



**JAYOTI VIDYAPEETH WOMEN'S UNIVERSITY,
JAIPUR**

SYLLABUS

**BACHELOR OF TECHNOLOGY
(B.TECH.) IN
FOOD BIOTECHNOLOGY (FBT)
(BATCH- 2017)**

DURATION – 4 YEARS (12 TRIMESTERS)

**SYLLABUS FOR:
I YEAR**

FACULTY OF ENGINEERING & TECHNOLOGY

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B.Tech FBT I-Trimester

Nature of course	Name of Course	C	T	D&T	P	P.S.
Mathematics	Elementary Mathematics	7	6	0	0	1
Chemistry	Fundamentals of Chemistry	8	5	0	3	0
Computer Science	Fundamentals of Computers	8	6	0	2	0
Core Biology	Basics of Biosciences	8.2	5	0.2	3	0
University compulsory course	English Communication	2	2	0	0	0
	Curriculum Training & Exposure	1	0	0	1	0
	Community Development Activities	1	0	0	1	0
University optional course	Professional activities	-	-	-	-	-
Total Credits		35.2	24	0.2	10	1

Note:

- **C** represents number of credit per course
- **T** represents number of theory credit per course
- **P** represents number of practical and per course
- **D &/T** represents Demonstration/Tutorial in the lecture hall
- **P.S.** represents Practice Session

	B.TECH FBT I-TRIMESTER				
Nature of Course	Course Name	C	T	D&T	P
Mathematics	Elementary mathematics I : Overview of Algebra	2	2	0	0
	Elementary mathematics II : Overview of Calculus	2	2	0	0
	Elementary mathematics III : Overview of Statistics	2	2	0	0
	10 Practice session based on Unit-I,II & III in Class room	1	0	0	10 sessions
Chemistry	Fundamentals of Chemistry I - Overview of Physical chemistry	3	2	0	1
	Fundamentals of Chemistry II : Overview of Inorganic chemistry	2	1	0	1
	Fundamentals of Chemistry III : Overview of Organic chemistry	3	2	0	1
Computer Science	Fundamentals of Computers - I : Basics of computer system and Number System	2.6	2	0	0.6
	Fundamentals of Computers -II : Boolean Algebra	2	2	0	0
	Fundamentals of Computers -III : Software and MS office	3.4	2	0	1.4
Core Biology	Basics of Biosciences I :Introduction to biology	3.2	2	0.2	1
	Basics of Biosciences II : Classification and physiology of plants	2	1	0	1
	Basics of Biosciences III : Classification and physiology of animals	3	2	0	1
	English Communication	2	2	0	0
University compulsory course	Curriculum Training & Exposure	1	0	0	1
University compulsory course	Community Development Activities	1	0	0	1
University optional course	Professional activity	-	-	-	-
	Total Credit	35.2			

Note:

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- D & T represents Demonstration/Tutorial in the lecture hall

B.Tech FBT II-Triester

Nature of course	Name of Course	C	T	D&T	P	P.S.
Core Biotechnology	Fundamentals of Biotechnology	8.1	5	0.1	3	0
Core Food Technology	Fundamentals of Food Science & Technology	5.1	3	0.1	2	0
Core Biotechnology	Biomolecules	8.2	5	0.2	3	0
Chemistry	Analytical Chemistry	7	5	0	2	0
Physics	Elementary physics	7.1	5	0.1	2	0
University compulsory course	Curriculum Training & Exposure	1	0	0	1	0
	Community Development Activities	1	0	0	1	0
University optional course	Professional activities	-	-	-	-	-
Total Credits		37.5	23	0.5	13	0

Note:

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- T represents number of theory credit per course
- P represents number of practical and per course
- D & T represents Demonstration/Tutorial in the lecture hall
- P.S. represents Practice Session

		II – TRIMESTER			
Nature of Course	Course Name	C	T	D & T	P
Core Biotechnology	Fundamentals of Biotechnology I :Fundamentals of RDT	3.6	2	0.1	1.5
	Fundamentals of Biotechnology II :Basics of microbial, Animal and Plant cell culture	3.5	2	0	1.5
	Fundamentals of Biotechnology III :Introduction to patenting	1	1	0	0
Core Food Technology	Fundamentals of Food Science & Technology I :Food Processing & Packaging and Food Industries	1.6	1	0.1	0.5
	Fundamentals of Food Science & Technology II :Processing of Food Products	2	1	0	1
	Fundamentals of Food Science & Technology III :Unit Operations & Food Engineering	1.5	1	0	0.5
Core Biochemistry	Biomolecules I : Carbohydrates	2.1	1	0.1	1
	Biomolecules II : Proteins	3.1	2	0.1	1
	Biomolecules III : Lipids and Vitamins	3	2	0	1
Chemistry	Analytical Chemistry I : Separation methods	3	2	0	1
	Analytical Chemistry II :Spectral methods	3	2	0	1
	Analytical Chemistry III : Thermal method	1	1	0	0
Physics	Elementary physics- I : Overview of General physics	2.6	2	0.1	0.5
Physics	Elementary physics- II : Overview of sound	2	1	0	1
Physics	Elementary physics- III : Overview of optics	2.5	2	0	0.5
University compulsory course	Curriculum Training & Exposure	1	0	-	-
University compulsory course	Community Development Activities	1	0	-	-
Total Credit		37.5			

Note:

- **C** represents number of credit per course
- **T** represents number of theory credit per course
- **P** represents number of practical and per course
- **D &T** represents Demonstration/Tutorial in the lecture hall
- **P.S.** represents Practice Session

B.Tech FBT III-Trimester

Nature of course	Name of Course	C	T	D&T	P	P.S.
Core Microbiology	Fundamentals of microbiology	8.2	5	0.2	3	0
Chemistry	Thermodynamics	7.2	7	0.2	0	0
Core Biotechnology	Cell biology	7.3	5	0.3	2	0
Core Food Technology	Unit operations in Food Industry	5.5	4	0.5	0.5	0.5
University compulsory course	Curriculum Training & Exposure	1	0	0	1	0
	Community Development Activities	1	0	0	1	0
University optional course	Professional activities	-	-	-	-	-
	Industrial visit	1				
Total Credits		31.2	21	1.2	7.5	0.5

Note:

- C represents number of credit per course
- T represents number of theory credit per course
- P represents number of practical and per course
- D & T represents Demonstration/Tutorial in the lecture hall
- P.S. represents Practice Session

		III – TRIMESTER			
Nature of Course	Course Name	C	T	D & T	P
Core Microbiology	Fundamentals of microbiology I : Introduction-aims and scope	2	1	0	1
	Fundamentals of microbiology II : Characteristics of micro-organisms	3	2	0	1
	Fundamentals of microbiology III: Energy transduction in microbial systems	3.2	2	0.2	1
Chemistry	Thermodynamics I : Basic concept of Thermodynamics	3	3	0	0
	Thermodynamics II : Laws of Thermodynamics	2.1	2	0.1	0
	Thermodynamics III : Heat transfer	2.1	2	0.1	0
Core Biotechnology	Cell biology I : Ultra-structure of Plant and animal cell	3	2	0	1
	Cell biology II : Brief Idea about cell cycle	2.1	1	0.1	1
	Cell biology III : Cell signaling	2.2	2	0.2	0
Core Food Technology	Unit operations in Food Industry I: Fluid Flow, Heat Transfer	2.5	2	0	0.5
	Unit operations in Food Industry II: Separation, Mixing etc.	1.5	1	0.5	0
	Unit operations in Food Industry III: Mechanical Separation, Grading & Emulsification	1.5	1	0.5	0
University compulsory course	Curriculum Training & Exposure	1	0	1	0
University compulsory course	Community Development Activities	1	0	1	0
	Industrial visit	1			
Total Credit		31.2			

**B.Tech . FBT
I Year Syllabus**

I Trimester

Elementary Mathematics

Unit-I (Overview of Algebra) (2-.5-0)

Theory (2 Credits)

Set theory: Classification and types of Finite Set, Venn diagram, Algebra of sets. **Algebra:** Quadratic equation, Nature of roots of quadratic equations, Common Roots. Arithmetic progression, geometric progression and harmonic progression. Determinant of elementary properties of a determinant. Solution of Linear Simultaneous Equations by Cramer's Rule. Adjoint of matrices, Inverse of matrices.

Practice (0.5 Credits)

Practice on algebra and quadratic equation

Unit-II (Overview of calculus and trigonometry) (2-.5-0)

Theory (2 Credits) Calculus: Differentiation of Implicit and Explicit Functions. Indefinite integrals of standard functions (simple problems), Methods of integration, **Trigonometry-** Trigonometrical Equations and General Values.

Practice (0.5 Credits) Practice on Differentiation and trigonometry.

Unit-III (Overview of statistics) (2-0-0)

Theory (2 Credits)

Statistics- Definition and Applications of Statistics in various fields, classification and tabulation of data, graphical representation of data (bar diagram, pie chart, histogram, frequency polygon)

Measure of central tendency: Mean, mode, median, variance, standard deviation (definition & simple problems).

Recommended text Books:

1. Business maths: D.C.sancheti & V.K.kapoor, S.C.chand Publications
2. R.D.sharma, 12th Dhanpat rai Publications
3. Elements of Statistics, S.C.Gupta & V.K.kapoor, Sultan Chand & Son's Publishers

Reference books:

1. Algebra, Bhargava, Saini, Agrawal JPH
2. Statistical methods- S.P. Gupta Sultan & sons

Fundamentals of Chemistry

UNIT I –(Overview of Physical Chemistry) (2-1`-0)

Theory (2 Credits)

Solutions: Concept of homogeneous and heterogeneous solution, Introduction of the terms, Ionization, acidity, basicity, equivalent weight and gram equivalent weight with suitable example. Preparation of solution, Normality, Molarity, and Molality as applied in relation to a solution. Simple numerical problems related to volumetric analysis. Brief concept of gravimetric analysis.

Practicals: (1 credit)

Sr. no.	Name of practical	Nature	Credit
1	To perform semi micro analysis.	Practical	0.2
	(i) To the preparation of solution.	Practical	0.1
	(ii) Cation analysis group (I).	Practical	0.1
2	To perform of Analysis of anion.	Practical	0.2
	(i) To prepare solution.	Practical	0.1
	(ii) To separation group I, II	Practical	0.1
3	To the study Any two Confirmatory tests of Group I, II cation test.	Practical	0.2
4	To Determine the strength of given unknown solution.	Practical	0.2
	(i) Preparation of standard solution.	Practical	0.1
	(ii) Find out the concentration.	practical	0.1
5	To the calibration of Fractional weight and observe the result.	Practical	0.2

UNIT II- (Overview of Inorganic chemistry) (1-1-0)

Theory (1 Credits)

Occurrence and principles of extraction of aluminium, copper, zinc and Iron. position of hydrogen in periodic table, isotopes, preparation, properties and uses of hydrogen; hydrides-ionic, covalent and interstitial; physical and chemical properties of water, heavy water. Hydrogen peroxide- preparation, properties and structure; hydrogen as a fuel. Uses of hydrogen peroxide.

Practicals: (1 credit)

Sr. no.	Name of practical	Nature	Credit
1	To determination of the Recrystallization- (i) To the preparation of solution of (ii) Recrystallization.	practical	0.2
		Practical	0.1
		practical	0.1
2	To Identify of melting point of organic compound. (i) To prepare solution of organic compound. (ii) Melting points identification of naphthalene.	Practical	0.2
		Practical	0.1
		Practical	0.1
3	To Determination of organic compound with the help of Boiling point (Urea,Cinnamic acid).	Practical	0.2
4	To Determine of the mixed melting point of Urea cinnamic acid and mixture of various composition.	Practical	0.2
5	To the study of crystallization. (i) Naphthalic acid with hot water (ii) Find out the crystal result of organic compound.	Practical	0.2
		Practical	0.1
		practical	0.1

**UNIT III (Overview Organic Chemistry) (2-1-0)
Theory (2 Credits)**

Stereochemistry of Organic Compounds: Concept of isomerism. Type of isomerism.
Optical Isomerism - Elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules and erythro diastereomers, *, D & L and R & S systems of nomenclature.

Geometric Isomerism: Determination of configuration of geometric isomers. E & Z system of nomenclature. **Conformational isomerism:** Newman projection and Sawhorse formulae, Fischer and flying wedge formulae. Application of Stereochemistry in biochemistry.

Practicals: (1 credit)

Sr. no.	Name of practical	Nature	Credit
1	Chemical kinetics- To determine the specific reaction rate of hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ion at room temp.	practical	0.2
2	Distribution law. To the distribution of iodine between water and CCl₄.	Practical	0.2
3	Colloids -To prepare Arsenious Sulphide Sol compare the precipitating power of mono, bi, trivalent anions.	Practical	0.2
4	Phase rule -To study of a solute(e.gNaCl Succinic acid)on the critical solution temp partially misble liquid (water –phenolsystem) Concentration of the solute in the given water phenol system.	Practical	0.2
5	Viscosity - To determine the viscosity of amyl alcohol in water at different concentration and calculate the excess viscosity of these solution.	Practical	0.2

Recommended text books:

1. Stereochemistry P.S. Kalsi

Reference Books:

1. Advanced Inorganic Chemistry by Malik, Tuli and Madan.
2. Organic Chemistry by IL. Finar
3. Fundamentals of Organic Chemistry, Solomons, John Wiley.
4. Organic Chemistry, F.A. Carey, McGraw Hill, Inc.
5. Introduction to Organic Chemistry. Streitwieser. heathcock and Kosover. Macmilan.

Fundamentals of Computers

UNIT - I (Basics of computer System and Number System) (2-0.6-0)

Theory (2 Credits)

Introduction to Computer System and functions of its components, evaluation of Computers and their classification, hardware and software; Number System: Decimal, Binary, Octal and Hexadecimal and their inter conversions. Representation of integer and real numbers, characters and codes (BCD, ASCII and EBCDIC), error detecting and correcting codes (Parity, Gray and Hamming codes), binary and floating point arithmetic (addition and subtraction).

Practicals: (0.6 credit)

Sr. no.	Name of practical	Nature	Credit
1	Demonstration of different Hardware and software components of computers.	Practical	0.1
2	Description of assembly of computer system hardware	Practical	0.1
3	Description of the functionalities of different types of system software and application software.	Practical	0.1
4.	Practice of number systems and codes (BCD, ASCII and EBCDIC).	Practice	0.3

UNIT - II (Boolean Algebra) (2-0-0)

Theory (2 Credits)

Basic concepts of Boolean algebra and their electronic implementation through various logic gates, simplification of Boolean expressions (Boolean algebra and Karnaugh map method). Hard Devices and software device, CPU, Memory disks and its types.

UNIT – III (Software and MS office) (2-1.4-0)

Theory (2 Credits)

Network Basics and Internet, Concept of System software and application software, Office Automation (MS-Word, Excel and Power Point). Introduction to Data Bases, concept and architecture, Tables, Query and Report generation (MS- Access).

Practicals: (1.4 credit)

Sr. no.	Name of practical	Nature	Credit
Word Processing:			
1	Document creation & formatting of that document,	Practical	0.1
2	Create a word document and grammar & spelling checking in that document,	Practical	0.1
3	Table creation in a word document and table handling handling,	Practical	0.1
4	Find & Replace function in Microsoft word,	Practical	0.1
5	Mail Merge, Macro functions in Microsoft word,	Practical	0.1
6	Document with multiple columns, Templates	Practical	0.1
Spreadsheet:			
1	Creation of Workbook, entering data in multiple sheets, Cell referencing, charts,	Practical	0.2
2	Functions-Date & Time, Mathematical, Statistical, Look up and text.	Practical	0.2
Presentation:			
1	Creation of Presentation and formatting, different views of presentation,	Practical	0.2

2	layouts and templates, Master slides, Animation, Transition.	Practical	0.2
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Recommended text Books:

1. Computer Fundamentals, Architecture & Organization, B.RAM, New Age International, New Delhi, 2000
2. Fundamental of computer, [V. Rajaraman, Prentice Hall India Pvt., Limited.](#)

References:

1. Microsoft Office 2000 for Windows, S. Sagman, Berkeley Peachpit Press, 1999

Basics of Biosciences

UNIT-I (Introduction to biology) (2-1-0.2)

Theory (2 Credits)

Diversity in biological systems, Cell biology and cell structure, difference between Prokaryotes & Eukaryotes systems, Five-kingdom classification and General characters, Brief account on Ecology, Morphology, Nutrition, osmosis, Locomotion and Reproduction, useful and harmful effects of Bacteria, Viruses, Algae, Fungi and Protozoans.

Seminar (0.2 Credit) Based on Unit I is recommended.

Practicals: (1 credit)

Sr. no.	Name of practical	Nature	Credit
1	To perform gram staining.	Practical	0.2
	(i) To prepare gram stain	Practical	0.1

	(ii) Staining and observation of bacteria	Practical	0.1
2	To study different types of Algae by making their slides. (iii) To prepare slide of Algae (iv) Observation of slide	Practical	0.2
		Practical	0.1
		practical	0.1
3	To study different types of Fungi by making their slides. (i) To prepare slide of Fungi (ii) Observation of slide	Practical	0.2
		Practical	0.1
		Practical	0.1
4	To study slides of Protozoans. (i) To set up of microscope and collection of slides (ii) Observation of protozoan slides -	Practical	0.2
		Practical	0.1
		Practical	0.1
5	Study of osmosis by potato osmoscope. (i) Setting up of potato osmoscope (ii) Observation of osmosis -	Practical	0.2
		Practical	0.1
		Practical	0.1

UNIT-II (Classification and physiology of plants) (1-1-0)
Theory (1 Credits)

Classification of Plant Kingdom. Concepts of Growth, Meristems, Plant growth regulators, Bacterial & Plant photosynthesis; oxygenic and anoxygenic photosynthesis; chlorophyll as trapper of solar energy, photosynthetic reaction centres, Hill reaction, PS I & PS II, Photophosphorylation - cyclic & non-cyclic; Dark reaction & CO₂ fixation

Practicals: (1 credit)

Sr. no.	Name of practical	Nature	Credit
1	To isolate chloroplast from plants. (i) Preparation of reagents (ii) Isolation of chloroplast	Practical	0.3
		Practical	0.1
		practical	0.2
2	Separation of plant pigments through paper chromatography. (i) Preparation of solvents (ii) Separation of pigments	Practical	0.3
		Practical	0.1
		practical	0.2

3	Demonstration of O₂ evolution during photosynthesis. (i) Set up of apparatus (ii) Demonstration of O ₂ evolution	Practical	0.3
		Practical	0.1
		Practical	0.2
4	Study of distribution of stomata in the upper and lower surface of leaves.	Practical	0.1

UNIT-III (Classification and physiology of animals) (2-1-0)

Theory (2 Credits)

Classification of Animal Kingdom, Functions, morphology, growth and Reproduction, economic importance. Phylogeny of Invertebrate & Vertebrate Phyla, Concepts of Species & Ecosystem. Introduction of cell cycle, cell division, Electrolytes, Body fluids.

Practicals: (1 credit)

Sr. no.	Name of practical	Nature	Credit
1	To study mitosis in onion root tip. (i) Squash preparation (ii) Observation of chromosomes	Practical	0.2
		Practical	0.1
		practical	0.1
2	To study meiosis in grasshopper testis (i) Separation of testis (ii) Making slide and observation	Practical	0.2
		Practical	0.1
		practical	0.1
3	To test the presence of urea in urine. (i) Reagents preparation (ii) Perform test	Practical	0.2
		Practical	0.1
		practical	0.1
4	To detect the presence of sugar in urine/blood sample (i) Reagents preparation (ii) Perform test	Practical	0.2
		Practical	0.1
		practical	0.1
5	To detect the presence of albumin in urine. (i) Reagents preparation (ii) Perform test	Practical	0.2
		Practical	0.1
		practical	0.1

Recommended Text Books:

1. NCERT Textbook for Class 11 Biology
2. NCERT Textbook for Class 12 Biology

Reference Books:

1. Cell and Molecular biology – P.K. Gupta
2. Plant Physiology- H.S. Srivastav
3. Animal Physiology- A.K. Berry

ENGLISH COMMUNICATION

SYLLABUS

Objective: To enable students to develop Four major skills Reading, Writing, Speaking and Listening in relevance to English culture according to time and venue.

Unit 1: Reading and Listening

- Types of passages, purpose of reading, reading strategies, vocabulary building, antonyms and synonyms and one-word substitution etc.
- Role of Listening, Barriers of Listening, Remedies to remove the barriers. Listening to Narratives, Listening to specific information or data, listening to Conversational contexts etc.

Unit 2: Writing and Speaking

- Subject- Verb Concord, Sentence Pattern (SVOCA), Time and Tenses. Different Letter Writing Formats: Application, Cover Letter, Notice, Report etc. Resume Building.
- Introduction to the sounds of English-Vowels, Diphthongs and Consonants phonetic sounds, Introduction to Stress and Intonation, Situational Dialogues / Role Play ‘Just a minute’ Sessions (JAM), action verbs (play way method), Describing Objects/ Situations/ People (personality), Debates (current topics), Turn Coat, Telephonic Conversation.

Recommended Books:

- Phonetics by Peter Roach, Oxford University Press 2004.
- Better English Pronunciation by J.D.O’Connor, OUP 2010.
- Accents of English by J.C.Wells, Cambridge University Press.
- English Grammar Today with CD: An A-Z of Spoken and Written
- Grammar by Ronald Carter, Michael Mac Carthy, Geraldine Mark
- Anne O’Keefe, Cambridge University Press, 2009.
- Alred, Gerald J. . The Business Writers Handbook. 9th ed. Boston: Bedford/St. Martins, 2009.

- Geeta Jajivan, Kiranmai: Course Listening and Speaking Skills part 1. Foundation Books Pvt Ltd.
- Lorven: Enrich Your Communication in English

II Trimester

Fundamentals of Biotechnology

UNIT-I (Fundamentals of RDT) (2-1-0.1)

Theory (2 Credits)

Definitions and Historical perspective of Biotechnology, Commercial Potential of biotechnology, Scope and Importance of Biotechnology. Introduction to Recombinant DNA technology. Tools of Recombinant DNA technology. Introduction of Recombinant DNA into host cell, Making of Recombinant DNA. Introduction and screening techniques for Identification of Recombinants. Polymerase chain reaction.

Group Discussion (0.1 Credit) Based on Unit I recommended.

Practicals: (1.5 credit)

Sr. no.	Name of practical	Nature	Credit
1	To isolate genomic DNA from E.coli. (i) Grow colonies of E.coli. (ii) Make suspension of E.coli. (iii) Isolate DNA from E.coli.	practical	0.8
		Practical	0.2
		practical	0.2
		practical	0.4
2	To prepare Agarose gel for gel electrophoresis (i) Preparation of agarose solution (ii) Gel casting	Practical	0.2
		Practical	0.1
		practical	0.1
3	Introduction of new DNA into E.coli. by the technique of transformation. (i) Make suspension of E.coli. (ii) Making competent cells	Practical	0.4
		Practical	0.2
		practical	0.2
4	To demonstrate PCR.	Practice	0.1

UNIT-II (Basics of Animal and Plant cell culture) (2-1.5-0)

Theory (2 Credits)

Introduction to Microbial Culture Techniques. Different Microbial Culture Techniques. Measurement and Kinetics of Microbial Growth. Scale up of Microbial Process. Isolation of Microbial Products. Strain Isolation and Improvement. Applications of Microbial Culture Technology. Bioethics in Microbial Technology. Introduction to Plant tissue culture. Cell and Tissue Culture Techniques. Applications of Cell and Tissue Culture. Introduction to animal cell culture. Animal Cell Culture Techniques. Scale-up of Animal Culture Process. Applications of Animal Cell Culture.

Practicals : (1.5 credit)

Sr. no.	Name of practical	Nature	Credit
1	To isolate pure strain of E.coli. by the technique of streaking plate method. (i) Serial dilution of soil sample (ii) Media preparation (iii) Streaking plate	Practical	0.5
		Practical	0.1
		practical	0.2
		practical	0.2
2	To clean glassware and accessories used in plant tissue culture.	Practical	0.1
3	To prepare MS media. (i) Preparation of stock solutions (ii) Media preparation and autoclaving	Practical	0.3
		Practical	0.2
		practical	0.1
4	To initiate callus culture from explants. (i) Collection and cleaning of explants (ii) Inoculation of explants into media.	Practical	0.2
		Practical	0.1
		practical	0.1
5	To learn aseptic techniques of animal tissue culture.	Practical	0.2
6	To prepare BSS solutions. (i) Weighing of reagents (ii) Mixing and autoclaving	Practical	0.2
		Practical	0.1
		Practical	0.1

UNIT-III (Introduction to patenting) (1-0-0)

Theory (1 Credits)

Introduction to Patenting. Criterion for patents. Reading a patent. National and International Patent Laws. Ethical issues in agriculture and health care. Biotechnology in India and global trends. Product safety and Marketing.

Recommended text book:

Biotechnology- U. Satyanarayan

Reference Books :

1. Gene cloning and DNA analysis- T.A. Brown
2. Culture of animal cells- R. Ian Freshney
3. Introduction to plant biotechnology- H.S. Chawla
4. Microbiology- Pelczar
5. Biochemistry- J.L. Jain

Fundamentals of Food Science & Technology

UNIT – I (Food Processing & Packaging and Food Industries) (1-0.5-0.5)

Theory (1 Credit)

Scope of food processing in India; Introduction to food processing, food preservation, food packaging, food drying and dehydration. Important food industries in India; role of Food Science & Technology in national economy.

Practical: (0.5 Credit)

S. No.	Name of practical	Nature	Credit
1	Study of Various Processed foods available in the market	Practical	0.1
2	Study of Different Methods of Food Preservation	Practical	0.1
3	Study of Different types of Drying Techniques	Practical	0.1
4	Study of Different types of Packaging Materials	Practical	0.1
5	Study of Different Food Industries in India	Practical	0.1

Seminar: (0.1 Credit) Seminar based on Unit I is recommended

UNIT – II (Processing of food products) (1-1-0)

Theory (1 Credit)

Fruit and vegetable processing, processing of meat and meat products, processing of milk and milk products, processing of marine products.

Practical: (1 Credit)

S. No.	Name of practical	Nature	Credit
1	Processing of Fruits	Practical	0.2
2	Processing of Vegetables	Practical	0.2
3	Processing of Milk & Milk Products	Practical	0.2

4	Processing of Meat Products	Practical	0.2
5	Processing of Marine Products	Practical	0.2

UNIT - III (Unit operations and Food Engineering) (1-0.5-0.5)

Theory (1 Credit)

Unit operations in food industry. Rheology of food. Basic principles of food engineering. Introduction to various food processing equipments.

Practical (0.5 Credits)

S. No.	Name of practical	Nature	Credit
1	Study of Various Food Processing Equipments	Practical	0.2
2	Study of Unit operations in Food Industry	Practical	0.2
3	Study of Food Rheology	Practical	0.1

Recommended Books:

1. Norman N. Potter, Joseph H. Hotchkiss. Food Science, Springer, 1998
2. Vickie A. Vaclavik, Elizabeth W. Christian, Essentials of Food Science, Springer, 2008
3. B. Srilakshmi, Food Science, New Age International, 2007

Bio-molecules

Unit-I (Carbohydrates) (1-1-0.2)

Theory (1 Credit)

General account of the chemical nature of living cells. Carbohydrates: Classification (Monosachharides, Di- sachharides and Polysachharides), configurations and conformations, sugar derivatives, structural and storage polysaccharides.

Seminar (0.1 Credit) Based on Unit I recommended.

Practical: (1credit)

Sr. no.	Name of practical	Nature	Credit
1	To perform Molish test for the qualitative estimation of carbohydrate. (i) Preparation of Molish reagent (ii) Estimation and observation of carbohydrate	Practical	0.2
		Practical	0.1
		Practical and practice	0.1
2	To perform Benedict test for the qualitative estimation of carbohydrate. (i) Preparation of Benedict's reagent (ii) Estimation and observation of carbohydrate	Practical	0.2
		Practical	0.1
		Practical and practice	0.1
3	To perform Fehling's test for the qualitative estimation of reducing sugar's (i) Preparation of Fehling's reagent (ii) Estimation and observation of carbohydrate	Practical	0.2
		Practical	0.1
		Practical and practice	0.1
4	To perform Barfoed's test for the qualitative estimation of reducing sugar's (iii)Preparation of Barfoed's reagent (iv)Estimation and observation of carbohydrate	Practical	0.2
		Practical	0.1
		Practical and practice	0.1
5	To perform Inversion of Sucrose: (i) Preparation of reagents for inversion (ii) Estimation of converted sugar by Fehling's reagent.	Practical	0.2
		Practical	0.1
		Practical	0.1

Unit-II (Proteins) (2-1-0.2)

Theory (1 Credit)

Amino acids: General properties, peptide bond, essential and non-essential amino acids. Classification, different levels of protein structure, forces stabilizing protein structure, protein folding, protein modification.

Seminar (0.1 Credit) Based on Unit II recommended.

Practical : (1Credit)

Sr. no.	Name of practical	Nature	Credit
1	To perform Ninhydrin test for the qualitative estimation of amino acids. (iii)Preparation of Ninhydrin reagent (iv) Estimation and observation of amino acids.	Practical	0.2
		Practical	0.1
		Practical	0.1
2	To perform Xanthoproteic test for the qualitative estimation of amino acids. (iii)Preparation of Xanthoproteic reagent (iv)Estimation and observation of amino acids.	Practical	0.2
		Practical	0.1
		Practical	0.1
3	To perform Millon's test for the qualitative estimation of amino acids (Tyrosine, Phenylalanine & Glycine). (iii)Preparation of Millon's reagent (iv)Estimation and observation of amino acids.	Practical	0.2
		Practical	0.1
		Practical	0.1
4	To perform Lead-Sulfide test for the qualitative estimation of Cysteine and Cystine. (v) Preparation of Lead sulfite reagent (vi)Estimation and observation of amino acids.	Practical	0.2
		Practical	0.1
		Practical and practice	0.1
5	To perform Sakaguchi test for the qualitative estimation of Arginine. (i) Preparation of Sakaguchi reagent (ii) Estimation and observation of amino acids	Practical	0.2
		Practical	0.1
		Practical	0.1

Unit- III (Lipids and Vitamins) (2-1-0)**Theory (1 Credits)**

Lipids: Classification, properties of lipid aggregates and biological significance.

Vitamins: Water and fat soluble vitamins and their deficiency diseases .

Practicals : (1credit)

Sr. no.	Name of practical	Nature	Credit
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1	To Estimate the Saponification value of oils. (i) Preparation of reagents. (i) Determination of Saponification number.	Practical	0.3
		Practical	0.1
		Practical	0.2
2	To Estimate the acid value of oils. (i) Preparation of reagents. (ii) Determination of acid value by titration	Practical	0.3
		Practical	0.1
		Practical	0.2
3	Determination of Total Lipid Concentration (i) The preparation of a sample for solvent extraction (ii) Extraction of lipids and its determination.	Practical	0.4
		Practical	0.1
		Practical	0.3

Recommended Text Books:

1. Fundamentals of Biochemistry - J.L. Jain , S. Chand publication
2. Fundamentals of Biochemistry - Dr A C Deb

Reference Books:

1. Biochemistry- [U. Satyanarayana](#), [U. Chakrapani](#) , BOOKS AND ALLIED (P) LTD. (2008)

Analytical Chemistry

Unit- I (Separation methods) (2-1-0)

Theory (2 Credits)

Solvent extraction (liquid-liquid extraction): General principles, relationship between percentage of extraction and distribution coefficient and distribution ratio, multiple extraction, extraction of metal organic complexes and ion association complexes.

Chromatographic techniques: Classification, basic principles, theory of chromatography- Ion exchange chromatography - ion exchange process, synthesis and structure of ion-exchange resin and separation of lanthanides. Paper and thin-layer chromatography- stationary and mobile phases, various techniques of development – visualization and evaluation of chromatograms, separation of inorganic and organic compounds.

Practicals : (1 credit)

Sr. no.	Name of practical	Nature	Credit
1	To perform Ion exchange methods- (i) To the preparation of solution. (ii) To separation and estimation of mg (II) and Zn (II).	Practical	0.2
		Practical	0.1
		practical	0.1
2	To perform of Solvent extraction- (i) To prepare solution. (ii) To separation and estimation of Mg (II) and Fe.	Practical	0.2
		Practical	0.1
		practical	0.1
3	To the study Green leaves with the help of Thin layer chromatography-. (i) To preparation and Identification of organic compound.(Benzene) (ii) Determination of R _f value .	Practical	0.2
		Practical	0.1
		practical	0.1
4	To the study of Organic compound with the help of Column chromatography. (i) Separation of fluoresin and methylene blue. (ii) Separation of a mixture of dying using cyclo hexane and ethyl acetate(8.5:1.5).	Practical	0.2
		Practical	0.1
		Practical	0.1
5	To the study of Paper chromatography- Ascending and circular. (i))Separation of a mixture of Phenylalanine and glycine. (ii) Observation of result.	Practical	0.2
		Practical	0.1
		Practical	0.1

Unit- II (Spectral methods) (2-1-0)

Theory (2 Credits)

UV absorption spectroscopy: Beer-Lambert law, molar extinction coefficient, analysis of UV spectra, types of electronic transitions, effect of conjugation, concept of chromophores and auxochromes, bathochromic, hypsochromic, hyperchromic and hypochromic shifts, UV spectra of conjugated enes and enones

Practicals : (1 credit)

1	Spectral methods - (i) To Determine of Beer -Lambert law. (ii) Calculation of law by U.V	Practical	0.2
		Practical	0.1
		practical	0.1
2	Spectroscopy methods- (i)To prepare the solution. (ii) Simultaneous determination of Co (II) and Cr (III) in a mixture of both by spectro - photometric method.	Practical	0.2
		Practical	0.1
		Practical	0.1
3	Thermal Methods- (i) To the study of Determine the content of iron in vitamin tablets by colorimetric method. (ii) Calculation by colorimetric methods.	Practical	0.2
		Practical	0.1
		Practical	0.1
4	To the study of fluoresin and methylene blue with the help of Column chromatography- (i) Identification of organic compound. (ii) Separation of a mixture of dying using cyclo hexane and ethyl acetate(8.5:1.5).	Practical	0.2
		Practical	0.1
		Practical	0.1
5.	To Analysis Solvent extraction methods- (i) To the Preparation of solution. (ii) Separation and estimation of Mg (II) and Fe metal.	Practical	0.2
		Practical	0.1
		Practical	0.1

Unit-III (Thermal methods) (1-0-0)

Theory (1 Credits)

Theory, instrumentation and applications of Thermogravimetric method of analysis (TGA), (b) Differential thermal methods of analysis (DTA), (c) Differential scanning calorimetry (DSA)

Recommended text book:

Qualitative analysis ,G.R.Chatwal,

Reference books:

1. Vogel's Qualitative analysis ,Svehla,Orient Longman.
2. Inorganic synthesis Mc GrawHill

Elementary physics

UNIT-I (Overview of General physics) (2-0.5-0.1)

Theory (2 Credits)

Unit & Dimension, motion in one ,two and three dimension, simple harmonic motion(SHM) and its equation ,frequency, amplitude, time-period, S.H.M. Simple pendulum and expression for its time-period, Resonance. **Rotational Dynamics**- Torque, Moment of inertia , Theorem of perpendicular and parallel axis, moment of inertia of a cylinder ,circle. **Elasticity**- stress, strain, Hooke's law, determination of Hooke's constant.

Seminar (0.1 Credit) Based on Unit I recommended.

Practicals: (0.5 credit)

Sr. no.	Name of practical	Nature	Credit
1	To determine young's modulus of elasticity of the material of a given wire.	Practical	0.2
2	Using a simple pendulum plot L-T graph and hence find the effective length.	Practical & Practice	0.2 & 0.1

UNIT-II (Overview of sound) (1-1-0.2)

Theory (1 Credits)

Basic concept of sound, frequency, amplitude, resonance, Doppler's effect , musical sounds, Progressive waves, principle of superposition of waves ,standing waves in strings, fundamental mode and harmonics, Acoustics of buildings, noise.

Practicals: (1credit)

Sr. no.	Name of practical	Nature	Credit
1	To find the force constant of a helical spring by plotting graph between load and extension.	Practical	0.2
2	To find the speed of sound in air at room temperature using a resonance tube by two resonance positions.	Practical & Practice	0.2 & 0.1
3.	To study the relation between frequency and length of a given wire under constant tension using Sonometer.	Practical	0.2
4.	To study the relation between the length of a given wire and tension for constant frequency using sonometer.	Practical & Practice	0.2 & 0.1

UNIT-III (Overview of optics) (2-0.5-0)

Classification of optics, interference, intensity variation, fringe width ,Interference due to thin film, Newton's ring's, Determination of wavelength of light due to Newton's ring. Newton's corpuscular theory, Huygen's wave theory, Diffraction ,Double refraction, Brewster's law. Basic concepts of Absorption and Emission.

Practical (0.5 credit)

Sr. no.	Name of practical	Nature	Credit
1.	To determine the wave length of sodium light by newton's ring method.	Practical & Practice	0.2 & 0.1
2.	To determine the height of an object with the help of sextant.	Practical	0.2

Recommended text Books:

1. Physics text book for class XI, published by NCERT.
2. physics text book for class XII, published by NCERT.

Reference Books :

1. A text book of optics by N Subramaniam Brij Lal, S Chand publication

III Trimester

Fundamentals of Microbiology

Unit- I (Introduction-aims and scope) (1-1-0)

Theory (1 Credits)

Introduction-aims and scope, Role of microbes in agriculture, public health, medicine and industry, Organization of prokaryotic and eukaryotic cells: Structure and function of cell organelles and surface structure and cellular reserve materials; Distinguishing features of various groups of microorganisms: actinomycetes, bacteria, molds, yeasts and algae and their broad classification.

Practicals : (1 credit)

Sr. no.	Name of practical	Nature	Credit
1	Purify the given bacterial sample by serial dilution method	practical	0.2
	(iii)To prepare culture media for microorganisms	Practical	0.1
	(iv)Growth study of Microorganisms	practical	0.1
2	Perform Gram's staining in given bacterial sample	Practical	0.2
	(iii)Preparation of staining solutions		
	(iv)Microscopic observation and identification	Practical	0.1
		practical	0.1
3	Identify the fungal flora of soil and their microscopic view	Practical	0.2
	(iii) To prepare culture media for microorganisms		
	(iv) Microscopic examination and identification	Practical	0.1
		practical	0.1
4	Preparation of culture media for algae	Practical	0.2
	(i) Media preparation and standard stock preparation		

	(ii) Autoclaving and finalization of media for inoculation	Practical	0.1
		practical	0.1
5	Perform antagonistic activity of micro organisms n	Practical	0.2
	(i) Culture media preparation, inoculation of 2 different organisms	Practical	0.1
	(ii) Observation of result	practical	0.1

Unit-II (Characteristics of micro-organisms) (2-1-0)

Theory (2 Credits)

Characteristics of selected groups of microorganisms including microorganisms of extreme environment, Microbial nutrition and growth-principles of nutrition, growth measurement techniques, effect of environmental and culture parameters on growth, assimilation of nitrogen and sulphur, Isolation and preservation of cultures

Practicals : (1 credit)

Sr. no.	Name of practical	Nature	Credit
1	Isolate the microorganism of extreme environmental condition	practical	0.2
	(i) To prepare culture media for microorganisms	Practical	0.1
	(ii) Streaking	practical	0.1
2	Study the bacterial growth curve with complete phases	Practical	0.2
	(i) Preparation of culture media for microorganisms		
	(ii) Microscopic observation and identification of density of MO	Practical	0.1
		practical	0.1
3	Isolate nitrogen fixating bacteria and their identification	Practical	0.2
	(i) To prepare culture media for microorganisms		

	(ii) Staining, Microscopic examination and identification	Practical	0.1
		practical	0.1
4	Effect of environmental conditions on bacterial growth (i) Media preparation and standard stock preparation (ii) Effect of unusual condition on MO	Practical	0.2
		Practical	0.1
		practical	0.1
5	Perform the preservation process for bacterial culture (i) Culture media preparation, inoculation (ii) Observation of result after complete duration	Practical	0.2
		Practical	0.1
		practical	0.1

Unit-III (Energy transduction in microbial systems) (2-1-0.2)

Theory (2 Credits)

Energy transduction in microbial systems: fermentation, aerobic and anaerobic respiration. Phototrophic microorganisms, Phosphoketolase, Entner-Doudoroff and glyoxalate pathways, Control of microbial growth effect of heat, disinfectants and therapeutic agents, Microbial pathogenicity, Bioassays.

Seminar (0.2 Credit) Based on Unit II recommended.

Practicals : (1 credit)

Sr. no.	Name of practical	Nature	Credit
1	Study the batch and fed batch culture condition on bacterial growth (i) To prepare culture media for microorganisms (ii) Observation of different density and growth of MO	practical	0.2
		Practical	0.1
		practical	0.1
2	Isolate the bacterial pigments form cyanobacteria (i) Preparation of culture media for microorganisms	Practical	0.2

	(ii) Microscopic observation and identification and isolation of Chl pigment	Practical	0.1
		practical	0.1
3	Chromatographic evaluation of bacterial pigments (i) To prepare culture media for microorganisms (ii) Chromatographic identification of pigment	Practical	0.2
		Practical	0.1
		practical	0.1
4	To determine the ability of Microorganisms to degrade and ferment carbohydrates with the production of acid or acid and gas (i) Media preparation and standard stock preparation (ii) Microbial production	Practical	0.2
		Practical	0.1
		practical	0.1
5	To detect the antibiotic sensitivity on the given culture sample (Antibiotic Sensitivity Test) (i) Culture media preparation, inoculation (ii) Observation of result after complete antimicrobial activity	Practical	0.2
		Practical	0.1
		practical	0.1

Recommended Text Books:

1. Microbiology – L. M. Prescott
2. A Textbook Of Basic And Applied Microbiology - Aneja K.R.

Recommended Reference Books:

3. Pelczar Microbiology
4. Practical microbiology by Satish Gupte
5. Basic practical microbiology a manual – Cuteri

Thermodynamics

UNIT – I (Basic concept of Thermodynamics) (3-0-0)
Theory (3 Credits)

Basic Concepts: Introduction and scope of Thermodynamics, Thermostatistics, Thermodynamic properties, Cycle integral for property and non-property variable, Stored and transit forms of energy, Thermodynamic systems and control volume, Isolated system, Universe, Steady flow system, their characteristics and examples, Types of work, Thermodynamic Processes.

UNIT – II (Laws of Thermodynamics) (2-0-0.1)
Theory (2 Credits)

Laws of Thermodynamics: Zeroth Law, First Law of Thermodynamics, Second Law of Thermodynamics, Carnot Theorem, Steam Engine, Concept of entropy, T-S Diagram, availability and irreversibilities. Pure Substances: Behaviour of pure substances.
Group Discussion (0.1 Credit) Based on Unit II recommended.

UNIT – III (Heat transfer) (2-0-0.1)
Theory (2 Credits)

Rankine vs. Carnot, modified Rankine cycle. Air Standard Cycles: Assumptions, Analysis of Otto, Diesel, Dual and Joule cycles, Calculation of cycle work and state values. Introduction to Heat Transfer, Refrigeration and Air-Conditioning.
Seminar (0.1 Credit) Based on Unit III recommended.

Recommended text Books:

1. Heat thermodynamics and statistical physics by Brij lal, N.Subrahmanyam, S.Chand publication New Delhi.

Reference Books:

1. Timoshenko S P and Young D H, "Engineering Mechanics", McGraw Hill (International) 4/e, New Delhi (1984).
2. Beer, Ferdinand: Johnston, Jr., E. Russell, "Vector Mechanics for Engineers: Statics (in SI Units)", 3rd Edition Tata McGraw Hill, 2000.
3. R C Hibbeler, "Engineering Mechanics: Statics (in SI Units)", Pearson Education, India, 2000.

Cell Biology

Unit-I (Ultra-structure of Plant and animal cell) (2-1-0)

Theory (2 Credits)

Cell - Shapes, morphology, Cell theory, Cells , Structure-function relationship including organelles and their Biogenesis (e.g., Endoplasmic reticulum, Mitochondria, Chloroplast, Golgi body, nucleus, lysosomes, vacuoles), Membrane structure , Membrane transport, Cytoskeleton, Extracellular matrix , Cell junctions.

Practicals : (1credit)

Sr. no.	Name of practical	Nature	Credit
1	Study of Microscopy: - Simple, Compound, & Phase Contrast Microscope (i) Learn about simple microscope (ii) Learn about compound microscope (iii) Learn about phase contrast microscope	Practical	0.4
		Practical	0.1
		practical	0.1
		practical	0.2
2	Study of cell organelles by using Models, Charts and Slides. (i) Study of models (ii) Study of charts (iii) Study of slides	Practical	0.3
		Practical	0.1
		practical	0.1
		practical	0.1
3	To demonstrate osmosis by using potato osmoscope. (i) Setting up of potato osmoscope (ii) Demonstration of osmosis	Practical	0.3
		Practical	0.1
		practical	0.2

Unit-II (Brief Idea about cell cycle) (1-1-0.1)

Theory (1 Credits)

Cell cycle: different phases of cell cycle (G_1 , S- phase, G_2 and M-phase). Regulation of cell cycle: role of cyclins and CDKs, Check points. Mitosis: phases of mitosis (prophase, metaphase, anaphase, telophase and cytokinesis). Significance of mitosis. Meiosis: phases of meiosis and gametogenesis.

Group Discussion: Group Discussion based on Unit III is recommended (0.1 Credit)

Practicals : (1 credit)

Sr. no.	Name of practical	Nature	Credit
1	Squash preparation of Onion root tip to study Mitosis. (i) Squash preparation (ii) Making slide (iii) Observation of mitosis	Practical	0.3
		Practical	0.1
		practical	0.1
		practical	0.1
2	Preparation of polytene chromosome in chironomous larva/fruit fly. (i) Separation of chromosome (ii) Making slide (iii) Observation of chromosomes	Practical	0.3
		Practical	0.1
		practical	0.1
		practical	0.1
3	Study of meiosis in Grasshopper testis. (i) Separation of testis (ii) Making slide (iii) Observation of meiosis	Practical	0.3
		Practical	0.1
		practical	0.1
		practical	0.1
4	Learn about cell cycle and Gametogenesis through charts and models	Practice	0.1

Unit- III (Cell signaling) (2-0-0.2)**Theory (2 Credits)**

Cell Signaling: different pathways (G-protein mediated, cAMP mediated and tyrosine kinase mediated), secondary messengers. Cell differentiation, program cell death, techniques in Cell biology (microscopy, chromatography, centrifugation and spectroscopy).

Group Discussion: Group Discussion based on Unit III is recommended **(0.2 Credit)**

Recommended Books:

1. Cell and molecular biology by P.K. Gupta
2. Cell biology by C. B. Panwar, Rastogi publication.

Reference books:

1. Molecular Biology of the Cell- Bruce Alberts, Alexander Johnson, Julian Lewis and Martin Raff.
2. The Cell: A Molecular Approach, Sixth Edition by Geoffrey M. Cooper and Robert E. Hausman

Unit Operations In food Industry

UNIT – I (Flow, Heat Transfer) (2-0.5-0)

Theory (2 Credits)

Principles of fluid flow, heat transfer, heat exchanger, EMC & Water activity, Evaporation, Distillation, Drying, Dehydration; Types of dryers, Material handling equipment; Size reduction, Energy requirement in Size Reduction.

Practical (0.5 Credit)

S. No.	Name of practical	Nature	Credit
1	Solvent Extraction (Extraction)	Practice	0.2
2	Distilled Water Preparation (Distillation)	Practice	0.2
3	Study & Demonstration of Spiral & Planetary Mixers (Mixing)	Practice	0.2

4	Sieve Analysis (Sieving)	Practice	0.2
5	Study & Demonstration of Ball Mill (Size Reduction)	Practice	0.1
6.	Study & Demonstration of Refrigeration System (Refrigeration)	Practice	0.1

UNIT – II (Separation, Mixing etc.) (1-0-0.5)

Theory (1 Credit)

Sieve analysis, Mixing, Kneading, Blending, Homogenization, Size Separation, Sedimentation, Extraction, Leaching, Crystallization, Thermal Processing, Refrigeration principles, Cooling, freezing, thawing of food materials

Seminar: (0.5 Credit) Seminar based on Unit II is recommended

UNIT – III (Mechanical Separation, Grading & Emulsification) (1-0-0.5)

Theory (1 Credit)

Absorption and adsorption, Mechanical Cleaning, Grading, Sorting, Filtration, Membranic Separation, Emulsification

Group Discussion: Group Discussion based on Unit III is recommended **(0.5 Credit)**

Visit of a Modern Food Industry

Recommended Books:

1. Albert Ibarz, Gustavo V. Barbosa-Canovas, Unit Operations in Food Engineering, CRC Press 2010
2. Norman N. Potter, Joseph H. Hotchkiss. Food Science, Springer, 1998
3. R.L. Earle and M.D. Earle, Food Engineering, 1978

