

**DEPARTMENT OF FOOD TECHNOLOGY  
SCHOOL OF TECHNOLOGY**

**SYLLABUS**

**FOR**

**B. TECH FOOD TECHNOLOGY**

**(SEMESTER: I-VIII)**

**Choice Based Credit System  
(2015)**



**ISLAMIC UNIVERSITY OF  
SCIENCE AND TECHNOLOGY**

**ISLAMIC UNIVERSITY OF SCIENCE AND TECHNOLOGY  
AWANTIPORA, PULWAMA - 192122, J and K.**

**P.O. Box: 1418, G.P. O. Srinagar - 190 001.**

## B.Tech (Food Technology) Course Structure – at a Glance

### 1<sup>ST</sup> SEMESTER

Course Code	Course Title	Type of Course	L - P	Credit
PHY-111T/P	Applied Physics	C	3-2	4
CHM-111T/P	Applied Chemistry	C	3-2	4
MTH-101T	Applied Math	CF	4-0	4
BIO-101T	Applied Life Science	CF	4-0	4
BIO-102T	Environmental Science	CF	4-0	4
IDC-101T/P	Introduction to Computer Science	CF	2-6	5
CIV-101T/P	Engineering Drawing	CF	2-3	4
<b>Total Credits</b>				<b>29</b>

### 2<sup>ND</sup> SEMESTER

Course Code	Course Title	Type of Course	L - P	Credit
MTH-201T	Engg. Mathematics	CF	4-0	4
BFT-211T/P	Principles of Food Preservation	C	4-2	5
BFT-212T	Thermal Science	C	3-0	3
BFT-213T/P	Food Chemistry	C	4-2	5
BFT-214T/P	Food and Nutrition	C	3-2	4
BFT-215T/P	Basic & Food Microbiology	C	3-2	4
<b>Total Credits</b>				<b>25</b>

### 3<sup>RD</sup> SEMESTER

Course Code	Course Title	Type of Course	L - P	Credit
	Communicative English	G	2-0	2
<b>BFT-311T</b>	Food Hygiene & Sanitation	C	3-0	3
<b>BFT-312T</b>	Grain Storage Technology	C	3-0	3
<b>BFT-313T/P</b>	Fluid Mechanics	C	3-2	4
<b>BFT-314T</b>	Unit Operations in Food Processing	C	3-0	3
<b>BFT-315T/P</b>	Industrial Microbiology	C	4-2	5
<b>BFT-316T/P</b>	Post harvest physiology, handling & storage of fruits and vegetables	C	4-2	5
	Elective	G		
<b>Total Credits</b>				<b>25</b>

### 4<sup>TH</sup> SEMESTER

Course Code	Course Title	Type of Course	L - P	Credit
<b>BFT-411T</b>	Mass Transfer Operations	C	3-0	3
<b>ELE-417T/P</b>	Basic Electrical & Electronics	CF	3-2	4
	Industrial Economics	G	4-0	4
<b>BFT-402T/P</b>	Manufacturing Process	CF	2-6	5
<b>BFT-413T/P</b>	Food Process Engineering	C	4-2	5
	Elective	G		
<b>Total Credits</b>				<b>21</b>

## 5<sup>TH</sup> SEMESTER

Course Code	Course Title	Type of Course	L - P	Credit
BFT-511T	Heat Transfer Operation	C	4-0	4
BFT-502T/P	Process Control & Instrumentation	CF	4-2	5
BFT-503T/P	Food Regulation & Quality Control	CF	4-2	5
BFT-514T/P	Chemical Reaction Engineering	C	3-2	4
BFT-515T/P	Dairy Technology I	C	4-2	5
BFT-516T/P	Edible Oil Processing Technology	C	4-2	5
	Elective	G		
<b>Total Credits</b>				<b>28</b>

## 6<sup>TH</sup> SEMESTER

Course Code	Course Title	Type of Course	L - P	Credit
BFT-611T/P	Cereal & Legume Technology	C	4-2	5
BFT-612T/P	Dairy Technology II	C	3-2	4
BFT-613T/P	Food Additives & Ingredients	C	4-2	5
BFT-614T/P	Packaging Technology	C	4-2	5
BFT-605T/P	Technology of Effluent Treatment & Waste Management	CF	4-0	4
	Elective	G		
<b>Total Credits</b>				<b>23</b>

**7<sup>TH</sup> SEMESTER**

<b>Course Code</b>	<b>Course Title</b>	<b>Type of Course</b>	<b>L - P</b>	<b>Credit</b>
<b>BFT-711T/P</b>	Meat Fish & Poultry Technology	C	4-2	5
<b>BFT-712T/P</b>	Bakery and Confectionary Technology	C	4-2	5
<b>BFT-712T</b>	Food Plant Layout	C	4-0	4
	Human Resource Management	G	3-0	3
<b>BFT-713T/P</b>	Fruit and Vegetable Technology	C	4-2	5
<b>Total Credits</b>				<b>22</b>

**8<sup>TH</sup> SEMESTER**

<b>Course Code</b>	<b>Course Title</b>	<b>Type of Course</b>	<b>L - P</b>	<b>Credit</b>
<b>BFT-811P</b>	Industrial Training, Project report, Seminar and Group Discussions	C	0-52	26
<b>Total Credits</b>				<b>26</b>

## SEMESTER- I

PHY-111T/P APPLIED PHYSICS

CREDITS 3-2 (4)

### UNIT I

Electrostatics and Electrodynamics. Concept of electric field and potential, Gauss's law, Polarization of dielectrics, electrostatic energy, Forces on moving charges, Ampere's law.

### UNIT II

Mechanics: Viscosity, 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 III

Modern Physics: Wave-particle duality, de-Broglie concept, Uncertainty principle, Atomic spectra, Zeeman Effect, Stark effect, Paschenbeck effect, Raman spectroscopy.

### UNIT IV

Solid State Physics and Fiber optics : Distinction between metals, semiconductors, insulators on the basis of bands theory, Doping of semiconductors, contact potential, Hall effect, Qualitative description of PN-junction, Light emitting and photo diodes, Superconductivity, critical field.

Optical fiber, physical structure, basic theory, Application of optical fiber in information technology and sensors (briefly).

### Practical

1. Determination of dielectric constant of a solid
2. To study the characteristic of microwave wave guide.
3. To analyse the atomic spectra of Neon/Sodium lamp.
4. Determination of Electrical Resistivity of semiconductor using four probe method.
5. Determination of Hall coefficient and carrier type for a semiconducting material.
6. Determination of the transition temperature of a given super-conducting material.
7. Determination of Currie temperature of a Ferrite material
8. Determination of laser parameters like divergence, wave length etc. for a given laser source  
(2 or 3 experiments)
9. Study the attenuation and propagation characteristics of an optical fiber cable.
10. Modulation and demodulation of optical (Laser) signals.
11. Study characteristics of PN diode and zener diode.
12. Determination of the characteristics of Transistor and FET.
13. To analyse the suitability of a given zener diode as a power regulator.
14. To find out the intensity response of a solar cell/photo diode

***Books Recommended:***

1. Jordan, C and Balmain, K.G (1963). *Electromagnetic Waves and Radiating System*, (2nd Ed). Prentice Hall of Ind. Pvt. Ltd., New Delhi.
2. Griffith, D.J. (2001). *Introduction to Electrodynamics*, Prentice Hall of Ind. Pvt. Ltd., New Delhi.
3. Kraus, J.D. (1991). *Electrodynamics*, McGraw Hill, New York.
4. Feynman, R.P., Leighton, R.B. & Sands, M. (1995). *The Feynman Lectures on Physics Vol. I, II, III*, Narosa Publishing House, New Delhi.
5. H.C., Ohanian, (1994). *Modern Physics*, Prentice Hall of India (P) Ltd., New Delhi.

**UNIT I**

Chemical Bonding: Qualitative approach to quantum mechanics of valence bonds and molecular orbital theory of homonuclear and heteronuclear molecules. Bond theory of solids. Lattice enthalpy, permanent and induced dipole moments and total interaction.

**UNIT II**

Phase Equilibria: Phase diagrams of single substances, Properties of electrolyte solutions, Phase diagram of mixtures. Interpretation and application of equilibrium constants, Solubility equilibria.

**UNIT III**

Electrochemical cells: half reactions and electrodes, varieties of cells, reduction potential, application of reduction potential like electrochemical series. Reaction rates, Integrated rate laws, Half-lives, Temperature dependence of reaction ratio. The formulation of rate laws, unimolecular reactions and chain reactions.

**UNIT IV**

Chemistry of polymers, addition, condensation and copolymerization, types of polymers - plastics, elastomers, fibers and biopolymers. Mechanism and types of corrosion, factors effecting corrosion and its prevention by various methods like metal cladding, electroplating, painting, plastic coating, corrosion inhibitors. Crystalloids and colloids, types of colloidal system, characteristics of colloidal system, application of colloids, foams and emulsions.

Molecular Spectroscopy: General features of spectroscopy - experimental techniques, intensities and bandwidths. UV and visible spectroscopy – Beer-Lambert's law.

**Practical**

1. Determination of degree of hardness of water.
2. Determination of chlorine in bleaching powder.
3. Determination of Viscosity by Viscometer.
4. Preparation of phenol formaldehyde resin.
5. Preparation of sols and colloids.
6. Redox titrations (external indicator method.)
7. Study of partition of iodine between carbon tetrachloride and water.
8. Determination of surface tension and interfacial tension of liquids.
9. Preparation of solutions.
10. Determination of normality/molality/molarity of solutions.
11. Standardization of normal solutions.
12. Acid base titrations.
13. Iodometric titrations.



### ***Books Recommended***

1. Bhatia, S.C. (2008). *Engineering Chemistry*. CBS Publishers & distributors, New Delhi.
2. Duffey (2008). *Modern Physical Chemistry: A molecular Approach*, CBS Publishers & Distributers, New Delhi.
3. Waigh (2007). *Applied Biophysics: A Molecular Approach for Physical Chemists*. CRC Press USA.
4. Davis, & Berner (2004). *Handbook of Industrial Chemistry, Vol I & II*. CBS Publishers & Distributers, New Delhi.
5. Laidler, & Meiser (2006). *Physical Chemistry, 2nd edn*. CBS Publishers & Distributers, New Delhi.

**MTH-101T APPLIED MATHEMATICS****CREDITS: 4-0 (4)****UNIT 1:**

Matrix, types of matrix, properties of matrix addition and multiplication, transpose of a matrix, symmetric and skew symmetric matrix, orthogonal matrix, inverse of a square matrix. Elementary matrices, rank of a matrix, characteristic equation, Eigen values and Eigen vectors, Cayley Hamilton's theorem.

**UNIT 2:**

Limits, properties of limits, techniques for evaluating limits, continuity of a function, differentiation of some elementary function by first principle, the product and quotient rules and higher order derivatives. Increasing and decreasing functions and the derivative tests. Maxima and minima of a function. Rolle's Theorem and mean value theorem.

**UNIT 3:**

Integration, Integration of some elementary functions. Definite integral, properties of definite integral, area of region between two curves. Beta and Gamma functions.

**UNIT 4:**

Measures of central tendency, measures of dispersion, co-efficient of dispersion, skewness, measures of skewness, moments. Correlation, coefficient of correlation, limits of correlation, coefficient of correlation, Limits of correlation coefficient, computation of correlation coefficient, computation of correlation coefficient, Regression, Linear regression, Lines of regression, properties of regression coefficient.

**UNIT I**

Brief introduction to plant and animal kingdom and broad outlines of their classification. Study of plant and animal tissue; Morphology of root, stem, leaf and flower.

**UNIT II**

Reproduction in flowering plants. Inflorescence and its types; Fruit and types of fruit. Study of seed, its structure and seed germination with special reference to maize, pea, wheat, rice.

**UNIT III**

Definition and branches of Zoology. Idea of living and non living matter. Structure of cell; Plant and animal cell. Protoplasm and its structure. Properties of protoplasm. Cell division; amitosis, mitosis and meiosis. Chromosome- structure and functions. Brief idea of Nucleic acids – DNA, RNA and Extra Nuclear Genomes

**UNIT IV**

Concept of gene, Protein synthesis, Chromosome alterations, Mutation and its types. Recombinant DNA Technology.

***Books Recommended:***

1. *Text books of Biology for Class XI and XII by NCERT publication.*
2. Tyag, M.P., and Goyal, J.P (2002). *Truemans A to Z Biology*
3. Biswa, S. & Biswas, A.(2007). *A text book of Biology, Pradeep Publications.*

**UNIT – I**

Introduction to Environmental Science: Scope and importance, Environmental Ethics- Anthropocentricism and Ecocentricism, Environmental issues and Development, Developing v/s Developed countries, Public Environmental awareness and methods of its propagation, Campaigns as instruments to achieve better Environmental Outcomes, Green Consumerism.

**UNIT – II**

Introduction to Ecosystem and Ecology, Types of Ecosystems, Structure of an Eco system- biotic and abiotic components, Trophic Structure, Food chain and Food Web, Ecological Pyramids; Ecological Succession, Bioenergetics, Energy flow in an ecosystem, Biogeochemical cycles, Major World Ecosystems and their characteristics.

**UNIT – III**

Introduction to global climate change; Causes of climate change; Major ways in which climate change is manifested – temperature and extreme events- El-nino, Future projections about climate change, Melting of glaciers and polar ice caps, Sea level rise.

**UNIT – IV**

Natural resources and their conservation; Biodiversity-Definition, values and threats; Habitat and Species Loss; Classification of species as per conservation status; Conservation approaches – In-Situ and Ex-Situ conservation; Alternatives to conventional developmental approaches – Sustainable Development; Non – Conventional Sources of Energy

**UNIT – V**

Relevance of Mathematics in Environmental Sciences; Introduction to Mathematical Models; Types of Mathematical Models; Role of Models in Environmental Sciences/ Ecology; Gaussain plume Model, Lotka-Volterra Model-Nature and their relevance. Some Statistical Problems based on Environmental Data.

**Reading List:**

1. Ecology and Environment by P.D. Sharma. (Rastogi Publications)
2. Environmental Science Towards a Sustainable Future by Nebel and Wright (PHI) LPE
3. Environmental Studies by Erach Barucha (Oxford Publications)
4. Environmental Studies From Crises to Cure authored by R. Rajagopalan; Published by Oxford University Press. Price INR 160.
5. Environmental Management by Oberoi
6. Principles Of Environmental Science: Inquiry & Applications (Special Indian Edition) authored by William Cunningham & Mary Cunningham; Published by Tata McGraw Hill. Price INR 375.

**UNIT I**

**INTRODUCTION:**

Introduction to computers, A Simple Computer Model, Hardware and Software essentials of a computer, Need of computer in present world, Characteristics of Computers, Evolution of Computers, Basic Operations of a computer System.

**UNIT II**

**BASIC COMPUTER ORGANIZATION:**

Input / Output Units: Defining input and output units, types and description of Input – Output devices, Printing devices.

Storage: Primary memory, Memory Cell, Memory organization, ROM, RAM and its types, Secondary storage devices and its types.

**UNIT III**

Processor: Description of Processor, its components, ALU, CU, Processor Registers, Basic Architectures, Processor generations.

Number System ( Binary, octal, hexadecimal) and there conversion.

**UNIT IV**

**SOFTWARE, OPERATING SYSTEM AND INTERNET:**

System Software and utilities, Application Software, Licensed and open source softwares, Need of Operating Systems, Types of Operating Systems, World Wide Web, How internet works, Benefits and drawbacks of using internet, LAN, WAN, MAN.

**UNIT V**

**DOS COMMANDS & MS Office**

Internal and External commands in detail, Microsoft office (MS Word, MS Excel, MS Power.point)

**Books Recommended:**

Introduction to computers by Peter Norton, Tata McGraw Hill.

Computer Fundamentals by V. Rajaraman, Pearson Education.

Unix concepts and applications, Sumitabha Das, Tata McGraw Hill.

## Practicals:

1.	Identify the different parts of a computer system, Know how each and every parts of a computer system works, Learn how different parts of the computers work together to produce a good output.
2.	Create a document using a suitable word processing package, with at least three paragraphs and perform editing operations.
3.	Document creation, Text manipulation with Scientific Notations.
4.	Create a formal letter using a suitable word processing package, to place a purchase order for procurement of books. Use mail merge feature
5.	Table creation, Table formatting and Conversion. Use tables for list of books.
6.	Create a Spreadsheet and enter the marks of a student, calculate total and print grade, if the student has passed in all subjects.
7.	Create a Power-point presentation with at least 6 slides.
8.	Create an advertisement.
9.	Using simple mathematical formulas in excel.
10.	CHARTS – Line, XY, Bar and Pie.

\* Perform the above tasks using Open Office/ MS Office.

**UNIT- I:**

Basic Concepts of drawing quadrants, drawing instruments, types of lines etc. Dimensioning: General rules of dimensioning. Types: Aligned, unidirectional, chain, parallel, combined, title, block & margins. Orthographic projections: Concept of horizontal and vertical planes, first and third angle projections, orthographic projections of simple blocks, missing lines and missing views. Projection of points, lines and planes: Projection of points in different quadrants, projection of lines and planes positioned in different orientations with respect to the principle planes.

**UNIT II:**

Projection of solids: Projection of simple geometrical solids placed in simple positions and with single rotations of the face, edge or axis of the solid with respect to one of the principal planes of projection.

**UNIT III:**

Section of solids: Principal of sectioning, Section of simple geometrical solids, types of the section planes and their trace representation and location, true shape sections, sectioning by auxiliary planes.

**UNIT IV:**

Development of surfaces: Development of surfaces of simple sectional solids and intersecting solids, transition pieces, cones & cylinders.

**UNIT V:**

Isometric projections: Classification of pictorial projections, Isometric projection of plane figures, prisms, pyramids, cylinders and for the given orthographic projections. Introduction to Auto CADD. Basic commands of CADD.

**Books Recommended:**

1. Gill, P.S Engineering Drawing, S.K. Kataria and sons,
2. Bhatt, N.D Engineering Drawing, Charotar Book Stall, TulsiSadan, Anand
3. James, D Bethune Engineering Graphics with Auto CADD, 2006.
4. Narayana, Kannaiya Engineering Drawing, Scitech Publications, Chennai

**Reference Books:**

1. Sham Tickoo, Auto CADD 2006
2. B.C.RanaM.B.Shah Engineering Drawing, Pearson Education

## SECOND SEMESTER

**MTH-201T**

**ENGG. MATHEMATICS**

**CREDITS: 4-0 (4)**

### **UNIT 1:**

Differential calculus: Taylor's and Maclaurin's expansions, curvature, asymptotes, tracing of curves, partial differentiation, homogeneous functions and Euler's theorem, composite functions, total derivatives, derivative of an implicit function.

### **UNIT 2:**

Ordinary differential equation, exact and Bernoulli's differential equation, equations reducible to exact form by integrating factors, Clairaut's equation, Methods of finding complementary functions and particular integrals.

### **UNIT 3:**

Numerical analysis, finite difference, Numerical integration by trapezoidal, Simpson's and Weddle's rules. Numerical solution of ordinary differential equation by Picard's, Taylor's, Euler's, Euler's modified and Runge-kutta methods. Laplace transforms, properties of Laplace Transforms, inverse Laplace transforms.

### **UNIT 4:**

Theory of probability, Mathematical definition of probability, Statistical definition of probability, independent events, Addition and Multiplication theorem on probability. Conditional probability and Baye's Theorem. Random variable, Probability mass function and Probability density function. Distribution function. Binomial distribution, Poisson distribution and Normal distribution.

### **Books Recommended:**

A text book of Engineering Mathematics by N.P Bali and Manish Goyal. Laxmi Publication (P) LTD. 2007



**UNIT I**

Introduction and Historical Development of Food Preservation. Preservation by heat; Principles of heat preservation, heat resistance of micro organisms and their spores. Thermal death time; Heat treatments- boiling, steam under pressure, pasteurization, canning; Heat penetration studies.

**UNIT II**

Preservation by low temperature- Low temperature storage, refrigeration and freezing. Preservation by drying; Phenomenon and methods of drying- dehydration by air drying, sun drying and freeze drying. Intermediate and high moisture foods.

**UNIT III**

Preservation by food additives- antibiotics, chemicals, organic acids. Preservation by radiations; Ultraviolet and ionizing irradiations. Their effect on micro organisms, use in the treatment of food.

**UNIT IV**

Microwave heating- Properties, mechanism, microwave generator and microwave food application. Introduction to hydrostatic pressure technology, ohmic heating and extrusion cooking. Use of ultrasounds and magnetic fields in food processing.

**Practicals:**

1. Can Formation. Calculation of percent Hook overlap.
2. Tin coating measurement and tests for sulphide stain.
3. Use of refractometer and salinometer
4. Determination of thermal inactivation time of polyphenol oxidase enzymes.
5. Canning and bottling of fruits and vegetables.
6. Dehydration of fruits and vegetables.
7. Preservation of food products by refrigeration and freezing.
8. Preservation of food products by concentration, jam, jelly, concentrated milk..
9. Cut out examination of canned foods.
10. Quantitative tests for sodium benzoate and potassium metabisulphite.
11. Estimation of chemicals in preservation of foods.
12. product development and raw material calculations
13. Estimation of shelf life of foods on the basis of water activity and temperature.
14. Visit to a local cannery.

**Note : Students can use the Non-Programmable scientific calculator.**

### ***Books Recommended***

1. Desrosier (2006). *The Technology of Food Preservation*, 4<sup>th</sup> edition, CBS Publishers & Distributers, New Delhi.
2. Potter and Hotchkiss (2006). *Food Science*, 5<sup>th</sup> edition, CBS Publishers & Distributers, New Delhi.
3. Zuehl (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.

**UNIT I**

Introduction; First law of thermodynamics. Energy and its forms. Energy transfer across system boundaries. Zeroth Law. Applications of steady flow energy equation to engineering devices. Analysis of non-flow and flow processes for an ideal gas. Property changes work done and heat exchange during these processes.

**UNIT II**

Limitations of first law. Kelvin Plank and Clausius statements of second law and their equivalence; their applications to a refrigerator, heat pump and heat engines. Efficiency and philosophy of Carnot cycle and its consequences, Clausius inequality, concept of entropy, entropy change during various processes, representations of various processes on temperature-entropy plots. Third law available energy and availability.

**UNIT III**

Thermodynamic cycle; Carnot vapour cycle. Ideal Rankine cycle, Rankine reheat cycle, air standard Otto cycle, air standard diesel cycle, air standard Brayton cycle, vapour compression refrigeration cycle.

**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. Comparison between water tube and fire tube boiler. Guidelines for the choice of a new boiler. Essentials of a good boiler. High pressure boilers, Steam accumulators. Various boiler mountings & accessories.

***Books Recommended:***

1. Vasandani, V.P., and Kumar, B.S. (1998). *Heat Engineering*, Metropolitan Book Company Pvt. Ltd., 1, Netaji Subhash Marg, New Delhi.
2. Nag, P. K. (2005). *Engineering Thermodynamics (3<sup>rd</sup> edition)*. Tata Mc Graw Hill Publishing Company Limited.
3. Estop, T.D., and McConkey, A (2001). *Applied Thermodynamics for engineers and Technologist*, Longman Scientific and Technical, USA.
4. Zemansky, M.W., and Vanes, H.C. (2002). *Basic Engineering Thermodynamics*, McGraw Hill Book Co., Tokyo International Student Edition.
5. Spalding, D.B and Cole, D.H. (1997). *Engineering Thermodynamics*, ELBS and Edward Arnold Pub. Ltd., (Low Priced Ed.).

**UNIT I**

Introduction; Definition of food chemistry, historic development of food chemistry. Effect of biochemical reactions on quality and safety of food. Role of food chemistry in society. Water; structure of water, water solute interactions, water activity, moisture sorption isotherms.

**UNIT II**

Carbohydrates- Monosaccharides, monosaccharide isomerization and reactions, Oligo saccharides- lactose, maltose, sucrose; Polysaccharides, their solubility, gel formation and hydrolysis. Starch- structure, retro-gradation and gelatinization. Structure and functional properties of Gums, pectin, pentosans, cellulose dietary fibre and  $\beta$ -glucan.

**UNIT III**

Fats- Classification and structure of fats and fatty acids, rancidity of fats, refining, hydrogenation and inter-esterification of fats. Safety of hydrogenated fats, consumption trends and nutritional aspects of fats. Frying and fat changes.

**UNIT IV**

Protein- structure, denaturation, functional properties, viscosity, dough formation, protein quality and digestibility. Enzymes- types and chemical nature, factors influencing enzyme action, enzyme inactivation, coenzymes. Enzyme specificity, Kinetics and inhibition. Uses of enzymes in food processing. Browning and its control. Plant pigments, structure and their role in foods.

**Practicals:**

1. Determination of moisture on dry matter basis.
2. Determination of moisture sorption isotherms.
3. Determination of protein by Kjeldhal and Lowry method.
4. Estimation of sugars by Lane and Eyon method.
5. Quantitative determination of starch in cereal grains.
6. Quantitative determination of amylase and amylopectin.
7. Saponification value, iodine value, free fatty acids, acid value, peroxide value and
8. rancidity tests for fats and oils.
9. Estimation of non enzymatic browning by furfural estimation.
10. Estimation of crude fat content by soxhlet method.
- 11.** Estimation of beta carotene in fruits and vegetables.

***Books Recommended:***

1. Fennema, O. R., Damodaran, S. (2008). *Food Chemistry*, 4<sup>th</sup> Edn. CRC Press USA.
2. Meyer, L. H. (2006). *Food Chemistry*, CBS Publishers & Distributors, New Delhi.
3. Nielson, S.S. (2002). *Introduction to the Chemical Analysis of Foods*, CBS Publishers & Distributors, New Delhi.
4. Baianu, I.C. (1997). *Physical Chemistry of Food Processes*, Vol I & II, CBS Publishers & Distributors, New Delhi.
5. DeMan (2007). *Principles of Food Chemistry*, 3<sup>rd</sup> edition. CBS Publishers & Distributors, New Delhi.

## **BFT-214T/P FOOD AND NUTRITION**

**CREDITS: 3-2 (4)**

### **UNIT-I**

Definition and scope; Composition and nutritive value of food groups; functions of foods; water balance, energy balance, energy value of carbohydrates, fats and proteins, minerals and vitamins. Balanced diet.

### **UNIT-II**

Essential nutrients; sources and functions. Water soluble and fat soluble vitamins. Role of minerals in nutrition. Digestion, absorption , transport and metabolism of nutrients in human system. Basal metabolism; factors influencing BMR. Lactose intolerance and celiac diseases. Protein quality evaluation. Recommended daily allowances and requirements of infants, children, adults, old people, athletes, expectant and nursing mothers.

### **UNIT-III**

Diet surveys, malnutrition, deficiency diseases and disorders of metabolism, diet groups, importance of therapeutic nutrition, planning of diets for patients suffering for ulcer, Anemia, Diarrhea, Diabetes, Cardiac diseases, Jaundice, Nephritis and Tuberculosis, toxicants naturally occurring in foods, fortification of food with vitamins and minerals.

### **UNIT IV**

Diet and Health- Nutraceuticals and functional foods, hypocholestromic, hypolidimic and hypoglycemic effects of dietary fiber. Antioxidants and free radical scavengers.

### **Practicals:**

1. Determination of proximate composition of common foods (protein, carbohydrates, crude fiber, lipids, vitamin C, minerals).
2. Calculation of calories on the basis of chemical composition.
3. Planning of diet charts for various disease conditions (diabetics, hypertensive patients, cardiac patients and renal failure.
4. Preparation of baby foods like cerelac.
5. Use of bomb calorimeter
6. Preparation of sports diet
7. Visit to hospitals and slum area for diagnosis of malnutrition induced diseases.
8. Assessment of nutritional status by anthropometry. Calculations of body mass index.

***Books Recommended:***

1. Swaminathan, M.S. (1996). *A textbook of Food and nutrition*, Vol. I and Vol. II by, Bangalore Printing and Publishing Co.
2. Gupta, K., L, Gupta, C, and Gupta, A. (1993). *Food and Nutrition*, JayPee Brothers
3. Joshi, S. A. (2000). *Nutrition and Dietetics* by, Tata McGraw Hill and Co.

**UNIT I**

Introduction; Historical development, Discovery of microbial world, Biogenesis, abiogenesis controversy, germ theory of disease, immunization, chemotherapy, discovery of viruses, applied microbiology, Microbiology in twentieth century. General characteristics of bacteria, yeast, mold, viruses and algae. Brief account of bacterial, yeast and mold reproduction.

**UNIT II**

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, oxidation reduction potential and radiation on growth. Control of micro organisms by physical, chemical and biological agents, thermal death time, Z, F and D values.

**UNIT III**

Sources and prevention of contamination. General principles of food preservation. Microbiology of air, water, milk products; cereals and cereal products; meat and meat products, fish and fish products; poultry and eggs; spices and condiments; canned foods.

**UNIT IV**

Microbial techniques; Isolation and preservation of microbial cultures (Brief introduction). Methods of genetic improvement (Recombinant DNA Technology). Bacterial toxins and mycotoxins with special reference to Staphylococcus, Clostridium, Aspergillus. Food poisoning and safety measures.

**Practicals:**

1. Instruments of microbiology laboratory and their functions.
2. Preparation of nutrient medium slant, broths.
3. Demonstration of serial dilution method and techniques of isolation and enumeration of micro organisms.
4. To study the effect of temperature, pH and aeration on growth of micro organisms.
5. To demonstrate acid fast staining.
6. To stain the given bacteria by Gram's staining method.
7. To measure the size of given micro organisms by ocular micrometer.
8. To determine the number of micro organisms by Haemocytometer.
9. To determine the motility of bacteria by hanging drop method.
10. Biochemical tests for the micro-organisms.



## 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 5<sup>th</sup> 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*, 4<sup>th</sup> Edition, CBS Publishers, New Delhi
7. Barnart, G.J. (1997). *Basic Food Microbiology*, CBS Publishers, New Delhi.
8. Stainer, R.Y. (1996). *General Microbiology*, 5<sup>th</sup> edition, Mac Millan Publishers, New Delhi.

## SEMESTER – III

### PROFESSIONAL COMMUNICATION

CREDITS: 2-0 (2)

#### Unit-I

Principles of Communication- Communication , its role & significance. The process of communication, Barriers to communication. Interpersonal communication. Methods of communication, verbal & non-verbal communication, decoding body language.

#### Unit-II

Developing English Language Skills- Introduction to phonetic sounds and transcription of words. Enriching vocabulary, using words as different parts of speech. Homophones, Antonyms ,Synonyms, Idioms and phrases, One word substitution. Tenses, Reported speech, Concord, Gerunds and Articles.

#### Unit-III

Listening, Speaking & Personality Development- Art of effective listening .English in real life situations: Requests, Permissions, Advice and Suggestions, Complaints and Apologies. Public speaking, fear management, elocution, extempore speeches. Group discussions, Multi-perspective debates, presentation skills. Interview etiquette, E-mail etiquette, Telephone etiquette. Leadership qualities-SWOT analysis

#### UNIT IV-

Writing Skills-Technical communication: nature, origin and development of technical communication, salient features, difference between technical writing and general writing. Essentials of strong writing skills Report writing: structure, style and drafting of different types of reports Proposal Writing, Presentation writing. Writing and presenting papers, plagiarism.

#### UNIT V

Business Correspondence Ramification of business letters, analyzing audience, purpose, layout & form and types. CV/Resume writing and cover letter.

## Suggested Readings

1. Battacharaya, Indrajit. *An Approach to Communication Skills*. New Delhi: Dhanpat Rai and Co, 2002.
2. Chaturvedi, P.D and Mukesh Chaturvedi. *Business Communication*, Delhi: Pearson Education, 2006.
3. Day, Richard R, ed. *New Ways in Teaching Reading*. Illinois: TESO 1993.
4. Kumar, Sanjay and Pushp Lata. *Communication Skills*. India: OUP, 2011.
5. Mohan, Krishna and Meera Banerji. *Developing Communication Skill*, Delhi: Macmillian, 1990.
6. O'Connor, J.D. *Better English Pronunciation*. London: Cambridge University Press, 1985.
7. Prasad, LM. *Organisational Behaviour*. New Delhi: Sultan Chand & Sons, 1984.
8. Raman, Meenakshi and Sangeeta Sharma. *Technical Communication: Principles and Practice*. India: OUP, 2011.
9. Roach, Peter. *English Phonetics and Phonology*. London: Cambridge University Press, 2000.
10. Sasikumar V., P. Kiranmai Dutt and Geetha Rajeevan. *A Course in Listening and Speaking (I & II)*. Bangalore: Foundation Books, 2006.
11. Seely, John. *Writing and Speaking*. Delhi: OUP, 2004.
12. Sood, S C., et al. *Developing Language Skill*. Delhi: Manohar, 1998.
13. Taylor, Shirley. *Communication for Business*. New Delhi: Pearson Education, 1988.
14. Trimble, Louis. *English for Science and Technology*. Cambridge: CUP, 1985.
15. Guerin, Wilfred., et al. *MLA Handbook for Writers of Research Papers*. New York: Harper, 1966.

**Students can use the Non-Programmable scientific calculator.**

1. General principles of food hygiene, relation to food preparation, personal hygiene.
2. Food handling habits and water sources.
3. Impurities in water supply and treatment.
4. Sanitation facilities and procedures in food plant operation, rural and urban areas, fairs and festivals.
5. Disposal of sewage and right soil microbial standards for foods.

**Recommended Books:**

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).

**UNIT I**

General problems of storage. Sources and detection of infestation in stored food grains. Causes, types and content deterioration in stored food grains and methods to check them. Traditional and modern methods of bag and bulk storage.

**UNIT II**

Insect pest of stored grain and mill products; nature of damage. Chemical, non-chemical and integrated methods of controlling stored grain insect pest. Vertebrate pests and their control.

**UNIT III**

Toxic contamination in food grains, their ill effects. Pesticidal contamination and precautions of safe handling of pesticides. Mycotoxins and ergot poisoning. Pesticide residues; definition and types. Common pesticide residues in foods and their safer limits (MRL).

**UNIT IV**

Cleaning, aeration and drying of stored products at farmers, commercial and Govt. levels. Role of moisture in spoilage of stored grains. Categorization of food grains for storage, loss measurement and disposal. Principles of godown sanitation and hygiene. Safe storage of cereal seeds.

***Recommended Books:***

1. Dennis S. Hill (2005). *Pests of Stored foodstuffs and their control*. Springer (India) Private Limited.
2. K.P. Srivastava (2000). *A textbook of Applied Entomology Vol.1* . Kalyani Publishers.
3. A. S. Atwal (2001). *Agricultural pests of India and south-east Asia*. Kalyani publishers.
4. Rehman, S. (2003). *Handbook of food preservation*. Second Edition. CRC press.

**UNIT I**

Fluid and their Properties; Rheological concept of fluid, 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; compressibility and bulk modulus; Newtonian and non-Newtonian fluids. Modeling of rheological data, Power law model, Cassons model, Hershey bulkly model, storage and loss modulus.

**UNIT II**

Fluid Static; Pascal's law, Manometry. Action of fluid pressure on a plane (horizontal, vertical and inclined) 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, periodic time of oscillation. Pressure distribution in a liquid subjected to constant horizontal/vertical acceleration, rotation of liquid in a cylindrical container.

**UNIT III**

Fluid Kinematics and Dynamics; Classification of fluid flows, velocity and acceleration of fluid particle, local and convective acceleration, normal and tangential acceleration, streamline, path line and streak line, flow rate and discharge mean velocity, continuity equation in cartesian and cylindrical polar coordinates, Rotational flow, rotation viscosity and circulation, stream and velocity potential functions, flow net. Fluid; Euler's equation, Bernoulli's equation and steady flow energy equation; representation of energy changes in fluid system, impulse momentum equation, kinetic energy and momentum correction factors, flow along a curved streamline, free and forced vortex motions.

**UNIT IV**

Flow & Flow Measurements; Flow regimes and Reynolds number, laminar flow in circular cross-section pipes. Turbulent flows and flow losses in pipes, Darcy equation, minor head losses in pipes and pipe fittings, hydraulic and energy gradient lines. Pumps, Types of pumps & characteristics, selection of pumps, typical performance curve, fans, blowers & compressors.

**Practicals:**

1. To determine the metacentric height of a floating vessel under loaded and unloaded conditions.
2. To study the flow through a variable area duct and verify Bernoulli's energy equation.
3. To determine the coefficient of discharge for an obstruction flow meter (venturimeter /orifice meter).
4. To determine the discharge coefficient for a Vee notch or rectangular notch.
5. To study the transition from laminar to turbulent flow and to ascertain the lower critical Reynolds number.
6. To determine the hydraulic coefficients for flow through an orifice.
7. To determine the friction coefficient for pipes of different diameters.
8. To determine the head loss in a pipeline due to sudden expansion / sudden contraction /bend.
9. To determine the Reynolds No. for a flow through a pipe.

**Recommended Books:**

1. Kumar D.S, (2004). *Fluid Mechanics and Fluid Power Engineering* by Kataria & sons.
2. Massey B.S, (1998). *Mechanics of Fluid* ; Van Nostrand Reinhold Co.
3. Douglas J.F, (1999). *Fluid Mechanics*, Gasiorek JM, Swaffield JP; Pitman.
4. Streetes V.L and Wylie Eb, (2000). *Fluid Mechanics*; McGraw Hill Book Company.
5. Bansal R.K (2005). *A textbook of Fluid Mechanics & Hydraulic Machines, Laxmi Publication (P) Ltd.*
6. Wilhelm L.R. Suter D.A & Bruswitz G.H (2005), *Food & Process Engineering Technology*, Amer Society of Agriculture.

**UNIT I**

Preliminary unit operation: Cleaning, sorting and grading – aims, methods and applications, physical properties of food materials. Conveying and Handling: Various unit operations in post-harvest handling, study of different conveying systems like belt conveyors, chain conveyors, screw conveyors, pneumatic conveyors, vibrating and oscillating conveyors, bucket elevators – their selection, operation and maintenance.

**UNIT II**

Size reduction and sieve analysis: Theory of comminution, size reduction laws- calculation of energy required during size reduction, size reduction equipments: 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: Measurement of mixing, rate of mixing, liquid mixing, mixing equipments-liquid mixer, powder & particle mixer, dough & paste mixer, jet mixer, static mixer, purpose of agitation, agitated vessels – impellers, 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, filter cake. Ultrafiltration, membrane filtration, reverse osmosis. Sedimentation- Stoke's law. Free and hindered settling. Equipment for sedimentation. Crystallization, nucleation, crystal growth. Crystallisation equipment.

**Books recommended:**

1. Sahay, K.M. and Singh., K . K (1998). *Unit Operations of Agricultural Processing* by Kalya Publishers, Ludhiana.
2. Lloyd, A. & Penizer, R. (2006). *Handling, Transportation and storage of Fruits and Vegetables*, AVI Publications, UK.
3. McCabe W. L. and Smith J. C. (7<sup>th</sup> Edition ). *Unit operations of chemical engineering*. Mc Graw Hill Publication.
4. *Geankoplis C. J. ( 3<sup>rd</sup> Edition)*. *Transport processes in unit operations*. Prentice Hall of India.
5. P.Fellows.(2000) *Food processing technology. Principles and practice*. Ellis horwood England and V C H publishers Germany
6. Earl, P. (1994). *Unit operation in Food Processing*, Elsevier Science UK..



**UNIT I**

Fermentation- Definition, types, advantages and disadvantages. Fermentation systems (batch and continuous systems), fermenter design, instrumentation and control. Fermentation raw materials.

**UNIT II**

Down stream processing- introduction, separation process with examples. Immobilised enzyme technology- methods of immobilization and applications. Biotechnological role in the production of organic acids and alcohols.

**UNIT III**

Microbial production of various primary and secondary metabolites- Alcohol, amino acids (glutamic acid and lysine), organic acids (citric, acetic and lactic acid), enzymes, antibiotics (penicillin, cephalosporin).

**UNIT IV**

Biomass production- microbial production of single cell protein and Baker's yeast. Principle of overproduction of metabolites.

**Practicals:**

1. Production of Alcohol.
2. Production, recovery and control tests for Bakers Yeast by submerged culture.
3. Isolation and screening of microorganisms for antibiotic production.
4. Preparation of Wine, Cider, Miso, Tempeh, Yoghurt, riboflavin etc.

***Books Recommended:***

1. Prescott & Dunn (1992), *Industrial Microbiology*, 4<sup>th</sup> Edition. CBS Publishers, 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



## **Practical**

1. Studies on morphological features of some selected fruits and vegetables;
2. Studies of maturing indices;
3. Studies of harvesting of fruits and vegetables;
4. Determination of RQ;
5. Studies of pre cooling and storage of fruits and vegetables;
6. Studies on pre treatments on selected fruits;
7. Studies on use of chemicals for ripening and enhancing shelf life of fruits and vegetables;
8. Studies of regulations of ripening
9. Studies on various storage systems and structures;
10. Studies on pre packaging of fruits;
11. Studies on pre packaging of vegetables;
12. Studies on physiological disorders
13. Visit to commercial packaging house
14. Visit to commercial storage structures

## **Books Recommended:**

1. Kadar AA.1992. *Post-harvest Technology of Horticultural Crops*. 2nd Ed. University of California.
2. Pantastico B. 1975. *Post Harvest Physiology, Handling and Utilization of Tropical and Subtropical Fruits and Vegetables*. AVI Publ.
3. Salunkhe DK, Bolia HR & Reddy NR. 1991. *Storage, Processing and Nutritional Quality of Fruits and Vegetables*. Vol. I. *Fruits and Vegetables*. CRC.
4. Thompson AK. 1995. *Post Harvest Technology of Fruits and Vegetables*. Blackwell Sci.
5. Verma LR. & Joshi VK. 2000. *Post Harvest Technology of Fruits and Vegetables*. Indus Publ.
6. Lloyd, A. & Penizer, R (1998). *Handling, transportation and storage of fruits and vegetables*, AVI Publications
7. Wills, R.B. (2002). *Post harvest: An Introduction to the physiology and handling of fruits and vegetables*, CBS Publishers & Distributors, New Delhi.
8. Verma, L.R., & Joshi, V.K. (2004). *Post harvest technology of fruits and vegetables-handling, processing, fermentation and waste management*, Indus Publishing Co. New Delhi.
9. Arthey, D. (2005). *Fruit Processing: Nutrition, Products, and Quality Management, 2<sup>nd</sup> edition*, CBS Publishers & Distributors, New Delhi.

## SEMESTER IV

### BFT-411T MASS TRANSFER OPERATION

CREDITS: 3-0 (3)

#### UNIT I

Mass & Energy Balance-Units & dimensions, Mass balance, Concept of limiting & excess reactant, Tie element, Recycle & By-pass. Energy balance-concepts, Calculation of enthalpy change with & without reaction.

#### UNIT II

Principle of Mass Transfer, Diffusion, Molecular diffusion in fluids, diffusivity of fluids, mass transfer co-efficient in laminar flow of effective diffusivity. Extraction-Liquid-liquid extraction, selectivity & choice of solvent, liquid-liquid extraction equipment, Leaching-Introduction, leaching equipment, Principles of continuous-counter current leaching.

#### UNIT III

Absorption- packings & packed tower, Basic principle of absorption, desorption or stripping. Distillation – Vapour liquid equilibrium, relative volatility, flash & batch distillation, steam distillation, vacuum distillation, T-xy&xy curves for distillation, azeotropic mixtures, and distillation tower.

#### UNIT IV

Drying-Theory of drying, bound moisture, free moisture, equilibrium moisture content, critical moisture content, drying rate curves, engineering aspects of different types of driers including bin drier, tray drier, drum drier, tunnel drier, spray drier, fluidized bed drier, freeze drier. Principle of humidification & dehumidification, humidity chart, wet and dry bulb temperature & cooling tower.

#### ***Books Recommended:***

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

**UNIT I**

Electric Current and Ohm's Law; Ohm's Law, Resistance in Series, Resistance in Parallel, Division of current in Parallel circuits, Equivalent Resistance, Numericals. Network Theorems; Kirchhoff's laws, Thevenin Theorem, Work, Power and Energy effect of electric current, Joule's law of Electric heating. Numericals.

**UNIT II**

Electromagnetic Induction and A.C. Fundamentals; Faraday's law of Electromagnetic Induction, Generation of Alternating voltage, current, simple wave form, cycle Time period, frequency, Amplitude, phase, phase difference. Induction motor; Classification of A.C. Motors General Principle, construction, Relation between Torque and Slip, control of A.C. motors.

**UNIT III**

Transformer; Working principle of a Transformer construction, Elementary Theory of an ideal Transformer E.M.F. Equation of a Transformer Voltage Transformation Ratio Efficiency of a Transformer, Three phases – Transformer. D.C. Generators and D.C. Motors; Generator Principle, Construction and working of Generator, Motor Principle, Comparison of Generator and Motor action, comparison of shunt, series Motors, losses and Efficiency Power stages, Speed control of D.C. Motors.

**UNIT IV**

Electronic Devices, Semiconductors, Bipolar junction Transistor, transistor circuit configuration transistor characteristics Field Effect Transistor. Amplifiers, Classification, Configuration, Concept of feedback amplifiers. Special Diodes, Zener Diode, Voltage, Regulation. (6)

Cathode Ray oscilloscope (CRO) Introduction – Analog and Digital Instruments function of Instruments. Electronic versus Electrical Instruments.

**Students can use the Non-Programmable scientific calculator.**

### **Practicals:**

1. Study of staircase and godown wiring, performing tube connection and its testing.
2. Determination of power factor when R-L-C in series.
3. Determination of capacitance and impedance.
4. Measurement of power by three voltmeter, three ammeter and one wattmeter methods.
5. Study of construction operation in case of D.C. Motor.
6. Load carrying capacity and open circuit characteristics of D.C.
7. General relationship between speed variations, number of poles of induction motor.
8. Study of construction, operation and care of alternator and A.C. converter.
9. Solving problems of R-L-C circuits, A.C. and D.C. motors, D.C. generator etc.
10. Solving problems of Diode as rectifiers, transistor as an amplifier, CE, CC, CB amplifier, R-C amplified amplifier and direct coupled amplifier oscillators.

### **Books Recommended:**

1. Pruthi, G. (1998). *Fundamentals of Electrical Engg. and Electronics*.
2. Tora Vincent Del, (2002) *Principle of Electrical Engg.*
3. Mittal. G.K. (1998), *Basic Electronics*.
4. Malvino. A.P. (1996), *Electronic Principles*.
5. Millman, Halkias, "Basic Electronics", Tata McGraw-Hill.
- 6.. Coughlin and Driscoll, "Operational Amplifiers and Linear integrated Circuits", Prentice Hall of India.
- 7.. Bray B.B, "8086-486 Intel Microprocessor", Prentice Hall of India.
- 8.. Hall, D., "8086 Microprocessor", Tata McGraw Hill.

**UNIT I**

Concept and Techniques- Nature, scope and role of economics. Theory of demand and supply, substitutions effect elasticity of demand, production and cost- the production function, economics of scale: Estimating the production

**UNIT II**

Theory of firm-profit maximization, sale maximization wealth maximization. Market structure-perfect competition, imperfect competition

**UNIT III**

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 V**

Definition, importance, nature of ethics, need for business ethics, forms of Business ethics, ethics issues in marketing, advertising. Ethics of environment protection, obligations to future generation, Ethics & religion. Ethics in manufacturing of products

***Books Recommended:***

- 1 Adhikary (2000). *Business Economics*, Excel Books.
2. Baumol W.J (1996). *Economic Theory & Operations Analysis/* Prentice Hall Inc, New Delhi
3. Chopra, O.P (1985). *Managerial Economics*, TATA McGraw Hill.
4. Keat, Paul G & Philips KY Young (1996). *Managerial Economics*,Prentice Hall, New Jersey
5. Koutsoyiannis A. (1991). *Modern Micro Economics* Macmillan, New York
6. William H. Shaw, *Business Ethics*.
7. MarlUelG. Valesquez, (1998). *Business Ethics*, Pearson Education
8. Drucker P Panbooks (2000). *Managing in Turbulent times* London:
9. Boatright J. R, (1999) *Ethics and Conduct of Business* Pearson Education
10. Enis,B.M. Marketing Classics: (1991). *A Selection of Influential Articles*, New York, McGraw Hill,
11. Kotler, Phillip and Armstrong, (1997). *G. Principles of Marketing*, New Delhi,Prentice Hall of India,.
12. Ramaswamy,V.S and Namakumari,(2000). *S. Marketing Management Planning, Control*. New Delhi,

**UNIT I**

Plastics and their processing; Introduction, Types of Plastics, Thermo-plastics, Thermosetting plastics, Materials for processing plastics, Moulding processes compression moulding, Transfer Moulding, Injection moulding, Extrusion, Thermo forming.

**UNIT II**

Ferrous Metal and Alloys; Introduction, Pig iron, cast iron, wrought iron, carbon steel, alloy steel, blast furnace, classification of steel, unalloyed steels and alloy steels. Non-ferrous Metals and Alloy; Introduction, Aluminum and its alloys, copper and its alloys, lead and its alloys.

**UNIT III**

Mechanical Working of Metals (Metal forming); Introduction, hot working, cold working, metallurgical advantages of hot working over cold working processes, rolling, forging. Grinding Machines; Introduction, kinds of grinding, types of grinding machines, rough grinding and precision grinding.

**UNIT IV**

Joint Processes; Introduction, weldability, types of welding, welding processes, use of electricity in welding, formation and characteristics of electric Arc, types of joints and types of applicable welds, Arc Welding machine. TIG welding MIG welding, gas welding, relative merits of AC and DC welding.

**Practicals:**

1. Welding Shop- Fillet joint welding and corner joint welding – practice in welding shop
2. Foundry Shop- Sand mixing and mold making of simple jobs practice in foundry shop.
3. Carpentry Shop- Simple, jobs on sawing, ripping, planing and chiseling, wood turning, practice in carpentry shop.
4. Machine Shop- Machine shop practice on Lathe, Milling machine and sharper simple jobs.
5. Drilling Machine
6. Grinding.

**Note: Students can use the Non-Programmable scientific calculator.**



**Books Recommended:**

1. Hazra Chaudhary, (2007), *Elements of workshop technology 2<sup>nd</sup> Edition Volumes I, II.* Media Promoters and Publisher Pvt.Ltd.
2. Rao P.N (2007) *Manufacturing Technology, Tata McGraw Hill Publishing Company Limited.*
3. Chapman WAJ *Workshop Technology (5e) Part I&II Elsevier.*

**UNIT I**

Mass & Energy Balance-Units & dimensions, Mass balance, Concept of limiting & excess reactant, Tie element, Recycle & By-pass. Energy balance-concepts, Calculation of enthalpy change with & without reaction.

**UNIT II**

Principle of Mass Transfer, Diffusion, Molecular diffusion in fluids, diffusivity of fluids, mass transfer co-efficient in laminar flow of effective diffusivity. Rheology of solid foods.

**UNIT III**

Extraction-Liquid-liquid extraction, selectivity & choice of solvent, liquid-liquid extraction equipment, Leaching-Introduction, leaching equipment, Principles of continuous-counter current leaching, Absorption - packings & packed tower, Basic principle of absorption, desorption or stripping.

**UNIT IV**

Distillation – Vapour liquid equilibrium, relative volatility, flash & batch distillation, steam distillation, vacuum distillation, T xy & xy curves for distillation, azeotropic mixtures, distillation tower. Principle of humidification & dehumidification, humidity chart, wet and dry bulb temperature & cooling tower.

***Books Recommended:***

1. *Gean Koplis C. J. (3<sup>rd</sup> Edition). Transport processes in unit operations.* Prentice Hall of India.
2. Treyball R.E, *Mass Transfer Operation-3<sup>rd</sup> Edition-McGraw Hill Publication.*
3. Singh, R.P., & Heldman (2004). *Introduction to Food Engineering*, 3<sup>rd</sup> edition, Academic Press, London, UK.
4. McCabe, W.L. & J.C., & Harriott, P. (2000). *Unit operations of chemical Engineering*, 5<sup>th</sup> edition, Mc Graw Hill, Inc., New Delhi.
5. Frame, N.D. (2002). *The Technology of Extrusion Cooking*, Blackie Academic & Professional, London.
6. Humelblau B.M. *Basic principles and Calculation in Chemical Engineering-* Prentice Hall of India Ltd

## SEMESTER V

### BFT-511T HEAT TRANSFER OPERATION

CREDITS:4-0 (4)

#### UNIT I

Introduction: Modes of heat transfer and basic equations. Conduction- basic laws of conduction, thermal conductivity, resistance in series, heat flow through plane wall, composite wall and cylinders. Convection- natural and forced, overall and individual heat, transfer coefficient, Prandtl and Nusselt number. Heat transfer through flowing liquids.

#### UNIT II

Radiation- Stefan-Boltzmann, 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, horizontal tube-natural circulation evaporator, vertical type natural circulation evaporator, long tube vertical evaporator-once through and circulating evaporators, falling film evaporator, forced circulation evaporator, agitated film evaporator, open pan solar evaporator, open pan solar evaporator, single and multiple effect evaporator, Boiling point elevation. calculation methods for single effect evaporator. Evaporation of food material. Boiling- Pool and nucleate boiling, condensation-drop wise and film wise condensation.

#### UNIT IV

Heat exchange equipment, shell and tube heat exchanger- one shell one pass, one shell two pass, plate type exchanger, extended surface equipment, heat pipes, NTU, condensers and vaporizers, effectiveness.

**Students can use the Non-Programmable scientific calculator.**

#### **Books Recommended:**

1. McCabe W.L., Smith, J.C. (2008). *Unit Operations of Chemical Engineering* 7<sup>th</sup> edition, McGraw Hill Publication, New Delhi.
2. Geankoplis, C.J (2001). *Transport Process in Unit Operations*. 3<sup>rd</sup> edition, Prentice Hall of India.
3. Singh. R. Paul & Heldmann. Dennis R, (2000), *Introduction to Food Engineering*, 3<sup>rd</sup> Edition, Academic Press, London, UK.

**UNIT I**

Process measurement- Accuracy & repeatability, calibration, temperature measurement- thermocouples, resistance thermometers, thermistors, bimetal thermometer, pyrometers, pressure measurement, flow measurement – orifice meter, venturimeter, rotameter turbine meter, ultrasonic flow meter, magnetic flow meters; level measurements- float actuated devices, electrical method, sonic methods.

**UNIT II**

Physical property measurements like density, specific gravity, viscosity.

**UNIT III**

Process control- Introduction, process model, control loop elements, process dynamics, modes of control-on/off control, proportional control, integral control, derivative control combined control modes, controller tuning.

**UNIT IV**

Control technique: P&ID symbology, negative feedback control, feed forward control, ratio control, environmental control, cascade control, control equipments, 5

**Students can use the Non-Programmable scientific calculator.**

**Practicals:**

Use of transducers and measurement of pressure. Vacuum of temperature, humidity, pH Theological parameters, and study of different types of temperature and pressure controllers study of instruments used for measurement of solar energy instruments and controls used in various food processes/Food equipments.

**Books Recommended:**

1. Valentas, J.K. Rotstein, E., Singh, R. Paul (1997). *Handbook of Food Engineering Practice*, CRC Press New York.
2. Fribance. Austin E, (1996). *Industrial Instrumentation Fundamentals*.
3. Harriott, P. (1991). *Process Control*. Tata Mc Graw Publication Co. New Delhi.
4. Curtis Johnson (2004). *Process Control Instrumentation*. The Prentice Hall of India.
5. Eckman, D.P. (2004). *Industrial Instrumentation*. CBS Publishers & Distributors, New Delhi.

### **UNIT I**

General principles of food hygiene, relation to food preparation, personal hygiene. Introduction to food analysis, sampling techniques, storage and preservation of samples, expression of results. General principles of quality control, quality attributes, colour, gloss, viscosity and consistency, size and shape, and texture, flavour, taste, sensory evolution techniques.

### **UNIT II**

Proximate analysis of foods: Principles of estimation of moisture, fat, protein, carbohydrates, crude fibre, minerals and vitamins in foods.

### **UNIT III**

Methods of quality assessment of food materials: Fruits, vegetables, cereals, dairy products, meat products and eggs. Food hazards and food handling habits. Sources of water, sanitary aspects of water supply, quality of water. Impurities in water supply and their treatment.

### **UNIT IV**

Principles of food quality assurance, objectives, raw material quality assurance, finished product quality assurance. Food laws and standards, national and international regulatory agencies, Concept of HACCP & ISO 9000 series. Food adulteration: methods of evaluation of different food adulterants.

### **Practicals:**

1. Estimation of product quality with respect to color, size, shape, viscosity, texture, flavour, taste, sensory evaluation, market testing of products.
2. Evaluation of food standards.
3. Proximate analysis of foods
4. Quality evaluation of foods.

### **Books Recommended:**

1. *Krammar & Twigg, (1996), Quality Control for Food Industry. CBS Publishers.*
2. *Pomerans, Y. & Meloan (1978). Food Analysis: Theory and Practice, Westport. Connecticut: AVI Publishers*
3. *Ronald, S. Kirk, & Ronald, Sawyer (1991). Pearson's Composition & Analysis of Foods, 9<sup>th</sup> Edition, Longman Scientific & Technical, U. K..*

**UNIT I**

Introduction to chemical reaction engineering. Homogenous reaction, rate equation, Arrhenius Law, types of reactors: batch reactor, continuous flow reactor and industrial reactors. Conversion and design equation for batch and continuous flow reactors.

**UNIT II**

Batch reactor design and analysis: constant volume batch reactor- differential and integral method of rate analysis. Volume change in batch reactor with reaction- differential and integral method of rate analysis. Non isothermal batch reactors.

**UNIT III**

Continuous flow reactor design and analysis: differential and integral method for rate analysis. Experimental design rate law estimation. Pressure drop in packed beds.

**UNIT IV**

Heterogeneous reaction:- Catalysts and their properties, Solid catalysts and steps in catalytic reaction: adsorption isotherms, surface reaction, desorption, rate limiting steps.

***Books Recommended:***

1. O. Levenspiel, Chemical Reaction Engineering, 3rd Edition. John Willey & Sons.
2. H.S. Fogler, "Elements of Chemical Reaction Engineering", 4th Edition. Prentice Hall.
3. J. Smith, "Chemical Engineering Kinetics", 3rd Edition. McGraw-Hill.

**UNIT-I**

Milk composition and their characteristics- Composition and structure: Principal components, milk formation, factors affecting milk composition and properties of milk. Milk components: Lactose, lipids, proteins and salts. Constituent fatty acids, lipid classes and nutritional aspects. Proteins-survey of milk proteins, serum proteins, casein and nutritional aspects. Salts-composition and distribution among the phases, properties of salt formation, colloidal calcium phosphate, nutritional aspects and changes in salts.

**UNIT-II**

Milk properties and processing- Solution properties, acidity, redox potential, flavor, density, optical properties, viscosity, fluid rheology and liquid milk products. Processes of straining, filtration and clarification. Collection, transportation, reception and storage of milk in the dairy processing plants.

**UNIT-III**

Homogenization and Centrifugation- Objectives, operation of homogenizer, effects of turbulence, factors affecting fat globule size, surface layers, colloidal stability, homogenization clusters, creaming, other effects of homogenization and uses of homogenization. Cream separation and removal of particles.

**UNIT-IV**

Pasteurized and sterilized milk- Technology and shelf life of pasteurized, sterilized, reconstituted and flavored milks, extended shelf life of pasteurized milk, modification and loss of nutrients during processing. Infant formulas-formula composition and their manufacture.

**Practicals:**

1. Sampling equipments and sampling of milk.
2. Platform tests (Acidity, COB and Alcohol test).
3. Organoleptic tests.
4. Determination of milk fat percentage by Gerber's method.
5. Determination of specific gravity by lactometer.
6. Determination of SNF percentage and TS percentage of milk with lactometer.
7. Detection of common adulterants and preservatives of milk.
8. Reporting of the suitability of milk for heat processing.
9. Reporting on the quality of given sample of milk.
10. Visit to milk processing plants.
11. Microbial examination of milk samples.
12. Methylene blue reduction test of milk.

**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.



**UNIT I**

Introduction-Importance of oil seed processing industry in India, storage of oil seed grains. Composition of different oil seeds (sunflower, mustard, rapeseed, soyabean, corn, palm oil etc)

**UNIT II**

Types of fats and their composition-Animal- Lard, margarine their technology and applications. Vegetable oils, Hydrogenated fats. Cocoa butter equivalents, shortenings, low fat spreads, peanut butter etc. Speciality fats and designer lipids for nutrition and dietetics, especially by biotechnology.

**UNIT III**

Processing technologies for oil extraction-Traditional and Expellers Extraction methods, types of expellers and solvent extraction technology. Refining of oil seeds. Rendering of animal fats.

**UNIT-IV**

Processing of vegetable oils. hydrogenation of vegetable oils, shortenings and margarine. fractionation, winterzation, inter-esterification etc.for obtaining tailor-made fats and oils. Storage problems: Rancidity and flavor reversion, mechanism and their control measures. Quality assessment tests of fats and oils, oil and fat adultrants, Packaging and storage of fats and oils.

**Practicals:**

1. Effect of certain preparative treatments (flaking, heat treatment, dehusking, moisture conditioning) on rates of oil extraction from certain oilseeds.)
2. Determination of efficiency of oil extraction techniques (mechanical expelling and solvent extraction).
3. Determination of some quality parameters in oils extracted by different techniques (eg.Colour and FFA contents).
4. Demonstration and/or evaluation of techniques for clarification degumming, dewaxing, alkali refining, bleaching, deodorization of oils.
5. Visit to an oil extraction, refining and vanaspati unit.
6. Determination of certain analytical constants of edible fats and oils for conformation toBI S standards/detection of adulteration.
7. Determination of stability of fats & oils.
8. Determination of deep-fat frying performance of some refined oils.
9. Identity tests for various oils.

**Books Recommended:**

1. Williams. P.N. & Devine. J. (1996). *The Chemistry and Technology of Edible Oil and Fats*.
2. Berk, & Bhatia (2008). *Handbook of Industrial Oil and Fat Products*, Vol 1-4. CBS Publishers, New Delhi.
3. Meyer, (1998). *Food Chemistry*. CBS Publishers, New Delhi.
4. Hamilton, R.J. and Bharti, A. Ed. 1980. *Fats and Oils: Chemistry and Technology*. Applied Science, London.
5. Salunkhe, O.K. Chavan, J.K, Adsule, R.N. and Kadam, S.S. 1992. *World Oilseeds: chemistry, Technology and Utilization*. VNR, New York.
6. Wolf, I.A. Ed. 1983. *Handbook of Processing and Utilization in Agriculture*. (2 vol. set). CRC Press, Florida

## ***SEMESTER- VI***

**BFT-611T/P**

**CEREAL AND LEGUME TECHNOLOGY**

**CREDITS: 4-2 (5)**

### **UNIT-I**

General introduction , production and utilization trends. Structure of different grains- Wheat, Rice, Barley, Oat, Corn, beans, peas and Millets. Chemical composition of cereals and pulses.

### **UNIT-II**

Wheat: Types and physicochemical characteristics; wheat milling -products and byproducts; Flour milling, extraction rate and milling systems (Flow diagrams). Improvers and bleachers used in flour. Significance of ingredients used in bakery products like bread, biscuits, cake etc. and preparation method of the same.

### **UNIT-III**

Rice: Classification, physicochemical characteristics; cooking quality; rice milling technology; by- products of rice milling and their utilization; Parboiling of paddy. Rice bran oil and its properties. Wet and dry milling of maize. Preparation of oat flakes, porridge (dalia) and oat meal. Pearling and Malting of Barley.

### **UNIT-IV**

Legumes: composition, anti-nutritional factors, processing and storage. Processing of legumes for protein concentrates and isolates. Milling of pulses.

### **Practicals:**

1. Determination of physical characteristics of cereals.
2. Milling of wheat into flours.
3. Determination of wet and dry gluten.
4. Preparation of bread, biscuits, cookies and cakes.
5. Parboiling of rice.
6. Determination of crude fibre in wheat flour.
7. Visit to local roller flour mill.
8. Visit to local bakery.
9. Visit to local rice hulling unit.
10. Determination of ash and sugars in flour and bakery products.
11. Cooking quality of rice.
12. Protein isolation and extraction soyabeans and legumes.

**Recommended Books:**

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. Hosenev 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 Human Nutrition*. 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 and Utilization*. 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*.

**UNIT I**

Concentrated and dried milk products- Basic technology of concentration and drying. Manufacture of concentrated milk, bulk condensed milk, canned evaporated milk, sweetened condensed milk and recombined concentrated milk. Manufacture of skim milk powder, whole milk and high fat milk powder. Changes affecting structure and quality of concentrated and dried milk products. 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. Scope of Indian dairy products. Manufacture of Dahi, Srikand, Panir, Ghee, Khoa and Channa.

**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.

**Practicals:**

1. Preparation of flavoured milk.
2. Cream separation, neutralization and ripening.
3. Preparation of butter.
4. Preparation of Khoa.
5. Preparation of Paneer and Channa.
6. Preparation of common varieties of ice-cream.
7. Quality evaluation of milk and milk products.
8. Visit to different milk plants to learn about milk condensing and drying operations.

**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.*

**UNIT I**

Food additives- definitions, classification and functions, Preservatives, antioxidants, colours and flavours (synthetic and natural), emulsifiers, sequesterants, humectants, hydrocolloids, sweeteners, acidulants, buffering salts, anticaking agents, etc. - chemistry, food uses and functions in formulations; indirect food additives; toxicological evaluation of food additives.

**UNIT II**

Scope of spice processing industry in India. Spices -definition. Chemical composition, uses and processing of different spices-pepper, cinnamon, turmeric, fennel, chilli, cardmom (small and big), cumin, mint, ginger cloves and fenugreek. Condiments- definition. spice oleoresins, spice essential oils, encapsulated spices (Brief). Packaging of spices and spice products. Microbial contamination and insect infestation in spices and its control.

**UNIT III**

Food flavours- natural and synthetic flavourings. Flavour enhancers their properties and toxicity. Flavours from vegetables, cocoa, chocolate, coffee, vanilla beans. Evaluation tests for flavours. stability of flavours during food processing, analysis of flavours, extraction techniques of flavours, flavour emulsions; essential oils and oleoresins; authentication of flavours etc.

**UNIT IV**

Proteins, starches and lipids as functional ingredient; isolation, modification, specifications, functional properties and applications in foods and as nutraceuticals

**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. Determination of cold water extract.
9. Determination of alcohol soluble extract.
10. Determination of calcium oxide.
11. Determination of volatile oil.
12. Microscopic examination of spices.
13. Detection of Argemone seeds in mustard.
14. Detection of oil soluble color.
15. Extraction of oleoresins from spices.

**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, 2<sup>nd</sup> 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.*



**UNIT I**

Introduction of Packaging Technology: Definition, Factors involved in the evolution and selection of a food package, functions of packaging. Packaging operations and packaging functions. Safety considerations in food packaging, types of food safety problems associated with package, package labeling and food safety. Packaging requirements of selected foods-cereal and snack food, beverages, milk and dairy products, poultry & eggs, red meat, frozen foods, horticulture products and microwavable foods.

**UNIT II**

Food Packaging Materials: Paper and paper based packaging materials, types of paper and paper products, functional properties of paper, plastic packaging material, classification of polymers,

Functional and mechanical properties of thermoplastic polymers, testing of plastic packages. Metal packaging materials, container making process (end manufacture, three piece can manufacture and protective and decorative coatings), functional properties of metal containers. Tin plate containers-Quality control tests.

Glass packaging materials, composition and manufacture of glass container, glass container-closure functions, closure terminology and construction. properties of glass container, mechanical, thermal and properties. Testing of glass containers.

**UNIT IV**

Aseptic packaging: Sterilization of packaging material food contact surfaces & aseptic packaging systems. Active food packaging- definition, scope, physical and chemical principles involved. Vacuum packaging in food products.

**Practicals:**

1. Identification of Plastic films.
2. Pre-packaging of vegetables
3. Shrink packaging of fruits.
4. Estimation of shelf life of packaged foods.
5. Vacuum and gas packaging.
6. Hook overlap of metal containers.
7. Quality evaluation of tin plates.
8. Fabrication of tin containers.
9. Quality of evaluation of glass containers.
10. Shelf life studies of food in plastics.

11. Design of packaging.
12. Strength properties of packaging materials.
13. Water vapour and gas transmission rates of flexible packaging materials.

**Books Recommended:**

1. Scharow, S., and Griffin, R.C. (1980). *Principles of Food Packaging, 2<sup>nd</sup> Edition.*, AVI Publications Co. Westport, Connecticut, USA.
2. Rooney, M.L. (1995). *Active Food Packaging.* Blackie Academic & Professional, Glasgow, U.K.
3. Bakker, M. (1986). *The Wiley Encyclopedia of Packaging Technology*, John Wiley & Sons Inc: New York.
4. Robertson, (1998), *Principles of Food Packaging.* CRC Press, USA

**BFT-605T/P TECHNOLOGY OF EFFLUENT TREATMENT AND WASTE  
MANAGEMENT.**

**CREDITS: 4-0 (4)**

**UNIT I**

Introduction: Types of waste and magnitude of waste generation in different food processing industries. Concept, scope and importance of waste management and effluent treatment.

**UNIT II**

Waste characterization: Temperature, pH, oxygen demands (BOD, COD, TOD), fat, oil and grease content, metal content. Forms of phosphorus and sulphur in waste waters. Microbiology of waste. Other ingredients like insecticide, pesticide and fungicides residues.

**UNIT III**

Environmental protection act and specifications for effluent of different food industries. Waste utilization. Effluent treatment- Pre-treatment of waste, sedimentation, coagulation, flocculation and floatation. Secondary treatment: biological oxidation-trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, lagoons. Tertiary treatments: Advanced waste water treatment process-sand, coal and activated carbon filters, phosphorus, sulphur, nitrogen and heavy metals removal.

**UNIT IV**

Assessment, treatment and disposal of solid waste; concept of vermin composting and bio-gas generation.

**Students can use the Non-Programmable scientific calculator.**

**Books recommended:**

1. Cheremisinoff (2002). Handbook of water and waste water treatment technologies, CBS publishers, New Dehi.
2. Khan & Ahsan (2007). Textbook of Solid Wastes Management, CBS Publishers, New Delhi.
3. Duggal & Sharma (2009). Water and Waste Water Analysis, CBS Publishers, New Delhi.

## **SEMESTER – VII**

**BFT-711T/P MEAT, FISH AND POULTRY TECHNOLOGY**

**CREDITS: 4-2 (5)**

### **UNIT-I**

Introduction- Sources of meat and meat products in India, its importance in national economy. Per capita consumption of meat, poultry and fish. Present status of meat, poultry and fish industries in India. Chemical composition and microscopic structure of meat.

### **UNIT-II**

Methods of slaughtering & meat processing- Pre-slaughter care, Antemortem inspection of meat animals. Methods of stunning, slaughtering and dressing of meat animals and poultry birds Post mortem examinations of meat-Rigor mortis. Factor affecting post mortem changes, properties and shelf life of meat. Methods of meat tenderization. Meat curing-types and factors affecting quality of cured meats. Preparation of smoked meats, pickled meats, sausages and hamburgers. Methods of meat preservation- refrigeration, refrigeration, thermal processing and dehydration.

### **UNIT-III**

Poultry products- Structure, composition, nutritive value and functional properties of eggs. Grading of eggs. Factors affecting egg quality and measures of egg quality. Preservation of eggs by different methods- freezing, dehydration and coating.

### **UNIT-IV**

Fish products- Types of fish, composition, structure, post mortem changes in fish. Handling of fresh water fish. Nutritional quality of fish. Canning of fish.

### **Practicals:**

1. Fish, Meat cutting and handling.
2. Dressing of poultry.
3. Evaluation of the quality of meat, poultry and fish,
4. Canning, freezing, dehydration cured product of fish and meat.
5. Meat based soup and its quality control.
6. Measures of egg quality, egg powder etc.
7. Analysis of fish and fish products.
8. Preparation of fish oil and meal.
9. Fish protein concentrate uses.
10. Visit to meat, fish and poultry processing industries.

***Books Recommended:***

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

**UNIT I**

Status of bakery industry in India & Govt. Licensing Policy Raw material for bakery products. Flour, sugar, shortening, yeast, salt, emulsifiers, oxidants and reducing agents. Role and PFA specifications of these raw materials. Manufacturing techniques, uses & functionality of vital wheat gluten. Structure and function of wheat proteins (gluten).

**UNIT II**

Different types of bread and preparation of bread using different methods. Quality evaluation of bread. Preparation of rusks, buns and pizza.

**UNIT III**

Soft wheat products: Cakes, their types, methods of preparation of different cakes. Cake faults and their remedies. Biscuits, cookies and crackers. Types, Technology of manufacture and quality evaluation. Muffins technology of production.

**UNIT IV**

Confectionary products: Different ingredients used in candy, fruit butter and chocolate. Technology of manufacture, quality parameters.

**Practicals:**

1. Quality analysis of raw materials used in bakery and confectionary industry according to PFA standards.
2. Preparation and evaluation of bakery and confectionary products:
  - Bread, White sandwich, high volume milk bread, using different methods.
  - Cakes: with eggs, without eggs, using different methods.
  - Biscuits, using different methods.
  - Buns
  - Pizza
  - Candy
3. Study and analysis of the production charts used for different products by bakery industry.
4. Visits to bakery and confectionary industry.  
Local market survey for bakery and confectionary products

***Recommended Books:***

1. *Bernrd . Minife. W. (2003), Chocolate, Cocoa and Confectionary.*
2. *Mathur. R.B.L. (1999), Handbook of cane sugar technology, CBS Publishers.*
3. *Faridi Hamed , (2003), The Science of Cookie and Cracker Production.*
4. *Matz, (1989). Bakery Engineering and Technology, Vol I and II, CBS Publishers, New Delhi.*

**UNIT I**

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 – process layout, product layout, combination layout, fixed position layout; methods and tools of plant and factory layouts; plant layout procedures.

Layouts of different types of food and fermentation industries – canning, dairy, bread, biscuit, beer, tomato processing, rice mill and wheat mill.

**UNIT II**

Network Analysis of Processes-Basic terms, objectives and advantages of network analysis, various network techniques, PERT and CPM techniques, smoothing.

**UNIT III**

Factory Building and Cost Analysis- Considerations in building design, types of factory buildings, building construction materials for floors, walls, roofs, etc. Fixed cost, variable cost, depreciation, methods of economic analysis, profitability analysis of a plant.

**UNIT IV**

Plant Maintenance-Objectives and importance of maintenance, types of maintenance – corrective or breakdown maintenance, scheduled maintenance, preventive maintenance and predictive maintenance.

***Books Recommended:***

1. Douglas ,J.M. , “Conceptual Designs of Chemical Processes” ,. McGraw Hill, 1989.
2. Peters ,M.s and Timmerhaus ,K.D, “Plant Designs and Economics for Chemical Engineers” 4th Edition McGraw Hill,1 991
3. Biegler L.,grossmann I.E.and Westeberg A.W. “Systematic Methods of Chemical Engineering and Process Designs ,” prentice Hall ,1997.



**UNIT I**

Introduction- Introduction to Human Resource Management and its definition, functions of human resource management and its relation to other managerial importance of human resource in industry. Human relations and industrial relations- Difference between human relations and industrial relations, Factors required for good human relation policy in industry. Employee-Employer relationship. Causes and effects of industrial disputes in India. Importance of collective bargaining. Role of trade unions in maintaining cordial Industrial Relations.

**UNIT II**

Procurement and placement- Need for human resource planning, process of human resource planning, methods of recruitment, psychological tests and interviewing. Meaning and importance of placement and induction.

**UNIT III**

Training and development- Difference between training and development, principles of training, employee development, promotion merit V/s seniority performance appraisal.

**UNIT IV**

Job satisfaction- Job satisfaction and its importance, Motivation, factors affecting motivation. Introduction to motivation theory workers participation, Quality of working life. Maintenance- Meaning and importance of Employees Safety Accidents- Causes, preventions, safety provisions under the Factories Act 1948 in Welfare of employees and its importance, steps taken by Government of India. Future challenges for Human Resource Management.

***Books Recommended:***

1. *Fillipo. Dewin B., (1994), Principles of Personnel Management.*
2. *Jucius. Michael J., (1999), Personnel Management*
3. *Saxena. R.C. (2002), Labour Problems and Social Welfare.*
4. *Minappa . A.& Saidya. M.S., (2000), Personnel Management*
5. *Memoria. C.B. (2002), Personnel Management*

**UNIT I**

Indian and global scenario of Fruit and Vegetable production and processing. Preparing fruits and vegetables for processing; Basic steps in pre-processing; Blanching, Peeling etc and their importance in processing. History of canning, types of cans. Methods and steps involved in canning of fruits and vegetables. Calculation of vacuum in cans. Difference between canning and bottling. Spoilage of canned foods. Retortable pouches and retort processing.

**UNIT II**

Fruit products; Definition, formulation, preparation and FPO standards of fruit juices, squashes and cordials, fruit syrups and nectar, pulp, jams, jellies, marmalades and juice powders. Tomato products and pickles; Preparation, formulation and FPO standard for tomato juice, tomato puree, paste, ketchup, sauce, chutney. Pickling process and spoilage of pickles.

**UNIT III**

General methods of freezing fruits and vegetables, their packaging and storage. Advantages and disadvantages of freezing.

**UNIT IV**

Problems faced by Fruit and Vegetable processing industry. Drying of fruits and vegetables; Sun drying, its advantages and disadvantages. Dehydration of fruits and vegetables. Osmo dehydration of fruits and vegetables.

**Practicals:**

2. Preparation of fruit juices.
3. Preparation of squashes.
4. Preparation of jams.
5. Preparation of jellies, marmalades etc.
6. Preparation of pickles
7. Preparation of tomato puree, paste and ketchup
8. Dehydration and sun drying of fruits and vegetables.
9. Organoleptic evaluation of fruit and vegetable products prepared in class practicals
10. Adequacy of blanching using guical and hydrogen peroxide.
11. Visit to a local fruit processing plant.

**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. Khader Vijaya, (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*

## SEMESTER VIII

Course Code	Subjects	Credits	Marks	Int	Ext viva
FT-406	Industrial Training, Project report , seminar and group discussions	0-52 (26)	100	50	50

*Total Credits:* **26**