Micro organisms which can be used in industries for economic benefits.
- Fermentation process and fermenting micro organisms.
- Production of industrially important microbial products.
- Recovery of microbial products in industrial processes.
- Processes involved in strain improvement.

UNIT I

Fermentation- Definition, types, advantages and disadvantages. Classification of food fermentations- Alcoholic, lactic and acetic acid fermentations. Fermentation systems (batch and continuous systems), fermenter design, instrumentation and control. Fermentation raw materials. Media sterilization, antifoam agents, foam sensing, control device, Innoculum development.

UNIT II

Microbial production of various primary and secondary metabolites- Alcohol, amino acids (glutamic acid and lysine), organic acids (citric, acetic and lactic acid), enzymes (pepsin, amylase). Rate of microbial growth and death, Rate of product formation.

UNIT III

Downstream processing of extracellular and intracellular products, cell rupture- introduction, separation process with examples. Immobilised enzyme technology- methods of immobilization and applications.

UNIT IV

Biomass production- microbial production of single cell protein and Baker's yeast,Production of Bacteriocins,Bioflavors,and Biopigments Principle of overproduction of metabolites. Selection of natural variants, recombinant DNA technology, Induced mutations by chemical and physical mutagenic agents.

COURSE OUTCOMES:

After completion of course, the students would have learned:

1. Microbes and microbial processes involved in industries.
2. Fermentation technology.
3. Production of industrially important microbial products.
4. Downstream processing.
5. Strain improvement of industrially important microbes.
6. Understand the various important fluid properties and classification of fluids.

Books Recommended:

1. *Prescott &Dunn(1992), Industrial Microbiology, 4th Edition. CBSPublishers, New Delhi.*

2. *Ward, O. P. (1989). Fermentation Biotechnology- Principles, Process and Products. Prentice Hall Publishers, New Jersey.*
3. *Stansbury, P.F., Whitaker, A and Hall, S. J. (1995). Principles of Fermentation Technology,Pergamon Press, Oxford.*
4. *Young, M. Y. (1984).Comprehensive Biotechnology (Vol.1-4) , Pergamon Press Oxford.*

DFT291C MASS TRANSFER OPERATION LABORATORY **CREDITS: 0-2 (1)**

COURSE OBJECTIVES:

- To observe various mass transfer operations in the lab.
- To understand various fundamental processes of diffusion, extraction, distillation in the lab.
- To observe migration of a constituent of a fluid or a component of a mixture.

Practicals:

1. To determine the drying characteristics of a given sample by drying in a tray dryer.
2. To study the edible oil extraction from food samples (Solid Liquid Extraction)
3. Determination of the diffusion coefficient of an organic vapour (e.g. CCl4) in air.
4. To study the extraction of essential oils from different Himalayan sources
5. To determine the conductivity of unknown solution.
6. To study the separation of different components by using distillation apparatus
7. To study the extraction of starch from different sources an example of solid liquid extraction
8. To study the mass transfer characteristics of protein extraction from different food samples
9. To study the extraction of caffeine from the coffee
10. To study the preparation of sugar from sugar cans an example of crystallization
11. To study the extraction of beta-carotene by using vacuum distillation.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- To get familiarized with various fundamental operations of mass transfer in food industries.
- To understand the concept of material balancing in context to unit operations in food processing.
- To understand changes in the physical equilibrium of the system caused by the concentration differences.

DFT292G BASIC ELECTRICAL & ELECTRONICS LABORATORY

CREDITS: 0-2 (1) COURSE

OBJECTIVES:

- To determine various parameters of operation in circuits.
- To learn and solve problems pertaining to diodes and amplifiers.
- To study the operation of motors and generators.

Practicals:

Basics:

1. Familiarity with lab equipments like ammeters, voltmeters, wattmeters, multimeters, breadboard, CRO, power supplies, etc.
2. Familiarity with electrical/electronic components like resistors, inductors, capacitors, diodes, LEDs, etc.
3. To study the color coding of resistors.
4. Connection of Ammeters, voltmeters, Wattmeter's and Millimeters in DC and AC circuits and selection of their ranges.

Experiments on D.C. and A.C. Circuits:

1. To study the series and parallel operation of resistors
2. To verify the KVL and KCL in D.C. Circuits.
3. To verify Norton's and Thevenin's Theorem.
4. To verify Superposition Theorem.
5. To measure electric power in single phase AC circuits with resistive load, RL load and RLC load.

Experiments on electronic devices:

1. Study of V-I characteristics of diode.
2. To study and draw the characteristics of half wave and full wave rectifiers.
3. To obtain Zener diode characteristics and use zener diode as voltage regulator.
4. To plot the V-I characteristics of BJT.

Experiments on Transformers and DC Machines:

1. To perform open circuit and short circuit tests on a single-phase transformer.
2. To perform polarity test on a single phase transformer.
3. To study various parts of a dc machine and draw sketches of the same.
4. To plot the external characteristics of a separately excited dc generator.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Calculate various electrical parameters of circuits.
- Apply solutions to diodes and amplifiers.

DFT293C FOOD PROCESS ENGINEERING **CREDITS: 0-2 (1)**

COURSE OBJECTIVES:

- To demonstrate the principle of drying and data assessment.
- Evaluation of the thermal processing time calculation by numerical and graphical methods.
- To demonstrate the components of vapor compression refrigeration system.
- To describe the basic concepts of extrusion process and its application in food processing.
- To have an exposure to live operation of a food processing unit.

Practicals:

1. Determination of thermal process time by graphical & formula method.
2. Drying rate characteristics of different food materials.
3. To study the drying characteristics of a given material in a fluidized bed dryer.
4. Study of rehydration process and determination of diffusivity and activation energy.
5. Determination of sorption isotherm of a food sample.
6. Study of design parameters and refrigeration load capacity of a cold storage plant.
7. Determination of freezing curve and freezing time of selected food material.
8. Visit to a food processing industry

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Understand various basic operations of food processing.
- Hands on training on various drying equipments and apparatus.
- Understand the determination of thermal processing time, drying time and energy balance in refrigeration process.
- To understand the behavior of food material during drying, freezing and extrusion processes.

DFT294E FOOD BIOTECHNOLOGY LABORATORY **CREDITS: 0-4 (2)**

COURSE OBJECTIVES:

- Operation and control of Fermenter.
- Production of microbial products like alcohol, Yoghurt etc, and production of yeast biomass.
- Down streaming of various microbial products.

Practicals:

1. To study different parts of a fermentor
2. To study the operation /working of a fermentor
3. To study media formulation a and sterilization of a fermentation process
4. Production of Alcohol.
5. Isolation and screening of microorganisms for antibiotic production (crowded plate technique).
6. Preparation of Yoghurt.
7. Visit to fermentation plant.

COURSE OUTCOMES:

After completion of course, the students would have learned:

- Handling and use of fermenter.
- Production of various industrially important microbial products and microbial biomass.
- The bio-recovery of microbial products.

SEMESTER-V

DFT301C HEAT TRANSFER OPERATION **CREDITS: 3 0 (3)**

COURSE OBJECTIVES:

- To learn the phenomenon of heating and cooling of food products.
- To understand the basic modes of heat transfer such as conduction, convection, and radiation.
- To study the fundamentals of heat transfer and learn how they are related to the design and operation of food processing equipment.
- To learn mathematical equations to design and evaluate the performance of simple heat exchangers.

UNIT I

Introduction: Basic modes of heat transfer. Heat transfer by conduction: basic laws of conduction, resistance in series, heat flow through plane wall, composite wall and cylinders, Overall coefficient of Heat Transfer, Unsteady State Heat Transfer, Applications in Food Industry, Enthalpy balance in Heat Exchange equipment.

UNIT II

Heat transfer by Convection- natural and forced. Heat transfer by Radiation- Stefan-Boltzman, black body radiation, emission, irradiation, surface absorption, reflection and transmission, gray surface, microwave heating, mechanism of microwave heating, microwave oven and microwave heating of food and its application in food industry.

UNIT III

Evaporation- energy and material balance. Types of evaporation-open kettle evaporator, falling film evaporator, Rising Film Evaporator, forced circulation evaporator, agitated film evaporator, Counter and Parallel Flow, LMTD, single and multiple effect evaporator.

UNIT IV

Heat exchange equipment. 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 exchanger for food industry, Ohmic Heating.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- To get familiarized with the various thermal properties of the food.
- To understand phenomenon of heat transfer as basis for understanding how various food processes operate.
- To understand various heat transfer operations applied in food industry.

Books Recommended:

1. *Kern, D. Q., Process Heat Transfer, MC Graw Hill Publication, New Delhi.*
2. *Dutta, B. K., Heat Transfer Principles and Application, PHI.*
3. *Mccabe W.L., Smith, J.C. (2008). Unit Operations of Chemical Engineering 7th edition, MC Graw Hill Publication, New Delhi.*

DFT302C ENGINEERING PROPERTIES OF FOOD **CREDITS: 2 0 (2)**

COURSE OBJECTIVES:

- To introduce the students to the basics and important surface properties of food materials
- To teach the importance of thermal properties of foods in different states
- To teach the rheological characteristics of food materials and their industrial significance.
- To describe the electric and dielectric properties applied in various novel processing techniques of foods

UNIT I

Surface Properties of Foods:

Gibbs Adsorption Equation, Absorption and Adsorption Characteristics of Food Material, Interfacial Energy, Angle of Repose, Contact Angle and Surface Tension of Food

UNIT II

Thermal and Thermodynamic Properties of Foods:

Latent Heat, Specific Heat of Unfrozen and Frozen Foods, Thermal Conductivity of Unfrozen and

Frozen Foods, Thermal Diffusivity of Unfrozen Foods and Frozen, Thermal Compression and Expansion, Glass and Phase Transition in Food Materials

UNIT III

Rheological and Textural Properties of Foods:

Viscosity and Deformation in Food Material, Flow Behavior, Viscous and Plastic Flow, Viscoelastic Behavior, Compression, Snapping-Bending, Cutting Shear, Puncture, Penetration, Texture Profile Properties Farinograph and Mixograph

UNIT IV

Electric and Dielectric Properties of Foods:

Electrical Conductivity and Ohmic Heating of Food Material, Maxwell's Equations of Electromagnetics, Dielectric Constant and Dielectric Loss Factor of Foods, Radiofrequency and Microwave Heating of Food Material

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Understand various important and basic physical properties of food materials
- Comprehend the engineering aspects of food properties
- Understand the principle of electric and dielectric properties and their importance in food processing

Books Recommended:

Rao, M.A., Rizvi, S.S.H,. Dutta, A.K. and Ahmad, J. (2014). Engineering Properties of Foods (4th Edition). CRC Press Taylor & Francis Group, 6000 Broken Sound Parkway NW, Suite 300 Boca Raton, FL 33487-2742

1. *Sahin, S. and Sumnu, S.G. (2006). Physical Properties of Foods. Springer Science+Business Media, LLC., 233 Spring Street, New York, NY 10013, USA.*

DFT307C MILK AND MILK PRODUCTS TECHNOLOGY CREDITS: 2 0 (2)

COURSE OBJECTIVES:

- To develop knowledge of students in technology, manufacturing, processing and packaging of different milk products viz; concentrated, dried, fermented, coagulated and frozen dairy products.
- To impart knowledge about dairy hygiene and sanitation.

UNIT I

Concentrated and dried milk products- Basic technology of concentration and drying. Manufacture of concentrated milk - bulk condensed milk, canned evaporated milk and sweetened condensed milk. Manufacture of skim milk powder and whole milk powder. Physico-chemical properties of concentrated and dried milks. Changes affecting the quality of concentrated and dried milks. Microbiology of concentrated and dried milk products. Nutritive value of concentrated and dried milk products.

UNIT II

Cream, butter, margarine, spreads and cheeses- Handling of cream, processing of single, double, and coffee, whipped, scalded, dried and frozen creams. Chemistry and microbiology of cream and its application in non-dairy products. Chemistry, technology and microbiology of butter, margarine, spreads. Nutritive value of cream based milk products.

UNIT III

Frozen and Indian dairy products- Ice cream-role of ingredients, technology of ice creams, low fat frozen desserts, sherbets and ices. Physico-chemical nature of ice cream and microbiology of ice creams. Manufacture of traditional Indian dairy products.

UNIT IV

Dairy hygiene and sanitation-Introduction to hygiene and sanitation, CIP and COP scheduling, deposit formation, cleaning and disinfection. Legal standards for milk and milk products.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- The students will gain knowledge about specific technologies and manufacture of different milk and milk products.
- The students are expected to understand the nutritional importance of different milk and milk products.
- The students will gain knowledge about the good hygienic practices in the manufacture of different milk products.

Books Recommended:

1. *Smit, Gerrit (2003). Dairy processing: improving quality, Woodhead publishing limited, England.*
2. *De, Sukumar (1991). Outlines of dairy technology, Oxford university press, Delhi.*
3. *Varnam, A.H., Sutherland, J.P. (1994). Milk and milk products, Chapman and Hall, New York, USA*
4. *Walstra, P., Geurts, T.J., Noomen, A., Jellema, A., Boekel, M.A.J.S (1999). Dairy Technology: Principles of milk properties and processes, Marcel Dekker, Inc, New York.*

DFT304C FOOD ADDITIVES & INGREDIENTS **Credits2 0 (2)**

COURSE OBJECTIVES:

- To develop the understanding of additives used in food products and the benefits thereof.

UNIT I

Food additives- definitions, classification and functions, Nutritional and non-nutritional food additives. Naturally occurring food additives -vitamins, minerals and amino acids.

UNIT II

Food Preservatives : Introduction; Classification- Natural & chemical preservatives; Mode of action; Role in Food processing Antioxidants & chelating agents: Introduction; Role in foods; Types of antioxidants -natural & synthetic; Mode of action of antioxidants in foods; Chelating agents- Naturally & synthetic; Mode of action of chelating agents; Applications of antioxidants and chelating agents

UNIT III

Stabilizers, thickeners and Emulsifiers: Introduction; Types; Applications in food processing; Sweeteners: Introduction; Classification- Artificial sweeteners & Nonnutritive sweeteners; Health implications; Role in food processing. Bleaching & maturing agents: Introduction; Different bleaching & maturing agents; Role in food processing. Taste and Flavoring agents

UNIT IV

Colors: natural and synthetic, stability and applications, permitted colors, enzymes: types and applications, Starch modifiers: Introduction; Chemical nature; Role in food processing.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Define the utility and effects of using additives in food.

Books Recommended:

1. *Branen AL, Davidson PM &Salminen S. 2001. Food Additives. 2nd Ed.Marcel Dekker.*
2. *Gerorge AB. 1996. Encyclopedia of Food and Color Additives. Vol. III.CRC Press.*

DFT306C CEREAL, PULSES & OILSEED TECHNOLOGY **CREDITS: 3 0 (3)**

COURSE OBJECTIVES:

- To impart knowledge about the physical structure and chemical composition and milling of wheat.
- To make the students aware with knowledge and understanding the basic structure, composition and different processes involved with rice and corn and millet processing.
- To expose the students to composition, processing and storage of pulses and to impart them with different extraction methods and refining processes related to edible fats and oils.

UNIT-I

General introduction, production Importance of cereals. Losses, spoilage, storage and protection of food grains. Cereal starches and Proteins
Wheat: Structure, Types, Composition and physicochemical characteristics. Cleaning, tempering and conditioning. Wheat milling, Patent Flour Quality characteristics and their rheological properties of wheat milling products. By product utilization.

UNIT-II

Rice: Structure, Classification, Quality Characteristics, physicochemical properties of rice. Milling and Parboiling of Paddy, Curing and aging of paddy. Criterion and assessment of milling, cooking, nutritional and storage qualities of raw and parboiled rice. Processed rice products (Flaked, expanded and puffed rice). By products (Husk and rice bran utilization).

UNIT-III

Corn and other coarse grains: Structure, types and Composition of Corn. Wet and dry milling of corn. Starch and its conversion products, Processed corn products (Popped corn, corn flakes etc), Maize germ oil Importance of other cereals and Millets.Pearling and Malting of Barley. Oats: milling and its products

UNIT-IV

Pulses and Oilseeds: composition, anti-nutritional factors, processing and storage. Processing of legumes for protein concentrates and isolates. Milling of pulses. Sources, chemical composition and functional importance of some important oilseeds. Processing technologies for oil extraction, Refining of oils and different processing like fractionation, winterization, inter-esterification Hydrogenation

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Know the importance of cereals, legumes and oilseeds in human nutrition.
- Understand and gain the knowledge of structure, composition and different milling processes associated with wheat, rice, corn and millets.
- Expose the students to different processes related to production of Flaked, puffed rice, pop corn, corn flakes etc
- Understand different refining processes and detection of adulteration in oils and fats.

Books Recommended:

1. *Chakrabarty MM. 2003. Chemistry and Technology of Oils and Fats.Prentice Hall.*
2. *Dendy DAV &Dobraszczyk BJ. 2001. Cereal and Cereal Products. Aspen. Hamilton RJ & Bhati A. 1980. Fats and Oils - Chemistry and Technology. App. Sci. Publ.*
3. *Hoseney RS. 1994. Principles of Cereal Science and Technology. 2nd Ed. AACC.*
4. *Kay DE. 1979. Food Legumes. Tropical Products Institute.*
5. *Kent NL. 1983. Technology of Cereals. 4th Ed. Pergamon Press.*
6. *Kulp K & Ponte GJ. 2000. Handbook of Cereal Science and Technology. 2nd Ed. Marcel Dekker.*
7. *Lorenz KL.1991. Handbook of Cereal Science and Technology. Marcel Dekker.*
8. *Marshall WE & Wadsworth JI. 1994. Rice Science and Technology.Marcel Dekker.*
9. *Mathews RH. 1989. Legumes Chemistry, Technology and HumanNutrition. Marcel Dekker.*
10. *Matz SA. 1969. Cereal Science. AVI Publ.*
11. *Paquot C. 1979. Standard Methods of Analysis of Oils, Fats and Derivatives. Pergamon Press.*
12. *Pomeranz Y. 1987. Modern Cereal Science & Technology. VCH Publ.*
13. *Salunkhe DK.1992. World Oilseeds: Chemistry, Technology andUtilization. VNR.*
14. *Swern D. 1964. Bailey's Industrial Oil and Fat Products. InterSci. Publ.28*
15. *Watson SA & Ramstad PE.1987. Corn; Chemistry and Technology.*

DFT341C HEAT TRANSFER OPERATION LABORATORY CREDITS: 0-2 (1)

COURSE OBJECTIVES:

- To get familiarized with various thermal properties used in the phenomenon of heat transfer.
- To learn to calculate various heat transfer coefficients using various demonstration setups.
- To observe the heat exchange phenomenon in heat exchanger and evaporator.

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.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- To have hands on training to various heat transfer apparatus.
- To gain practical exposure to various heat exchange equipments and to relate them with the theory course.

DFT342C ENGINEERING PROPERTIES OF FOOD LABORATORY CREDITS: 0-2 (1)

COURSE OBJECTIVES:

- To demonstrate various important characteristics of different food materials
- To demonstrate evaluation of surface characteristics of food material
- To demonstrate flow behavior characteristics of different food materials
- To demonstrate the concept of electrical heating and evaluation of various relevant parameters

Practicals:

1. Determination of the angle of repose of food material of different particle/gain size
2. Determination of surface tension and contact angle of a spread and ketchup
3. Determination of the contact angles of powdered food material onto the air-liquid interface
4. Study of flow behavior of different Newtonian and non Newtonian food materials
5. Determination of glass transition temperature of fruit juice sample using temperature ramp frequency seep test
6. Study on electrical conductivity of a liquid food material using lab scale ohmic heating setup

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Recognize various physical properties of food materials and their importance
- Comprehend the evaluation of engineering aspects of food properties
- Understand the principle of concept of ohmic heating or electrical resistance heating and relevant parameters

DFT343C FOOD ADDITIVES & INGREDIENTS LABORATORY **CREDITS: 0-2 (1)**

COURSE OBJECTIVES:

- To carry various tests of food additives and use them in food

Practicals:

1. Determination of oxidizing agent in wheat flour
2. Detection of flavour Enhancers (MSG) in various foods.
3. Use of potassium metabisulphite as an antioxidant agent.
4. Determination of diacetyl content of butter
5. Spectrophotometric method for total chlorophyll.
6. Determination of calcium oxide.
7. Determination of volatile oil.
8. Detection of oil soluble color.
9. Extraction of oleoresins from spices.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Evaluate various food ingredients for their quality

DFT346C CEREALS, PULSES & OILSEED TECHNOLOGY LABORATORY CREDITS: 0-2 (1)

COURSE OBJECTIVES:

- To train the students to learn to evaluate proximate composition of different cereals, legumes and oilseeds.
- To familiarize the students with new techniques regarding evaluation of nutritional components.
- To train the students to compare different rice verities on the basis of cooking quality.
- To expose the students to industrial exposure.

Practicals:

1. Determination of wet and dry gluten from wheat flour.
2. Conditioning of wheat
3. Parboiling of rice
4. Quality tests of rice
5. Assessment of degree of polishing
6. Malting of barley
7. Puffing and popping of grains.
8. To check the cooking quality of different rice Varieties.
9. Visit to local roller flour mill.
10. Visit to local bakery.
11. Visit to local rice hulling unit.
12. Extraction of oil using expellers
13. Study of milling characteristics using ball mill

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Impart practical training to students regarding the analysis of proximate composition, Evaluation of ingredients for use in bakery and to train them to evaluate different physical as well as chemical parameters of cereal grains.

DFT347C MILK AND MILK PRODUCTS LABORATORY **CREDITS: 0-2 (1)**

COURSE OBJECTIVES:

- To acquaint students with different sampling techniques applied to different milk products
- To learn and understand the principle, procedure and requirements for carrying out different tests of milk and milk products.
- To learn the methods of manufacture of different milk products.

Practicals:

Sampling equipment and milk sampling.

1. Platform tests (Acidity, COB and Alcohol test).
2. Organoleptic tests.
3. Determination of specific gravity by lactometer.
4. Determination of liquid milk fat by Gerber's method.
5. Separation and standardization of milk.
6. Testing efficiency of pasteurization of milk.
7. Determination of common adulterants and preservatives in milk.
8. Determination of SNF percentage and TS percentage of milk with lactometer.
9. Methylene blue reduction test of milk.
10. Preparation of flavoured milk.
11. Cream separation.
12. Preparation of khoa.
13. Preparation of paneer and channa.
14. Preparation of kaladhi.
15. Visit to different milk processing plants.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- The students will understand the importance of milk testing for the safe production and consumption of milk and milk products.
- To develop the practical skills of students related to milk testing methods.
- The students will be able to prepare different milk products

SEMESTER-VI

DFT352C PACKAGING TECHNOLOGY **CREDITS: 3 0 (3)**

COURSE OBJECTIVES:

- To impart knowledge and skills on the various aspects of selection of packaging materials for the packaging of food products
- To acquaint the students about the various types, characteristics and functional properties of various packaging materials.
- To impart the knowledge about the various packaging operations related to packaging machinery

UNIT I

Introduction to packaging, definition and new forms of packaging, Packaging design and development, marketing requirements, levels of packaging material selection and machinery considerations

UNIT II

Different types of packaging materials, their key properties and applications, metal cans, plastic packaging, different types of polymers used in food packaging and their barrier properties. Manufacture of plastic packaging materials; glass containers, types of glass used in food packaging, manufacture of glass and glass containers, closures for glass containers. Paper and paper board packaging, modification of barrier properties and characteristics of paper/ boards.

UNIT III

CAP and MAP, shrink and cling packaging, vacuum and gas packaging; active packaging, factors affecting the choice of packaging materials, disposal and recycle of packaging waste, Printing and labelling; lamination. Tests on packaging materials – mechanical tests, permeation tests – GTR, WVTR, and migration tests.

UNIT IV

Advanced Food Packaging Technologies Retort Pouch, Aseptic Packaging, Modified atmosphere packaging, Active packaging moisture, CO2 & O2 control. Intelligent Packaging – Self-heating and Cooling cans, Indicators, Barcode and RFID, Sensors. Smart packaging, antimicrobial packaging, Nano-packaging, Edible packaging and biodegradable packaging.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- To understand the basic concept of packaging and its packaging functions.
- To understand the properties of packaging materials along with their methods of testing and evaluation.
- Ability to understand the basic concept of packaging materials and their various forms.
- To give the detailed account of protective lacquers and coatings for metal containers.

- To understand the basic concept about the rigid and flexible plastics, containers and films along with their mechanical and sealing properties.
- Ability to understand the various aspects related to packaging equipment and machinery including vacuum packaging machines, seal and shrink-packaging machine.
- To understand different forms of Food packaging systems for different food products including dehydrated foods, dairy products, meat, poultry and sea foods.
- Ability to understand the specialized techniques in food packaging including Active and intelligent packaging systems,retortable pouches and aseptic packaging

Books Recommended:

1. *Principal of Food Packaging by Sacharow& Griffin, Van NastrandRainhold Company, New York.*
2. *Food Packaging Materials by Mahadeviah&Growramma*
3. *A Handbook of Food Packaging by Frank A. Paine*
4. *Food Packaging Materials by N.T.Crosby*
5. *Canning and Aseptic Packaging by Ranganna, TMH.*
6. *Food Packaging: Principles and Practices by Gordon L.Robertson*
7. *Food Science and Processing Technology Vol. II by MridulaMirajkar and Sreelata Menon.*

ELE353G PROCESS CONTROL & INSTRUMENTATION **CREDITS: 3 0 (3)**

COURSE OBJECTIVES:

- To study introduction to instruments and their representation.
- To learn measurement principles, constructional features, advantages, limitation etc of various possible instruments for a particular measurement situation.
- To deal with the general treatment of Instruments and their characteristics.

UNIT I

An Industrial process, process parameters, Actuating and controlling devices, batch and continuous process. Measuring Devices: Elements of measuring system and their function, Process measurement: statics and dynamics, transducers: classification and its role in food industry.

UNIT II

Functions and general classification of instruments used in food industry: temperature measurement, Pressure, Level, water activity measurement, Humidity measurement, and color measurement, Viscosity of liquid foods, density, specific gravity. Biosensors for food application.

UNIT III

Concept of Transfer functions, Basics of Laplace Transform, Control System Block diagrams, Block diagram reduction, First and higher order systems, closed and open loop response, Response to step and impulse inputs, Transient response.

UNIT IV

P&ID symbology, PI and PID Controllers, design of controllers, cascade, ratio, feed forward, adaptive control, negative feedback control, internal model control, Tuning methods of controllers.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- To learn and understand Instrumentation principles, measuring techniques and data analysis.
- To familiarize the students with latest instruments used for food measurement and characterization.
- To lay emphasis on measurement standards and calibration methods which are essential feature of measurement operation in food industry.

Books Recommended:

1. *Bhuyan, Manabendra. (2006) Measurement and Control in Food Processing, CRC.*
2. *Instrumentation and Sensors for the Food Industry by Erika Kress-Rogers And Christopher J.B. Brimelow*
3. *Process Systems Analysis and Control, by Coughanowr, D. R., 2nd edition McGraw Hill 1991.*
4. *Principles of Industial Instrumentation, by Patranabis D.,*
5. *Principles of Industrial instrumentation by Eckman D.P., Willey Eastern,1978*
6. *Curtis Johnson (2004). Process Control Instrumentation. The Prentice Hall of India.*
7. *Eckman, D.P. (2004). Industrial Instrumentation. CBS Publishers & Distributors, New Delhi.*

354C FOOD SAFETY AND STANDARDS **CREDITS: 3 0 (3)**

COURSE OBJECTIVES:

- To impart the knowledge about the regulatory aspects of foods and their quality control.
- To acquaint the students about the Implementation of HACCP and its implications in food industries.
- To impart the knowledge about the industrial legislation Including WTO, GATT, Patent laws, acts.

UNIT I

Introduction to Quality,

Introduction to food safety and importance of safe food, Hazards and types of hazards, Food adulteration, common food adulterants; Methods to detect food adulteration. Quality management system, concept of total quality management (TQM).

UNIT II

Food safety standards act- 2006 and regulation 2011.- FSSAI- Functions, Registration and Licensing of food businesses, International Organization for standardization (ISO): Introduction, ISO standards, benefits. ISO 9000, ISO 22000; PRP for Food Safety: GAP, GMP, GHP, GLP – objectives, benefits in food industry, HACCP: Introduction, Principles of HACCP, Benefits of HACCP. AGMARK, BIS, Codex Alimentarius commission.

UNIT III

Industrial legislation, Disputes and trade unions, Industrial disputes act 1947, WTO, GATT, IPR.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Ability to understand the food quality evaluation and the basic concept of total quality control.
- To understand the various requirements related to good manufacturing practices, good hygienic process and codex alimentarius commission.
- To understand the basic concept of FSSAI, HACCP and its implications in food industries.
- To provide the students about the in-depth understanding of ISO 9000 series, ISO 22000 series and ISO19011.
- To understand the industrial organization and types of organization structure, forms of business organization.
- To impart the knowledge about the division of Industries including industrial sectors both private and public, social obligations of industries towards society.
- To provide the students about the in-depth knowledge related to Industrial legislation.
- To give the brief overview of industrial disputes act-1947, WTO, GATT, Patent Laws and IPR.

Books Recommended:

1. *Quality Assurance for the Food Industry by J. Andres Vasconcellos.*
2. *Food Safety Handbook by Ronald H. Schmidt and Gary E. Rodrick.*
3. *Bioterrorism and food safety by Barbara A. Rasco & Gleyn E. Bledsoe.*
4. *Quality control in food industry (Vol. I and II) by Kramer and Twingg.*
5. *Various acts, orders, standards & specification.*
6. *The prevention of Food Adulteration Act, 1945, Universal Laws*.

355E WASTE MANAGEMENT IN FOOD INDUSTRY **CREDITS: 2-0 (2)**

COURSE OBJECTIVES:

- To acquaint students with characterization and utilization of by-products from food industries.
- To understand the treatment processes of effluent from food industries.

UNIT I

Characterization and utilization of by-products from cereals, pulses, oilseeds, fruits, vegetables, plantation, dairy, eggs, meat, fish and poultry processing industries.
Elements of importance in efficient management of food wastes. Standards for emission or discharge of environmental pollutants from food processing industries

UNIT II

Unit concept of Treatment of food industry effluents. Screening, sedimentation, floatation as pre and primary treatments, biological oxidations: objects, organisms, reactions, oxygen requirements, aeration devices and equipments.
Treatments system: lagoons, trickling filters, activated sludge process, oxidation ditches, rotating biological contractors their variations and advanced modifications.

UNIT III

Advanced wastewater treatment systems. Physical separations, Micro-strainers, Filters, Ultra filtration and reverse osmosis. Physico-chemical separations: activated carbon adsorption, Ion exchange electro-dialysis and magnetic separation. Chemical oxidations and treatment Coagulation and flocculation. Disinfection. Handling and disposal of sludge

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Classify and explain different types of food waste and their utilization.
- Outline industrial effluent generation patterns, as well as its management and disposal techniques.

Books Recommended:

1. *Water and waste water Tech. 5th Ed. By Mark & Hammer, PHI.*
2. *Industrial microbiology by L.E.Casida, New Age Publication.*
3. *Environmental pollution by K.C.Agrawal.*
4. *Environmental pollution control engineering by C.S. Rao.*
5. *Food processing waste management by green and Kramer (AVI)*
6. *By- products from food industries: utilization and disposal by AFSI*

DFT356C TECHNOLOGY OF SPICES, FLAVOUR AND PLANTATION CROPS CREDITS: 2-0 (2)

COURSE OBJECTIVES:

- To develop the understanding of spices and their processing.
- To study the flavors in various food products
- To acquaint students with the processing of plantation crops

UNIT I

Spices and condiments: definition. Classification, Chemical composition, uses and processing of different spices with focus on traditional spices-pepper, cinnamon, turmeric, fennel, chilli, cardamom (small and big), cumin, mint, ginger, garlic cloves, fenugreek, saffron. Oleoresins and essential oils, Cryogenic grinding of spices. Microbial contamination and insect infestation in spices and its control.

UNIT II

Food flavours- development of flavor during processing, natural and synthetic flavourings. Stability of flavours during food processing. Flavour enhancers, their properties and toxicity. Plantation Crops: Coffee: composition, post-harvest processing and manufacture of coffee powder. Instant coffee. Tea: composition, post-harvest processing, types of tea, their manufacture and grading. Cocoa and its products: cocoa bean, processing, cocoa powder, chocolate: types, manufacture and processing technology.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Explain various spices and flavors in food and processing of plantation crops.

Books Recommended:

1. *Purseglove, J.W. (1998). Spices Vol and Vol II, Longman Publicationers.*
2. *Tainter, D.R. And Grenis, A.T. (1993). Spices and Seasonings- A Food Technology Handbook, VCH Publisheers, Inc.*
3. *Merory, J. (1978). Food flavorings, Composition, Manufacture and Use, 2nd edition, AVI Publishing, INC.*
4. *Farrel, K.T. (1985). Spices, condiments and Seasonings, AVI Publiching, INC.*
5. *Heath, H, B. &Reineccius, G. (1996). Flavour Chemistry and Technology. CBS Publishers & Distributors, New Delhi.*

DFT392C PACKAGING TECHNOLOGY LABORATORY **CREDITS: 0-2 (1)**

COURSE OBJECTIVES:

To develop skills related to:

1. Various testing methods for packaging materials to assure Food Quality.
2. Use of various methods and techniques to check the barrier properties of packaging materials to avoid food contamination and spoilage.

Practicals:

1. Test the thermal shock resistance of glass container.
2. Determine the WVTR of some packaging materials.
3. To estimate wax content of wax paper.
4. To determine the bursting strength of a carton board.
5. To determine the amount of tin coating in a can plate.
6. Testing of lacquered tin plate steel for following: -

i. Continuity of tin layer
ii. Resistance of lacquer to acid

7. Determination of iron content in canned foods.
8. Test for alkalinity on the surface of glass jar.
9. To study the compression strength of a box.
10. To study the puncture resistance of a cardboard.
11. To study the drop resistance of a given packaging material.
12. Identification of different packaging materials
13. Tests of packaging materials

COURSE OUTCOMES:

After completion of course, the students will be able to:

- To develop the practical skills of students related to packaging material testing methods.
- Students will get acquainted about the Testing of lacquered tin plate steel.
- Students will get the experience about the testing of drop resistance of different packaging materials.

ELE393G PROCESS CONTROL & INSTRUMENTATION LABORATORY CREDITS: 0-2 (1)

COURSE OBJECTIVES:

- To gain hands on experience to various instruments used for measurement in food Industry.
- To understand various systems of units in use.
- To familiarize with static performance characteristics and dynamic characteristics of Instruments respectively.

Practicals:

1. To study the performance of Relay control combination of P,I and D control schemes in a temperature control system.
2. To study the open loop and closed loop step response of first, second and third order simulated linear systems.
3. To measure the pressure using Bourdon tube pressure gauge.
4. Measurement of temp using thermocouple device.
5. Determination of accuracy and precision of different types of weighing balances.
6. Study of different aspects of length/dimension measuring instruments.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- To augment the engineering aspect of measurement and analysis in food processing and technology.
- To familiarize the students with latest instruments used for food measurement and characterization.

DFT394C TECHNOLOGY OF SPICES, FLAVORS AND PLANTATION CROPS LABORATORY CREDITS: 0-2 (1)

COURSE OBJECTIVES:

- To acquaint students with various quality evaluation tests of spices and flavors

Practicals:

1. Determination of moisture in whole and ground spices.
2. Determination of total ash in spices.
3. Sampling and determination of extraneous matter in spices.
4. Determination of pungency rating (Scoville method) in red pepper.
5. Adulteration tests for different spices.
6. Organoleptic evaluation of flavours.
7. Identification of saffron by sulphuric – diphenylamine test.
8. Microscopic examination of spices.
9. Detection of Argemone seeds in mustard.
10. Extraction of oil

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Carry out quality evaluation of spices and flavors.

SEMESTER-VII

DFT401C MEAT, FISH & POULTRY PRODUCTS TECHNOLOGY CREDITS: 3-0 (3)

COURSE OBJECTIVES:

- This course aims to develop knowledge of students about the meat industry in India and abroad.
- The course aims to impart knowledge to students about techniques and practices in modern abattoirs/slaughter houses.
- The course will enable the students to appreciate the application of modern scientific principles in processing, packaging of meat and fish products.

UNIT I

Introduction: Present status of meat, poultry and fish industries in India. Traditional meat products. Sources of meat and meat products in India, importance of livestock sector in national economy. Chemical composition, nutritional profile and microscopic structure of meat

UNIT II

Modern abattoir practices- pre-slaughter care, ante-mortem inspection of live animals, slaughtering techniques of large animals, small animals and poultry. Post-mortem examination of meat, conversion of muscle into meat/post-mortem changes in meat, factors affecting postmortem changes in meat.

Properties of fresh meat- water holding capacity of meat, colour, pigments, texture and juiciness. Meat microbiology and safety- spoilage characteristics of meat, preventive measures for avoiding meat spoilage.

UNIT III

Meat processing- communition, emulsification, curing, smoking, ageing and tenderization. Meat products- fermented meats, comminuted meat products, sausages, ham, bacon and meat analogues. Meat storage and preservation- by moisture control (dehydration, freeze drying and intermediate moisture meat), by temperature control (chilling, freezing and thermal processing), by direct microbial inhibition (irradiation and chemical preservatives). Meat packaging, meat industry byproducts and their utilization.

UNIT IV

Inspection of live birds, slaughter and dressing of poultry. Composition and nutritive value of poultry meat.

Poultry products- structure, composition, nutritive value and functional properties of eggs, grading of eggs, measures of egg quality and factors affecting egg quality. Preservation and safe handling of eggs. Egg powder and egg based products.

Types of fish. Composition, structure, nutritional profile and post-mortem changes in fish.

Handling of fresh water fish. Canning of fish. Different fish products. Curing, smoking, salting, canning, freezing and drying of fish, Comminuted Fish Products, Fish protein concentrate, Packaging of fish, Utilization of fish and marine industry by-products.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- The students are expected to appreciate the importance of livestock sector in national economy.
- The students are expected to understand and identify the need of modern scientific abattoirs/ slaughter houses.
- The students will gain knowledge about the specific processing technologies used for meat, poultry and fish products.

Books Recommended:

1. *Lawrie, R. A. (1975). Meat Science. 2nd Edn. Pergamon Press. Oxford UK.*
2. *Annonymous (1995). Meat processing and Meat Products Handbook, EIRI Board of Consultants and Engineers, Indian Institute of Consultants, New Delhi.*

DFT402C BAKERY, CONFECTIONERY AND SNACK TECHNOLOGY CREDITS: 3-0 (3)

COURSE OBJECTIVES:

- To make the students aware about food safety rules and regulations and maintenance of hygienic conditions in bakery units.
- To impart knowledge about different ingredients used in bakery and to make the students aware about production processes of different bakery products.
- To teach the students manufacturing processes involved for confectionary products and to evaluate their quality parameters.
- To make the students aware with knowledge and understanding in the basic operation and working of various equipments involved in bakery and confectionary technology.

UNIT I

Current Status, growth rate and economic importance of Bakery and Confectionary Industry in India, Food safety rules and regulations for bakery and confectionary products and hygienic conditions required in bakery plant; Essential and optional ingredients; Functionality of bakery ingredients, Flour grades and their suitability for baked goods.

UNIT II

Bread: Principles and different methods of dough formation: Equipments used in Bakery: Dividers, Rounders, Proofers, Moulder and Sheeter, Slicer and Baking Ovens. Operation and maintenance of bakery equipments. Rheological testing of Dough:- Farinograph, Mixograph, Entensiograph, Amylograph/ Rapid Visco Analyzer, Falling number and interpretation of the data.

UNIT III

Quality Characteristics of bread. Staling and losses in baking, Bread Faults and remedies. Other bakery Products: Methods of preparation and quality Evaluation of biscuits, cookies, cakes, doughnuts, and rusks.

UNIT IV

Confectionary Products: Characteristics and processing of raw material; Technology of manufacture of hard boiled candies, toffees, chocolates, chewing-gum and other confections, Product quality parameters, defects and corrective measures.

UNIT V

Snack foods: Types, specifications, compositions, ingredients, Formulations, processing, equipment, packaging, storage and quality testing, Snack food seasonings

COURSE OUTCOMES:

After completion of course, the students will be able to:

- To gain the knowledge about the current status of bakery and confectionary industry in India and world.
- Build knowledge about the manufacturing processes of different bakery products and their quality evaluation.
- Develop knowledge about raw materials used and technology for the manufacturing of confectionary products and will be able to assess different defects and their remedial measures.
- Acquire knowledge of working, operation, and maintenance of various bakery equipments used in bakery units.

- Get the experience of testing dough and batters for different rheological parameters.

Books Recommended:

1. *Bernrd .Minife. W. (2003), Chocolate, Cocoa and Confectionary.*
2. *Mathur. R.B.L. (1999), Handbook of cane sugar technology, CBS Publishers.*
3. *FaridiHamed , (2003), The Science of Cookie and Cracker Production.*
4. *Matz, (1989). Bakery Engineering and Technology, Vol I and II, CBS Publishers, New Delhi.*
5. *Stanley. P & Linda. S. (2007), Technology of Bread Making, Blackwell Publishing. Stanley. P & Linda. S. (2006), Baked Products, Blackwell Publishing.*
6. *Matz, (1989). Cookie and Cracker Technology, CBS Publishers, New Delhi.*
7. *FaridiFaubion, Dough Rheology and Baked product texture.*

DFT404F CREDIT SEMINAR **CREDITS: 1-0 (1)**

Components:

- Presentation: The student would be required to deliver a power point presentation on a topic pertaining to the field, comprised but not limited to:
- Background, Introduction, Advantages, Disadvantages, Applications, Future, and conclusion
- Write-Up: Providing a thorough account of the topic to be submitted as a hard-copy.
- Discussion: Question and answer session aimed to judge the knowledge level of the student for the topic under question.

DFT407G FOOD PLANT LAYOUT AND MANAGEMENT **CREDITS: 3-0 (3)**

COURSE OBJECTIVES:

- To acquaint students with various concepts such as economics, layout and human resource essential to industries.

UNIT I

Nature, scope and types of marketing, marketing environment, strategic marketing planning, marketing information system and marketing research. Market segmentation, targeting and positioning. Product decisions: product mix, product life cycle, new product development, branding decisions (Basis). Pricing: objectives, channel, management-channel types

UNIT II

Plant Location and Layout-Concept and factors governing plant location. Location economics comparison of rural vs urban plant sites, plant site selection guide. Classes of layout problems, objectives, principles and types of layouts. Layouts of different types of food and fermentation industries – canning, dairy, bread, biscuit, beer, tomato processing, rice mill and wheat mill.

UNIT III

Factory Building and Cost Analysis- Considerations in building design and construction. Fixed cost, variable cost, depreciation, methods of economic analysis, profitability analysis of a plant.
Plant Maintenance-Objectives and importance of maintenance, Factory Building and Cost Analysis Considerations.

UNIT IV

Introduction- Introduction to Human Resource Management and its definition, functions of human resource management, Causes and effects of industrial disputes in India, Need for human resource planning, process of human resource planning, methods of recruitment, Meaning and importance of placement and induction. Training and development- Difference between training and development, principles of training.

COURSE OUTCOMES:

After completion of the course the students will be able to:

- Understand and use the managerial concepts learned in food industries

DFT406C POST HARVEST TECHNOLOGY OF FRUITS & VEGETABLES CREDITS: 3-0 (3)

COURSE OBJECTIVES:

- To impart the knowledge of post harvest changes occurring in the fruits and vegetables.
- To provide broader overview of ripening processes in fruits.
- To provide knowledge of integrated post harvest management of crops.
- To provide an overview of different storage system for fresh produce.

UNIT I

Importance and role of post-harvest technology. Present status of post-harvest technology in India. Post-harvest changes in fruits and vegetables: Composition, nutritive value, and factors affecting post-harvest losses. Factors responsible for changes in color, texture, and flavor after harvest. Respiration and water loss: Physiology of respiration, factors affecting the rate of respiration, respiratory quotient, and calculations based on Q10. Loss of water from harvested horticultural crops.

UNIT II

Biosynthesis of ethylene: Regulation and action on harvested fruits. Role of ethylene in fruit ripening. Controlling agents for regulating ethylene action. Ripening process: Fruit maturation and physiological changes. Climacteric and non-climacteric fruits. Climacteric drift: Special reference to apple and avocado.

Non-ripening mutants of tomato.

UNIT III

Post-harvest handling and transportation of fruits and vegetables: Importance and need. Maturity indices. Method of harvesting. Perishable and durable crops. Cooling of produce. Packaging. Methods of transportation. Causes of losses: Mechanical damage. Overheating. Supply chain management of fruits and vegetables.

UNIT IV

Storage systems for fruits and vegetables. Types of storage: Zero energy cool chamber. Low-temperature storage. Hypobaric storage. Modified atmospheric storage. Controlled atmospheric storage.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Understand the post harvest biology of fruits and vegetables.
- Grasp the techniques available for storage of fresh produce after harvest.

Books Recommended:

1. *Wills, R.B. (2002).Post harvest: An Introduction to the physiology and handling of fruits and vegetables, CBS Publishers & Distributors, New Delhi.*

2. *Kadar AA.1992. Post-harvest Technology of Horticultural Crops. 2nd Ed. Universiity of California.*
3. *Pantastico B. 1975. Post Harvest Physiology, Handling and Utilization of Tropical and Subtropical Fruits and Vegetables. AVI Publ.*
4. *Salunkhe DK, Bolia HR & Reddy NR. 1991. Storage, Processing and Nutritional Quality of Fruits and Vegetables. Vol. I. Fruits and Vegetables. CRC.*
5. *Thompson AK. 1995. Post Harvest Technology of Fruits and Vegetables.Blackwell Sci.*
6. *Lloyd, A. &Penizer, R (1998). Handling, transportation and storage of fruits and vegetables, AVI Publications*

DFT441C MEAT, FISH & POULTRY TECHNOLOGY LABORATORY CREDITS: 0-2 (1)

COURSE OBJECTIVES:

- The students will learn about meat cutting and handling.
- The students will learn about the procedure for carrying out the physio-chemical and microbiological analysis of various milk and fish products.
- The students will learn about the different measures of egg quality.

Practicals:

1. Determination of Ph of meat.
2. Determination of meat swelling capacity
3. Determination of extract release volume of meat
4. Determination of specific density of an egg
5. Preparation of various value added meat products
6. Slaughtering and dressing of poultry
7. Measures of egg quality
8. Preservation of shelled eggs by various methods
9. Analysis of fish products
10. Studies on hygiene and sanitation in meat processing plant
11. Visit to meat/poultry/egg processing plant.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Analyze the different samples of meat, fish and poultry products.
- Prepare and analyze different value added meat products

DFT442C BAKERY & CONFECTIONARY TECHNOLOGY LABORATORY **CREDITS: 0-2 (1)**

COURSE OBJECTIVES:

- Train the students regarding quality evaluation of ingredients used in bakery.
- Acquaint with the preparation of various bakery and confectionary products and perform quality analysis for the same.
- Expose the students to industrial exposure.

Practicals:

1. Perform the quality test on wheat flour/ maida for bakery application on different parameters (moisture, Total ash, gluten content, sedimentation value).
2. Perform quality assessment test for yeast and skimmed milk powder for bakery application.
3. Preparation of bread, cookies and cake.
4. Development and quality evaluation of baked products based on composite flour;
5. Preparation of confectionery products.
6. Quality evaluation of confectionery products.
7. Visit to bakery and confectionary Industries.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- The students will gain knowledge about processing of cereal grains and preparation of bakery products. The students will get practical knowledge which inturn will help them to get adjusted in bakery industries.

DFT445C POST HARVEST TECHNOLOGY OF FRUITS & VEGETABLES LABORATORY CREDITS: 0-2 (1)

COURSE OBJECTIVES:

- To demonstrate different techniques of post harvest management in fruits and vegetables.
- To demonstrate working of different storage systems available.
- To expose students to the artificial ripening methods used commercially.

Practicals:

1. Evaluation of morphological features of some selected fruits and vegetables.
2. Evaluation of maturity indices of fruits and vegetables.
3. Identification of equipment and machinery used in preservation of fruits and vegetables
4. Packaging methods and types of packaging.
5. Studies on effect of post harvest treatments for shelf life elongation of fruits.
6. Studies on various storage systems and structures.
7. Identification of physiological disorders and spoilages in fruits and vegetables.
8. Visit to commercial packaging house and CA store.
9. Visit to fruit ripening units.
10. Study and preparation of can products
11. Visit to fruit orchard.
12. To determine the optimum temperature for storage of different fruits and vegetables.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Understand post harvest morphological changes in fruits and vegetables practically.
- Grasp practical knowledge on working of packaging houses and CA stores.
- Gain practical knowledge of different pre-cooling techniques adopted for fruits and vegetables

DFT444C ADVANCED INSTRUMENTATION LABORATORY **CREDITS: 0-2 (1)**

COURSE OBJECTIVES:

- To make students familiar with the advanced instrumentation in food technology
- To make students understand the principle and application of instruments in food analysis

Practicals:

1. Chromatography: Theory, components, working, and applications of HPLC, UHPLC and GC
2. Spectroscopic techniques: Theory, instrumentation and applications of FTIR, NIR, UVVisible
3. Mass Spectrometry: Principle and applications in GC, LC and ICP
4. Atomic absorption spectroscopy: Theory, components and applications of AAS
5. Refractometry and colorimetery: Theory, principle, and applications of bench top refractomer and hunter Lab colorimeter
6. Rheological and texture measurements: Principle, instrumentation and working of Rheometer; texture analyser; viscometer and rapid visco analyser (RVA)
7. Differential scanning calorimetry: Principle, working and applications of DSC
8. Nuclear magnetic resonance: Principle, instrumentation, applications and interpretation of NMR spectra
9. Microscopy: Theory, instrumentation, and its applications of Scanning electron microscope and Transmission Electron Microscope
10. X-ray crystallography: Principle, applications and interpretation of spectra.
11. Polymerase chain reaction: Principle and applications in food.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Understand the working and principle of instruments used in food technology
- Understand the role of advanced instrumentation in understanding the food matrix

SEMESTER-VIII

DFT450C IN-PLANT TRAINING, PROJECT REPORT, SEMINAR AND GROUP DISCUSSIONS CREDITS: 20

OBJECTIVES:

- To provide students with a practical exposure of food industries so as to enable them to visualize the concepts learned and prepare them for the field.
- To learn about the operation and functioning of food industries.

The in-plant training is to be completed in three Months from the industry within or outside J&K.
In Plant training which will be followed by the report submission and Viva-voce.

OUTCOMES:

- Apply the expertise gained during the internship to deliver and demonstrate better skills

GUIDELINES FOR THE PREPARATION OF INPLANT TRAINING PROJECT REPORT

Writing format:

- The report should be typed in MS word format, Times New Roman (12 font size), 1.5 line spacing. Alignment should be in 'justify' mode.
- The main headings should be in Times New Roman (14 font size and bold). Sub-headings (or further subheadings) under each heading should be in Times New Roman (font size 12 and bold).
- Page numbering should be in the entire project report on right bottom corner.
- The binding color of the project report should be NAVY BLUE

Page set up:

- Left margin: 1.25"
- Right margin: 1.00"
- Top margin: 1.00"
- Bottom margin: 1.00"

Order or arrangement of pages (Start each heading from separate page):

1. TITLE PAGE (one outside i.e., on the cover; same page inside as well before certificates)
2. CERTIFICATE OF ORIGINAL WORK (BY STUDENT)
3. CERTIFICATE FROM THE INDUSTRY
4. CERTIFICATE FROM THE DEPARTMENT
5. ACKNOWLEDGEMENTS
6. LIST OF ABBREVIATIONS
7. MAIN BODY

Important Note:

- All the students are required to submit their report by incorporating all the instructions mentioned above.
- Departmental Training & Placement Coordinators are required to ensure that all the above instructions are followed and adhered to in totality by the students.

OPEN-ELECTIVES

FT-E01-T INTRODUCTION TO FOOD PROCESSING **CREDITS: 2-0 (2)**

COURSE OBJECTIVES:

- To provide students with the basic understanding of various food processing operations

UNIT I

Introduction, classification of thermal processes, principles of thermal processing, thermal resistance of microorganisms, thermal death time, lethality concept, characterization of heat penetration data, thermal process calculations

UNIT II

Dehydration: normal drying curve , effect of food properties on dehydration , change in food during drying ,drying methods and equipments air convection dryer, tray dryer, tunnel dryer, continuous belt dryer , fluidized bed dryer, spray dryer, drum dryer, vacuum dryer, freeze drying, foam mat drying

UNIT III

Freezing- mechanism and freezers freezing methods -direct and indirect, still air sharp freezer, blast freezer, fluidized freezer, plate freezer, spiral freezer and cryogenic freezing. food irradiation and microwave heating: ionizing radiation and sources, unit of radiations, direct and indirect radiation effects, safety and wholesomeness of irradiated food. microwave heating and application.

UNIT IV

Packaging of foods: Packaging: Properties of packaging material, factors determining the packaging requirements of various foods and brief description of packaging of frozen products, dried products, fats and oils and thermally processed foods

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Understand the various operations used in food processing

Books Recommended

1. *Arsdel WB, Copley MJ & Morgan AI. 1973. Food Dehydration. 2nd Ed. Vols. I, II. AVI Publ.*
2. *Desrosier NW & James N.1977. Technology of Food Preservation. 4th Ed. AVI. Publ.*
3. *Fellows PJ. 2005. Food Processing Technology: Principle and Practice. 2nd Ed. CRC.*
4. *Jelen P. 1985. Introduction to Food Processing. Prentice Hall. Potter NN & Hotchkiss*

FT-E02-T FOOD AND NUTRITION **CREDITS: 2-0 (2)**

COURSE OBJECTIVES:

- To provide students with the basic understanding of various nutrients and their requirements
- To acquaint students with the mechanisms of immunity and quality of diets

Unit I

Nutrient Requirements–Macronutrients

Historical perspective of nutrient requirements, methods of assessment of nutrient needs – a critical review, critical evaluation of sensitive methods and derivations of requirements and recommended dietary allowances of macronutrients for all age groups: energy values carbohydrates and dietary fibre, proteins and amino acids, lipids, water, critical evaluation of national and international nutrient allowances; factors affecting the nutritional requirements.

UNIT II

Nutrition, Immunity and Infection

Host defense mechanisms and nutrients essential in the development of immune system, effect of Infections on the nutritional status of an individual, nutrient deficiencies and excesses affecting the immuno-competence and susceptibility to infections, operational implications.

UNIT III

Nutritional Quality of Diets

Ways of enhancing nutritional quality of diets, assessment of protein quality, dietary diversification, bioavailability of nutrients, nutrient losses during cooking and processing.

UNIT IV

Emerging Concepts in Human Nutrition

Ongoing nutrition transition and its implications, changing trends in life style patterns in population groups and their implications, nutrigenomics, nutraceuticals, bioactive compounds.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Understand the various concepts in human nutrition and immunity.

Books Recommended:

1. *Handbook of Nutrition and Food, Third Edition Carolyn D. Berdanier, Johanna T. Dwyer, David Heber, CSC press*
2. *Gupta, K.L,, Gupta, C and GUpat, A(1993). Food nutrition, jaypee brothers.*
3. *Joshi,S.A (2000). Nutrition and dietetics by Tata McGraw Hill and Co.*

FT-E03-T HYGIENE AND FOOD SAFETY CREDITS: 2-0 (2)

COURSE OBJECTIVES:

- To provide students with the understanding of spoilage and diseases associated with food products
- To provide students with the understanding of basic concepts of preservation and hygiene

UNIT I

Food Spoilage and Preservation

Food spoilage: Definition, sources of contamination and microorganisms involved in spoilages of various foods: Milk, Bread, Canned food, Vegetables and fruits, Fruit juices, Meat, Eggs and Fish Physical and chemical means used in destruction of microbes: Definition of sterilization and disinfection, role of heat, filtration and radiation in sterilization, use of chemical agents-alcohol, halogens and detergents

UNIT II

Food Safety

Public health hazards due to microbial contamination of foods: Important food borne infections and intoxications due to bacteria, moulds, viruses (*Salmonella typhi, Helicobacter pylori, Campylobacter jejuni, Yersinia enterocolitica, Bacillus cereus, Staphylococcus aureus, Clostridium botulinum, Escherichia coli, Mycotoxins, Hepatitis A virus & Rota virus*)- Symptoms, mode of transmission and methods of prevention.

UNIT III

Hygiene and Sanitation

General principles of food hygiene, relation to food preparation, personal hygiene. food handling habits and water sources. impurities in water supply and treatment. sanitation facilities and procedures in food plant operation, rural and urban areas, fairs and festivals. disposal of sewage and right soil microbial standards for foods.

COURSE OUTCOMES:

After completion of course, the students will be able to:

- Understand the various concepts associated with food safety and hygiene.

Books Recommended:

1. *Gaston, Ed & Tiffney. (2000). Guide to improving food hygiene.*
2. *Mountney. J. &Geod. W.A. (2000) Practical food microbiology and Technology (2nd edition)*
3. *Hobbs. Betty C. (1998) Food Poisoning and food hygiene - (3rd Edition).*