THIRUVALLUVAR UNIVERSITY

BACHELOR OF SCIENCE

DEGREE COURSE

B.Sc. BIOTECHNOLOGY

UNDER CBCS

(with effect from 2008-2009)

The Course of Study and the Scheme of Examinations

B	Part	Subject	Paper	Title of the Paper	Ins. Hrs/ Week	Credit	Exam hrs	Max. Marks		
								IA	Uni. Exam.	Total
I Year I Semester	I	Language	Paper I		6	3	3	25	75	100
	II	English	Paper I		6	3	3	25	75	100
	III	Core	Paper I	Cell and Molecular Biology	6	4	3	25	75	100
	III	Core Practical			3	-	-	-	-	-
	III	Allied I	Paper I	Principles of Biochemistry	4	4	3	25	75	100
	III	Allied Practical	-	Principles of Biochemistry	3	-	-	-	-	-
	IV			**Environmental Studies**	2	2	3	25	75	100
I Year II Semester	I	Language	Paper II		6	3	3	25	75	100
	II	English	Paper II		6	3	3	25	75	100
	III	Core	Paper II	Microbiology	6	5	3	25	75	100
	III	Core Practical	Practical I	Cell and Molecular Biology and Microbiology	3	2	3	40	60	100
	III	Allied I	Paper II	Biostatistics	4	4	3	25	75	100
	III	Allied Practical	Practical I	Biochemistry and Biostatistics	3	2	3	20	30	50
				Value Education	2	2			50	50
II Year III Semester	I	Language	Paper III		6	3	3	25	75	100
	II	English	Paper III		6	3	3	25	75	100
	III	Core	Paper III	Immunology	4	4	3	25	75	100
	III	Core Practical		Immunology	2	-	-	-	-	-
	III	Allied II	Paper III	Basic Computer Applications	4	4	3	25	75	100
	III	Allied Practical	-	Basic Computer Applications	3	-	-	-	-	-

B	Part	Subject	Paper	Title of the Paper	Ins. Hrs/ Week	Credit	Exam hrs	Max. Marks		
								IA	Uni. Exam.	Total
	IV	Skill based Subject I	Paper I	Environment, Health and Management	3	3	3	25	75	100
		Non-Major Elective I	Paper I	Nursery and Gardening	2	2	3	25	75	100
II Year IV Semester	I	Language	Paper IV		6	3	3	25	75	100
	II	English	Paper IV		6	3	3	25	75	100
	III	Core	Paper IV	Molecular Genetics	4	4	3	25	75	100
	III	Core Practical	Practical II	Molecular Genetics and Immunology	2	2	3	40	60	100
	III	Allied II	Paper IV	Bioinformatics	4	4	3	25	75	100
	III	Allied Practical		Computer Applications and Bioinformatics	3	2	3	20	30	50
	IV	Skill based Subject II	Paper II	Microbial Disease and Control	3	3	3	25	75	100
		Non-Major Elective II	Paper II	Bio Processing	2	2	3	25	75	100
III Year V Semester	III	Core	Paper V	Biophysics	6	6	3	25	75	100
	III	Core	Paper VI	Industrial Biotechnology	6	6	3	25	75	100
	III	Core	Paper VII	Genetic Engineering	6	6	3	25	75	100
	III	Core Practical		Industrial Biotechnology and Genetic Engineering	4	4	-	-	-	-
		Elective I	Paper I	Biofertilizer Technology	5	5	3	25	75	100
	IV	Skill based Subject III	Paper III	Bioprocessing Technology	3	3	3	25	75	100
III Year VI Semester	III	Core	Paper VIII	Environmental Biotechnology	6	6	3	25	75	100
	III	Core	Paper IX	Plant and Animal Biotechnology	6	6	3	25	75	100
	III	Core Practical	Practical III	Industrial Biotechnology and Genetic Engineering	-	-	3	40	60	100
	III	Core Practical	Practical IV	Environmental Biotechnology, Plant and Animal Biotechnology	5	5	3	40	60	100
		Elective II	Paper II	Herbal TEchnology	5	5	3	25	75	100
		Elective III	Paper III	Vermiculture	5	5	3	25	75	100
	IV	Skill based Subject IV		Food Processing Technology	3	3	3	25	75	100
	V	Extension Activities				1	3			50
				Total	180	140				3700

THIRUVALLUVAR UNIVERSITY

B.Sc. BIOTECHNOLOGY

SYLLABUS

UNDER CBCS

(with effect from 2008-2009)

I SEMESTER

PAPER I

CELL AND MOLECULAR BIOLOGY

UNIT-I

Cell as a basic unit - classification of cell types - cell theory - organization of plant and animals cells - comparison of microbial, plant and animal cells.

UNIT-II

Ultra structure of cells - sub-cellular organization - structure and function of cell membranes, cytosol / Endoplasmic recticulum, nucleus, cytoskeleton, ribosomes, mitochodria and chloroplast, vacuoles, peroxisomes, lysosome, cell wall.

UNIT-III

Cell division (Eukaryotic and Prokaryotic) - mitosis, meiosis and cell cycle.

UNIT-IV

Cell - Chemical nature and macromolecular protein structure and function; membrane architecture, membrane associated process, ATP synthesis and photosynthesis, Sub-cellular organelles - mitochondria, chloroplast.

UNIT-V

Chromosomal Architecture - modern concept of Gene; Prokaryotes and Eukaryotes, Genetics of bacteria - Gene transfer in bacteria - Transformation, transduction and conjugation - mechanism and their use in genetic mapping, DNA transfections: Replication, repair, recombination, restriction and modification.

Reference

1. Cell Biology, De Roberties & De Roberties, Blaze publishers & Distributors Pvt. Ltd., New Delhi, 2001.
2. Molecular cell Biology (III rd Edition), Harvey Lodish, David Baltimore et al., W.H. Freeman, 2000.
3. Molecular Biotechnology - Principles and Applications of recombinant DNA, Glick, B.R and J.J Pasternak, 2002. Panima Publishing Co-operations.
4. Microbial Genetics (II Edition) - Maloy S.R., Cronan, J.E.Jr and Frieifelder, D. Jones. Bartlett publishers
5. Concept of Genetics (IV Edition) Willam S. Klug & Micheal R. Cummings.

ALLIED

PAPER I

PRINCIPLES OF BIOCHEMISTRY

UNIT-I

Aqueous solutions - properties of water - hydrogen ion concentration - acids, bases and their concept - buffers and electrolytes and their functions - acidity, alkalinity and pH determination.

UNIT-II

Bioenergetics - energy and its forms - free energy - laws of thermodynamics - enthalpy and entropy - redox potential - redox coupling and ATP bioenergetics.

UNIT-III

A brief account on the biochemistry of Carbohydrates (sugars, starch, cellulose), Lipids (triglycerides, fats), Proteins (structural, catalytic) - primary, secondary, tertiary and quaternary structure and characteristics of proteins and amino acids.

UNIT-IV

Enzymes: classification and nomenclature of enzymes - physico chemical nature of enzymes - enzyme kinetics - mechanism of enzyme action - factors affecting enzyme activity.

UNIT-V

A brief account on the biochemistry of the secondary plant products:

Alkaloids, flavonoids, anthocyanins, terpenes - Elementary treatment of fractionation of biological materials by chromatography (PC, TLC), electrophoresis (principle and types), centrifugation (principle and types).

Reference

1. Biochemistry, L.Stryer, 1999. IV Edition. Freeman Company, New York.
2. Biochemistry, Lehninger, 1982. Worth Publications Inc., CBS Publication, New Delhi.
3. Elements of Biochemistry, H.S.Srivastava, Rostogi Publications.
4. Outline of Biochemistry, Corn & Stump.

ENVIRONMENTAL STUDIES

(For all UG Degree Courses)

UNIT-I: INTRODUCTION TO ENVIRONMENTAL SCIENCES: NATURAL RESOURCES :

Environmental Sciences - Relevance - Significance - Public awareness - Forest resources - Water resources - Mineral resources - Food resources - conflicts over resource sharing - Exploitation - Land use pattern - Environmental impact - fertilizer - Pesticide Problems - case studies.

UNIT-II: ECOSYSTEM, BIODIVERSITY AND ITS CONSERVATION:

Ecosystem - concept - structure and function - producers, consumers and decomposers - Food chain - Food web - Ecological pyramids - Energy flow - Forest, Grassland, desert and aquatic ecosystem.

Biodiversity - Definition - genetic, species and ecosystem diversity - Values and uses of biodiversity - biodiversity at global, national (India) and local levels - Hotspots, threats to biodiversity - conservation of biodiversity - Insitu & Exsitu.

UNIT-III: ENVIRONMENTAL POLLUTION AND MANAGEMENT

Environmental Pollution - Causes - Effects and control measures of Air, Water, Marine, soil, solid waste, Thermal, Nuclear pollution and Disaster Management - Floods, Earth quake, Cyclone and Land slides. Role of individuals in prevention of pollution - pollution case studies.

UNIT-IV: SOCIAL ISSUES - HUMAN POPULATION

Urban issues - Energy - water conservation - Environmental Ethics - Global warming - Resettlement and Rehabilitation issues - Environmental legislations - Environmental production Act. 1986 - Air, Water, Wildlife and forest conservation Act - Population growth and Explosion - Human rights and Value Education - Environmental Health - HIV/AIDS - Role of IT in Environment and Human Health - Women and child welfare - Public awareness - Case studies.

UNIT-V: FIELD WORK

Visit to a local area / local polluted site / local simple ecosystem - Report submission

REFERENCES

1. KUMARASAMY, K., A.ALAGAPPA MOSES AND M.VASANTHY, 2004. ENVIRONMENTAL STUDIES, BHARATHIDSAN UNIVERSITY PUB, 1, TRICHY

2. RAJAMANNAR, 2004, ENVIRONEMNTAL STUDIES, EVR COLLEGE PUB, TRICHY

3. KALAVATHY,S. (ED.) 2004, ENVIRONMENTAL STUDIES, BISHOP HEBER COLLEGE PUB., TRICHY

II SEMESTER

PAPER II

MICROBIOLOGY

UNIT-I

History of Microbiology.

Classification of microorganisms - Kingdom protista, prokaryotic and eukaryotic microorganisms, the five kingdom concept of classification, archaeobacteria, eubacteria and eukaryotes.

UNIT-II

Microscope-light, electron and laser optic system; micrometry.

Algae, bacteria, fungi, viruses and protozoa - morphology, ultra structures, sub cellular structure and cell envelope - slime, capsule, cell wall, cell inclusion

Reproduction and life cycle pattern.

UNIT-III

Nutritional requirements and nutritional grouping of microorganisms, selective and differential media, enrichment media, microbial assay media.

Growth curve; axenic culture, synchronous culture, continuous culture; Methods of enumeration of microorganisms and preservation of microbes

UNIT-IV

Factors controlling microbial growth-Physical agents and processes- pH, light, temperatures, desiccations, osmotic pressure, radiation, filtration; Chemical agents-Disinfectants, antiseptics and chemical sterilants; Antimicrobial chemotherapy evaluation-tube dilution, agar plate technique, phenol coefficient techniques.

UNIT-V

Microbes as a source of protein - Single Cell Protein.

Role microbes in food spoilage and human diseases such as hepatitis, typhoid, TB, cholera, Malaria, fungal skin diseases.

Reference

1. Microbiolgoy-Concept and applications, Pelczer M.J.J, E.C.S. Chang & N.R. Krieg, 1993. McGraw Hill company New York
2. Microbiology. Prescot L.M, J.D. Harley & D. A. Klein, 1999. McGraw Hill.
3. Microbiology, Fundamentals and Applications, Ronald M. Atlas, 1987. Prentice Hall.
4. General Microbiology, Stanier, 1986. McMillan Publishing Co.
5. Microbiology - An Introduction, 4th Edition, Gerard J. Tortora, Berdell R. Funke, Christine L. Care, 1992. The Benjamin/Cummings Publishing Company, Inc.

CORE PRACTICAL I
CELL AND MOLECULAR BIOLOGY AND MICROBIOLOGY

Cell and Molecular biology

1. Cell Types - Microbial, Animal and Plant Morphometric measurements.
2. Fractionation of cellular components.
3. Cell membrane, Separation and analysis of membrane components.
4. Mitosis and Meiosis
5. Microscopy and calibrations
6. Single Cell Colony Isolation - Checking for Genetic Markers
7. Induced Mutagenesis (UV and NTG)
8. Isolation of antibiotic resistant and auxotrophic mutants.
9. Bacterial Transformation
10. Bacterial Conjugation

Microbiology

1. Microscope - calibration using ocular stage micrometers
2. Sterilization methods
3. Preparation of culture media for bacteria and fungi
4. Isolation and enumeration of bacteria and fungi
5. Culture technique - streak plate, pour plate and spread plate
6. Measurement of bacterial growth rate
7. Identification - staining techniques, motility, biochemical tests.

ALLIED

PAPER II

BIOSTATISTICS

UNIT-I

Biostatistics - definition - statistical methods - basic principles. Variables - measurements, functions, limitations and uses of statistics.

UNIT-II

Collection of data primary and secondary - types and methods of data collection procedures - merits and demerits. Classification - tabulation and presentation of data - sampling methods.

UNIT-III

Measures of central tendency - mean, median, mode, geometric mean - merits & demerits. Measures of dispersion - range, standard deviation, mean deviation, quartile deviation - merits and demerits; Co-efficient of variations.

UNIT-IV

Correlation - types and methods of correlation, regression, simple regression equation, fitting prediction, similarities and dissimilarities of correlation and regression.

UNIT-V

Statistical inference - hypothesis - simple hypothesis - student 't' test - chi square test.

Reference

1. Biostatistic, Danniel, W.W., 1987. New York, John Wiley Sons.
2. An introduction to Biostatistics, 3rd edition, Sundarrao, P.S.S and Richards, J. Christian Medical College, Vellore
3. Statistical Analysis of epidemiological data, Selvin, S., 1991. New York University Press.
4. Statistics for Biology, Boston, Bishop, O.N. Houghton, Mifflin.

5. The Principles of scientific research, Freedman, P. New York, Pergamon Press.
6. Statistics for Biologists, Campbell, R.C., 1998. Cambridge University Press.
7. Statistics for medicine, Colton, T., 1974. Little Brow, Boston

ALLIED PRACTICAL I

BIOCHEMISTRY AND BIOSTATISTICS

Biochemistry

1. Determination of pH from unknown biological samples using pH paper and pH meter.
2. Measurement of energy by Bomb colorimeter.
3. Analysis of carbohydrates (sugars, starch), proteins, lipids, and amino acids in biological samples.
4. Assays of amylase, peroxidase, catalase from biological samples using Spectrophotometer.
5. Separation of plant pigments and amino acids by PC and TLC.
6. Demonstration of gel electrophoresis.
7. Fractionation of biological material into its various components by Centrifuge.

Biostatistics

1. Calculation of mean, standard deviation and standard error
2. Calculation of correlation coefficient values and finding out the probability
3. Calculation of 'F' value and finding out the probability value for the F value.

Reference

1. Physiology Chemistry, Oser. B. L. Hawks 1965. TATA McGrew Hill.
2. Laboratory manual in biochemistry, Strolve, B.L.A., Mzka vora, V.C.1989. MIR Publisher, Moscow.
3. Biochemical methods - Sadasivam and Manikam (1996) New age international publishers, Second Edition. New Delhi

VALUE EDUCATION
(For all UG Degree Courses)

UNIT-I

Value Education - Definition - relevance to present day - Concept of Human Values - self introspection - Self esteem.

UNIT-II

Family values - Components, structure and responsibilities of family - Neutralization of anger - Adjustability - Threats of family life - Status of women in family and society - Caring for needy and elderly - Time allotment for sharing ideas and concerns.

UNIT-III

Ethical values - Professional ethics - Mass media ethics - Advertising ethics - Influence of ethics on family life - psychology of children and youth - Leadership qualities - Personality development.

UNIT-IV

Social values - Faith, service and secularism - Social sense and commitment - Students and Politics - Social awareness, Consumer awareness, Consumer rights and responsibilities - Redressal mechanisms.

UNIT-V

Effect of international affairs on values of life/ Issue of Globalization - Modern warfare - Terrorism. Environmental issues - mutual respect of different cultures, religions and their beliefs.

Reference Books

1. T. Anchukandam and J. Kuttainimathathil (Ed) Grow Free Live Free, Krisitu Jyoti Publications, Bangalore (1995)
2. Mani Jacob (Ed) Resource Book for Value Education, Institute for Value Education, New Delhi 2002.
3. DBNI, NCERT, SCERT, Dharma Bharti National Institute of Peace and Value Education, Secunderabad, 2002.
4. Daniel and Selvamony - Value Education Today, (Madras Christian College, Tambaram and ALACHE, New Delhi, 1990)
5. S. Ignacimuthu - Values for Life - Better Yourself Books, Mumbai, 1991.
6. M.M.M.Mascaronhas Centre for Research Education Science and Training for Family Life Promotion - Family Life Education, Bangalore, 1993.

WEBSITES AND e-LEARNING SOURCES:

www.rkmissiondhe/.org/education.html/

www.clallam:;org/lifestyle/education.html/

www.sun.com/../edu/progrmws/star.html/

www.infoscouts.com

www.secretofsuccess.com

www.1millionpapers.com

http://militarlyfinance.umuc.edu/education/edu-network.html/

III SEMESTER

PAPER III

IMMUNOLOGY

UNIT-I

Historical perspectives - overview of immune system, innate and acquired immunity, immune - systematic structure and organization.

UNIT-II

Antigen and antigenicity, Immunoglobulins - structure, complements, antigen - antibody interaction - monoclonal antibodies.

UNIT-III

Organisation and expressions of immunoglobulin genes - histocompatability complex.

UNIT-IV

Cytokines: Structure and function-cytokine receptors-biological functions of cytokines - cell mediated immunity; reports and T cell activation - Humoral response; B cell activation and proliferation - hypersensitive reactions.

UNIT-V

Immune regulation, autoimmunity, vaccines and immune response to infectious diseases - Immunodeficiency diseases (AIDS) - immune suppression & transplantation.

Reference

1. Immunology (V Edition),- Richard A.Goldsby, Thomas. J. Kindt, A. Osborne, JanisKuby, 2003. W.H. Freeman and company
2. Immunology, Ivan Roitt, 2001. Harcourt publishers, ltd.
3. Essential immunology, Ivan Riott, 2000. Blackwell Science, 9th Edition.
4. Immunology - An Introduction, Tizard.

ALLIED

PAPER III

BASIC COMPUTER APPLICATIONS

UNIT-I

Fundamentals of Computers: Classification, Computer organization, Input devices, Processing unit, Output devices, external storage devices, System Software, Language, flowcharting examples.

UNIT-II

Basics of Basic: Sample program, Listing and editing, Saving and running programs, Merging and erasing programs.

Constants and Variables: Getting data into memory.

Expressions: Hierarchy of aberration, Rules of arithmetic evaluation of expressions, Relational expressions, Logical operations, Library functions.

UNIT-III

Printer Controls: Comma, Semicolon, tab, print using, print, and Silicon graphics - branching looping - goto, if-then, on-goto, for-next; subscripted variables- single, double, searching and sorting, functions and subroutines.

UNIT-IV

Histograms and graph - histograms, plotting single and two graphs, matrix algebra addition, subtraction, multiplication, transpose, invert; string manipulation-string and string related functions, concatenation, subscripted string variables, alphabetical sorting.

UNIT-V

File Management - file types, handling sequential files, handling random files.

Computer graphics - resolution and colour, points, lines, boxes, circles, ellipse, painting an area.

Reference

1. Programming in BASIC, E.Balagurusamy, 1991. Tata McGraw Hill, IIIrd Edition.
2. Digital Computer Fundamentals, Bartee, 6th Edn.
3. Fundamentals of Computer algorithms, Horowitz, Shahni, Rajasekaran.
4. Programming with Basic, Gottfried, 3 Edn.
5. Basic Programming, B.J. Holmes.
6. Computer Programming in Basic, S. Grover.
7. Fundamentals of algorithms, Brassard, Bratley.

SKILL BASED SUBJECT I

PAPER I

ENVIRONMNET, HEALTH AND MANAGMENT

UNIT-I:

Ecology - ecosystem and their types - definitions - environmental components and interrelationships - physical, chemical and biological characteristics of environment energy flow and materials cycling.

UNIT-II:

Definition - source of pollution - types of pollution - air, water, soil, noise and radioactive pollution - environmental sanitation - environmental issues - global - national - regional and local.

UNIT-III:

Prescribed environmental standards - WHO - Pollution Control Board - risk probability and hazards to humans - toxicology - chemical hazards - biological hazards: disease development and developing countries.

UNIT-IV:

Pollution control methods - physical, chemical and biological - waste water treatment - activated sludge process, oxidation ponds and trickling filter - anaerobic process.

UNIT-V:

Tool for environment management - Environmental Impact Assessment - waste minimization techniques - environmental planning in urban development - natural resources and sustainable development - environmental ethics.

SUGGESTED READINGS:

1. Kurian Joseph and R.Nagendra (2004) "Essentials of Environmental Studies" Pearson Education, New Delhi.
2. Tyler Miller.J.R. (2004) "Environmental Science" Thomson Brooks/Cole, Singapore.
3. Suresh K.Dhameja (2005) "Environmental Science and Engineering" Kataria sons, Delhi.
4. Dubey.R.c. (2006), "Environmental Health Ecological Perspectives", Jones and Bartlett Publishers, Singapore.
5. Rajendran, P. and P. Gunasekaran (2006). Microbial Bioremediation", MJP Publishers, Chennai, India.

NON-MAJOR ELECTIVE I

PAPER I

NURSERY AND GARDENING

UNIT-I:

Nursery: definition, objectives and scope and building up of infrastructure for nursery, planning and seasonal activities - Planting - direct seeding and transplants.

UNIT-II:

Seed: Structure and types - Seed dormancy; causes and methods of breaking dormancy - Seed storage: Seed banks, factors affecting seed viability, genetic erosion - Seed production technology - seed testing and certification.

UNIT-III:

Vegetative propagation: air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings - Hardening of plants - green house - mist chamber, shed root, shade house and glass house.

UNIT-IV:

Gardening: definition, objectives and scope - different types of gardening - landscape and home gardening - parks and its components - plant materials and design - computer applications in landscaping - Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting.

UNIT-V:

Sowing/raising of seeds and seedlings - Transplanting of seedlings - Study of cultivation of different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomatoes, and carrots - Storage and marketing procedures.

REFERENCES:

1. Bose, T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
3. Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
4. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
5. Agrawal, P.K. 1993, Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.
6. Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San Francisco, USA.

IV SEMESTER

PAPER IV

MOLECULAR GENETICS

UNIT-I

Gene as a unit of mutation and recombination - DNA as a genetic material - different types; RNA as a genetic material - different types-genetic code; Mutation - molecular nature - physical and chemical mutagens and its applications.

UNIT-II

DNA replication - prokaryotic and eukaryotic DNA replication - Mechanisms of DNA replication - Enzymes and accessory proteins involved in DNA replication - Bacterial genetic system - transformation, conjugation and transduction.

UNIT-III

DNA damage - mechanism of repair - excision repair, recombination repair, promoter, operator, terminator and attenuator - SOS, and adaptive responses and their regulation - Heat shock response.

UNIT-IV

Genomics and Proteomics: structural and functional genomics; proteomics -definition - analysis and characterization - related technologies, and interrelations with genomics.

UNIT-V

Discovery of types and structure of plasmids - artificial plasmid transfer and their applications - Insertion sequence in prokaryotes - Transposable elements - discovery and characterization.

Reference

1. Molecular Biology, H.D.K.Kumar, Vikas Publishing House Private LTD.
2. Introduction to Sub molecular Biology, Alberts Szent- Gyorgyi, 1960. Academic press.
3. The Molecular Biology of the Gene, J.D.Watson et al., 1987. Benjamin Cummings.
4. Genes V II. Benjemin Lewin, 1994. Oxford University Press. Oxford.
5. Molecular cell Biology (III rd Edition), Harvey Lodish, David Baltimore et al., W.H. Freeman, 2000.
6. Development Biology 3rd Edition, Leon W.Browder, Erickson and William R.Jefhery. Saunders College Publishing.

CORE PRACTICAL II
MOLECULAR GENETICS AND IMMUNOLOGY

Molecular Genetics

1. Induced mutagenesis (UV & NTG)
2. Isolation of chromosomal DNA from animal tissues & Bacteria.
3. Isolation of plasmid-DNA.
4. Isolation of total RNA from animal tissues.
5. Bacterial transformation

Immunology

1. Blood grouping
2. Blood cell analysis
3. Lymphocyte subset identification and enumeration.
4. Handling of laboratory animals.
5. Routes of inoculation
6. Preparation of Antigen - Protocol of immunization
7. Methods of bleeding
8. Preparation of serum components
9. Immuno diffusion
10. Radial immuno-diffusion test.
11. Immuno electrophoresis
12. Complement fixation test
13. Haemoagglutination.
14. Serum electrophoresis.
15. Antigen-antibody reaction (precipitation & agglutination reaction tests)

Reference

Sambrook *et al.*, "Molecular Cloning-A laboratory Manual"

ALLIED

PAPER IV

BIOINFORMATICS

UNIT-I

Bioinformatics-definition, history; computer - system, topology and peripherals for communication; Internet - basics, connection, web browsing and URL

UNIT-II

Data bases - Nucleic acid sequence data bases (NCBI, EMBL, DDJB), Protein sequence data base-SWISS-PORT, data base searching - BLAST.

UNIT-III

Allignments local, global, pairwise & multiple sequences; anlaysis phylogenetics - CLUSTAL, PHYLIP & UPGAMAS. Gene finding and gene scan.

UNIT-IV

Protein prediction - physical properties, secondary structure, alpha & beta structure, motifs, tertiary structures, specialized structure and function.

Molecular visualization - protein conformation and visualization tool (RASMOL).

UNIT-V

Drug discovery - role of bioinformatics in drug discovery, target discovery, lead discovery, microarray, docking and prediction of drug quality. Bioinformatics companies.

Reference

1. Programming in ANSIC, E. Balagurusamy, 1991. Tata Mcgraw Hill.
2. Introduction to bioinformatics, 2001. AH wood, T.K. Parry smith DJ, Pearson education Asia.
3. C & Unix programming; A conceptual perspective, 1995. Kulti, Tata Mc Graw Hill.
4. Developing bioinformatics in computer skill, Gibas C, Jambeek P.S, oreilly, 2001. associates inc. Shrott publishes.

ALLIED PRACTICAL II

COMPUTER APPLICATIONS AND BIOINFORMATICS

1. Quadratic equations
2. Mean, standard deviation
3. Factorial (using subroutine)
4. NCR using subroutine
5. Prime numbers
6. Largest and smallest numbers
7. Matrix addition, transpose.
8. Familiarization of windows - Windows 95-2000.
9. Fundamentals of Networking, operation, telnet, FTP.
10. Database & information retrievals.
11. Tools in database search: BLAST, RASMOL.

SKILL BASED SUBJECT II

PAPER II

MICROBIAL DISEASE AND CONTROL

UNIT-I:

Micro organisms - microbial interactions - pathogens.

General epidemiology - pathogenesis - pathology - diagnostic procedure - clinical manifestation - prevention and control measures.

UNIT-II:

Virus: (a) HIV, (b) Pox virus, and (c) Picorna virus - Epidemiology - pathogenesis - pathology - diagnostics procedure - clinical manifestation - prevention and control measures.

UNIT-III:

Bacteria: (a) Streptococcus (b) Staphylococcus and (c) Salmonella - Epidemiology - pathogenesis - pathology - diagnostic procedure - clinical manifestation - prevention and control measures.

UNIT-IV:

Fungi: (a) Aspergillus, (b) Candida and (c) Microspora - Epidemiology - pathogenesis - pathology - diagnostic procedure - clinical manifestation - prevention and control measures.

UNIT-V:

Protozoa: (a) Entamoeba histolytica, (b) Plasmodium species and (c) Trypanosoma gambiense - Epidemiology - pathogenesis - pathology - diagnostic procedure - clinical manifestation - prevention and control measures - vectors.

SUGGESTED READINGS:

1. Medical Microbiology by David Green Wood Richard slack & John Peuthrer. Churchill Livingston Company.
2. Text book of Medical Parasitology. Jaypee Brothers Medical Publishers (P) Ltd. Parasitology by K.P.Chattergy Medical Microbiology by Jawelz, Melnick, Geo R.Brokes Me Graw-Hill Company.
3. Medical Microbiology by Anantanarayan & Panekar Orient Longman Limited. Practical Medical Microbiology by Mackic & Mc Carteney.
4. Bacterial Diseases by Wilson & Topley. Medical Microbiology by Cruckshank - Vol.I & Vol.II.
5. General Virology by Luria & Parnel Virology by Dimmock.
6. Textbook Virology by Rhodes & Van Royen
7. Medical Mycology by Jagedeese Chander
8. Medical Microbiology by Jawatz.

NON-MAJOR ELECTIVE II

PAPER II

BIOPROCEESING

UNIT-I:

Introduction to fermentation: rate of microbial growth and death. Fermentation - types, classification, basic requirements, design of a fermentor, factors involved in fermentor design - basic functions - containment body construction - temperature control-stirring and mixing - viscosity - Newtonian and Non Newtonian fluids.

UNIT-II:

Isolation and preservation of industrially important micro organisms - strain development mutation and recombination - upstream processing, media for industrial fermentation - characteristics of an ideal production medium - raw material - screening for production media - media formulation - sterilization - (batch and continuous) - addition of antifoaming agents.

UNIT-III:

The development of inoculums for various fermentation processes - operation, measurement and control in fermentation - aeration and agitation in fermentation - oxygen requirement - measurement of adsorption coefficients - bubble aeration, mechanical agitation. Sterilization-air sterilization, media sterilization - recovery and purification of intracellular and extra cellular products.

UNIT-IV:

Fermentation kinetics of batch, continuous and fed batch fermentation - cell recycle - scale up window - principle types of fermentor: tower fermentor, cylindro conical, airlift fermentor, deep jet fermentor, photo bioreactor, membrane bioreactor and micro carrier reactors.

UNIT-V:

Biological waster treatment and in-plant sanitation - principle and use of biosensor - production of vitamins, amino acids, organic acids, enzymes and antibiotics, alcohols. Enzyme technology - production and recovery of enzymes, enzyme immobilization - application of enzyme in industries. Biosensors - types and application in various industries.

SUGGESTED READINGS:

1. Stanburry P.P. and Whitaker, A. 1984. Principles of Fermentation Technology. Pergamon Press, Oxford UK.
2. Steinkraus, K.H. 1983. Handbook of Indigenous Fermented Foods. Marcel Dekker, New York.
3. Casida, J.E., 1968. Industrial Microbiology, Wiley Eastern Publication
4. Cruegar, W. and Cregar, A., 1989. Biotechnology: A text book of industrial Microbiology, 2nd edition. Panima Publishing Corporation, New Delhi.
5. Patel. A.H. 1966. Industrial Microbiology, Mac Millan India Ltd.
6. Stanbury, A.H., A. Whittaker and Hall S.J. 1995. Principles of fermentation technology 2nd edition, Pergamon Press.

V SEMESTER

PAPER V

BIOPHYSICS

UNIT-I

Energetics of a living body, sources of heat limits to temperature (qualitative treatment), Heat dissipation to conservation, laws of thermodynamics.

Nature of chemical bonds - intra and intermolecular interactions in biological systems.

UNIT-II

Absorption spectroscopy - Beer Lambert's law, colorimetry to spectrophotometry (Single and double beam spectrophotometer) - primary biophysical events in photosynthesis.

Physical methods for determining size and shape of macromolecules - diffusion to sedimentation - reverse osmosis.

UNIT-III

Spectroscopic techniques for molecular structure (quantitative techniques) - general spectroscopy (UV, visible, fluorescence, atomic absorption, IR to Raman spectra).

UNIT-IV

Physical methods of imaging intact biological structures (X-ray, CAT-Scan, ECG, EEG, NMR) and radioactive pollution.

UNIT-V

Structure of proteins - X-ray crystallography - centrifugation, autoradiography - GM Counter -LS counter.

Reference

1. Physical Biochemistry, Applications to Biochemistry and Molecular Biology - D, Freifelder.
2. General Biophysics, Vol. I & II - H.V. Volkones.
3. Molecular Biophysics - B. Pullman & M. Voino.

PAPER VI

INDUSTRIAL BIOTECHNOLOGY

UNIT-I

Introduction to biotechnology and products. Major classes of commercial products using micro organisms-enzymes, amino acids, vitamins, antibiotics, organic solvents, organic acids, food and beverages.

UNIT-II

Industrially important microorganisms: screening techniques - detection & assay of fermentation products-strain improvements - mutations, protoplast fusion and rDNA techniques for strain development.

UNIT-III

Bioreactors / Fermentor: Types, features, operation: sterilization (Batch and Continuous), inoculation and sampling. Control of bioprocess parameters. Microbial growth and media formulation. Microbial culture - batch, fed batch, semi-continuous, continuous. Growth kinetics of microorganisms.

UNIT-IV

Down stream processing: Solid-liquid separation, flotation, flocculation, filtration, centrifugation, cell disruption, concentration, evaporation, liquid-liquid extraction, membrane filtration, precipitation, adsorption. Product purification by chromatography.

UNIT-V

Industrial process of beverages - enzymes - amino acid - organic acids - organic solvents - antibiotics.

Introduction to nanotechnology - history and recent developments - sources of nanoparticles - microbial production of nanoparticles - advantages of microbial nanoparticles - applications.

Reference

1. Manual of industrial microbiology and Biotechnology, Demain A.L. Solomon, J.J., 1986. ASM press.
2. Industrial Microbiology, Reed C., Prescott and Dann's, 1982. Macmillan publishers.
3. Fundamentals of Biotechnology, Prave. P. Faust, V. Sitih. W., Sukatsh, DA, 1987. ASM press.
4. Biotechnology, Satyanarayana, U., 2006. Books and Allied (P) Ltd.
5. AN introduction to Genetic Engineering, Desmond, S.T., Nicholl, 1994. Cambridge press.
6. Principles of Gene Manipulation. 4th edition, Old R.W. and S.B. Primrose, 1994. Blackwell scientific publication London.
7. Fundamentals of Biotechnology, P.Prave, P.Faust, V. Sitting, word sukatasch D., 1987. VCH verlasgetell Schafor MBH, Weinhkeim.

PAPER VII

GENETIC ENGINEERING

UNIT-I

Recombinant DNA: Historical perspective and early experiment, *in vivo* gene construction like P1, transduction, cloning vectors, cloning hosts; bacteria fungi animal and plant cells - Gene transfer in nature; interspecies gene transfer.

UNIT-II

Restriction enzymes and their use - DNA modifying enzyme like DNA polymerases, ligases, polynucleotide kinase, restriction and ligation of DNA, cloning vector for cloning large pieces of DNA like yeast artificial chromosomes.

UNIT-III

Types of plasmids - conjugative and non conjugatives, incompatibility group, Transfer of plasmids, properties of plasmids like F, Ti drug resistance plasmids, carcinogenic plasmid, plasmid vector, high and low copy number of vectors, regulation of copy number, general purpose plasmid, cloning vectors - Col E1 derived vectors, integrative plasmid vectors - Ti plasmids and their structure.

UNIT-IV

Phage biology lytic and lysogenic cycle phage vector - early, middle & late order of genes, phage as a cloning vector, replacement and integrated vector - commit and their construction, plant and animal viruses and their use as vectors.

UNIT-V

Gene transfer in bacteria, plant and animal cell, electroporation and particle bombardment. Analysis of cloned foreign genes; Hybridization in liquid and on solid support, DNA and RNA probes. Transgenics - generation of transgenics and uses of transgenics.

Reference

1. Gene Cloning - An introduction, T.A. Brown. Van Reinhold, 1988.
2. Recombinant DNA - Watson JD, Gilman M, Witkowski J and Zoller M, 1992. Second Ed. Scientific American Books.
3. DNA Cloning I and II, D.M. Glover and B.D. Hames, 1995. IRL press.
4. Genetic Engineering - An introduction, D.S.T. Nicholl.
5. Principles of Gene Manipulation, R.N.Old and S.B. Primrose, 1994. Blackwell Publishers, New York.

ELECTIVE I

PAPER I

BIOFERTILIZER TECHNOLOGY

UNIT-I:

An introduction to fertilizers, synthetic fertilizers, natural fertilizers, inorganic fertilizers, organic fertilizers, bio-fertilizers - importance, advantages and constraints.

UNIT-II:

Isolation, culturing methods, enumeration and identification of microbial species - Rhizobium, Azospirillum Azotobacters, blue green algae and phosphate solubilisers.

UNIT-III:

Morphology of Rhizobium, Azospirilium, Azotobacters, blue green algae and phosphate solubilisers and maintenance - inoculant preparation.

UNIT-IV:

Preparation of microbial inoculants - large-scale production of microbes - their application as biofertilizers - crop responses to biofertilizers.

UNIT-V:

Azolla - distribution, morphological and biochemical characteristics - cyanobacterial symbionts - azolla biofertilizer technology - organic matter and composting - method of processes, applications and limitations.

SUGGESTED READINGS:

1. N.S.Subba Rao, (2000). Biofertilizers in Agriculture. Oxford & IBH publishing Co., New Delhi.
2. Daniel Sundararaj, D. and G. Thulasidas. (1993). Botany of Field Crops. (2nd Ed.) Macmilan India Ltd.
3. Jeswani, L.M. and Balddev, B. (1990). Advances in Pulse Production Technology. ICAR, New Delhi
4. Malsen, L.J.G.V. and S. Somaatmadja, (1993). PROSEA - Plant Resources of South East Asia. No.1. Pulses. International Book Distributors, Dehradun.

SKILL BASED SUBJECT III

PAPER III

BIOPROCESSING TECHNOLOGY

UNIT-I:

Scope and history of bioprocess technology - isolation and screening of industrially important microbes - microbial strains improvement.

Basic principles in bioprocess technology. Fermentations-submerged and solid state.

UNIT-II:

Sterilization methods - batch and continuous sterilization systems, sterilization of air. Fibrous filters. Media formulation - bioreactor - types and functions.

UNIT-III:

Bioprocess control and monitoring of variable factors such as temperature, agitation, pressure, pH - on line measurement - on/off control, PID control.

UNIT-VI:

Ultra filtration, centrifugation, chromatography, electrophoresis, solvent extraction. Distillation - purification of biological (Down stream processing).

UNIT-V:

Process of canning, packing and preservation of food products – immobilization and lyophilization.

SUGGESTED READINGS:

1. Comprehensive Biotechnology - Volume 2, 3 and 4 by Moo- Yours (Editor) (1985). Pergarmon press.
2. Fundamentals of Biotechnology by P.Prave A.Faust, W.Sitting and D.A.Sankasesj (1987) WCH Weinthein.
3. Principles of Fermentation technology by P.F.Stanbury, and A.Whitakor (1984). Pergamon press
4. Chemical Engineering by J.M.Coulson and J.F.Richaxlson (1984) Pergarmon press.
5. Microbial Biotechnology by Glazer and Niteaid D (1995) W.H.Freeman and Co., New York.
6. Industrial Biotechnology by Casida
7. Industrial Biotechnology by Patel.
8. Bioprocess Engineering principles by Pauling M.Doran (2005).

VI SEMESTER

PAPER VIII

ENVIRONMENTAL BIOTECHNOLOGY

UNIT-I

Environment - basic concepts and issues, global environmental problems - ozone depletion, UV-B, greenhouse effect and acid rain due to anthropogenic activities, their impact and biotechnological approaches for management.

UNIT-II

An overview of atmosphere, hydrosphere, lithosphere and anthrosphere - environmental problems.

Environmental pollution - types of pollution, sources of pollution, measurement of pollution, methods of measurement of pollution, fate of pollutants in the environment, Bioconcentration, bio/geomagnification.

UNIT-III

Microbiology of waste water treatment, aerobic process - activated sludge, oxidation ponds, trickling filter, towers, rotating discs, rotating drums, oxidation ditch. Anaerobic process - anaerobic digestion, anaerobic filters, up-flow anaerobic sludge blanket reactors. Treatment schemes for waste waters of dairy, distillery, tannery, sugar and antibiotic industries

UNIT-IV

Xenobiotic compounds - organic (chlorinated hydrocarbons, substituted simple aromatic compounds, polyaromatic hydrocarbons, pesticides, surfactants) and inorganic (metals, radionuclides, phosphates, nitrates). Bioremediation of xenobiotics in environment - ecological consideration, decay behavior and degradative plasmids, molecular techniques in bioremediation

UNIT-V

Role of immobilized cells/enzymes in treatment of toxic compounds. Biopesticides, bioreactors, bioleaching, biomining, biosensors, biotechniques for air pollution abatement and odour control.

Reference

1. Waste water engineering - treatment, disposal and reuse, Metcalf and Eddy Inc., Tata McGraw Hill, New Delhi.
2. Environmental Chemistry, AK. De, Wiley Eastern Ltd, New Delhi.
3. Introduction to Biodeterioration, D.Allsopp and K.J. Seal, ELBS / Edward Arnold.
4. Bioremidation, Baaker, KH and Herson D.S., 1994. Mc.GrawHill Inc, NewYork.
5. Industrial and Environmental Biotechnology - Nuzhat Ahmed, Fouad M. Qureshi and Obaid Y. Khan, 2006. Horizon Press.
6. Environmental Molecular Biology, Paul. A, Rochelle, 2001.Horizon Press.

PAPER IX

PLANT AND ANIMAL BIOTECHNOLOGY

UNIT-I

Cell and tissue culture, plant tissue culture media, plant hormones and growth regulators in tissue culture, preparation of suitable explants, callus culture, anther and ovary culture for haploid plant production, somatic embryogenesis, protoplast culture, protoplast fusion, cybrids, somatic hybridization, synthetic seeds.

UNIT-II

Genetic engineering in plants for virus and pest resistances, herbicidal resistance, stress tolerance (heat & salt); cytoplasmic male sterility; resistance to fungi and bacteria; delay of fruit ripening; secondary metabolite production.

UNIT-III

Principles of sterile techniques and cell propagation-Chemically defined and serum free media for membrane cell culture Scaling up of animal cell cultures-Preservation and characterization of animal cells organ culture-Cytotoxicity and viability assays-stem cells and their applications

UNIT-IV

Production of useful proteins in transgenic animals. Genetic engineering as applied to production of vaccines and hormones.

Molecular diagnosis of genetic disorder, Gene therapy, DNA fingerprinting

UNIT-V

Artificial insemination, super-ovulation, embryo transfer, *In vitro*-fertilization, pregnancy diagnosis, sexing of embryos, embryo splitting, cryopreservation of embryo, transgenic animals, transgenic fish

Reference

1. Basic Biotechnology, S. Ignachimuthu. 1995. Tata McGraw Hill Publishers, New Delhi
2. Genetic engineering of animals, (Ed) A. Puhler, 1993. VCH publishers Weinheim, FRG.
3. Gene transfer and expression protocols-methods in molecular biology. Vol. 7, (Ed.) E. T. Murray, 1991. Humana press.
4. Animal Biotechnology, P. Ramadas.
5. Animal cell culture, Freshney.

CORE PRACTICAL III

INDUSTRIAL BIOTECHNOLOGY AND GENETIC ENGINEERING

LAB IN INDUSTRIAL BIOTECHNOLOGY

1. Determination of bacterial growth curve
2. Immobilization of enzymes using sodium alginate
3. Immobilization of yeast cells using sodium alginate
4. Ethanol production using immobilized yeast cells
5. Estimation of ethanol
6. Compound separation using column chromatography and thin layer chromatography
7. Fermentors

Spotters

GENETIC ENGINEERING

1. SDS-PAGE
2. Agarose Gel Electrophoresis
3. Isolation and Visualization of Plasmids
4. Isolation of Genomic DNA from Plant, Mammalian and microorganisms
5. Restriction Digestion of Plasmid DNA
6. Construction of recombinant plasmid by ligation
7. Preparation of competent cells (*E.coli*) and Transformation
8. PCR (Demonstration)

CORE PRACTICAL IV

ENVIRONMENTAL BIOTECHNOLOGY AND PLANT AND ANIMAL BIOTECHNOLOGY

ENVIRONMENTAL BIOTECHNOLOGY

- Water/Soil analysis - DO, salinity, pH, chloride, total hardness, alkalinity, acidity, nitrate, calcium, Magnesium and phosphorus.
- Gravimetric analysis-Total solid, dissolved solid, suspended solid in an effluent
- Microbial assessment of air (open plate and air sample) and water

PLANT & ANIMAL BIOTECHNOLOGY

- Preparation of plant tissue culture media and sterilization
- Callus culture, anther and ovary culture in the tissue culture media.
- Isolation and quantification of DNA and RNA in plant tissue by spectrophotometer.
- Antigen-antibody reactions-agglutination-precipitation ring test, immunodiffusion, immunoelectrophoresis.
- Demonstration of Western Blot
- Demonstration of monoclonal antibody production

ELECTIVE II

PAPER II

HERBAL TECHNOLOGY

UNIT-I:

Herbal medicines: history and scope - definition of medical terms - role of medicinal plants in Siddha systems of medicine; cultivation - harvesting - processing - storage - marketing and utilization of medicinal plants.

UNIT-II:

Pharmacognosy - systematic position - chemical constitution and medicinal uses of the following herbs in curing various ailments; Tulsi, Ginger, Fenugreek, Indian Goose berry and Ashoka.

UNIT-III:

Phytochemistry - active principles and methods of their testing - identification and utilization of the medicinal herbs; Catharanthus roseus (cardiotonic), Withania Somnifera (drugs acting on nervous system), Clerodendron Phlomoides (anti-rheumatic) and Centella asiatica (memory booster).

UNIT-IV:

Analytical pharmacognosy: Drug adulteration - types, methods of drug evaluation - Biological testing of herbal drugs - Phytochemical screening tests for secondary emtabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds, fatty acids, tannins, glycosides and volatile oils).

UNIT-V:

Medicinal Plant Biotechnology: Genetics as applied to medicinal herbs - mutation - polyploidy. Plant tissue culture as source of biomedicinals - Historical developments - types of cultures - phytopharmaceuticals in tissue cultures.

REFERENCES:

1. Glossary of Indian medicinal plants, R.N.Chopra, S.L.Nayar and I.C.Chopra, 1956. C.S.I.R, New Delhi.
2. The indigenous drugs of India, Kanny, Lall, Dey and Raj Bahadur, 1984. International Book Distributors.
3. Herbal plants and Drugs Agnes Arber, 1999. Mangal Deep Publications.
4. Ayurvedic drugs and their plant source. V.V. Sivarajan and Balachandran Indra 1994. Oxford IBH publishing Co.
5. Ayurveda and Aromatherapy. Miller, Light and Miller, Bryan, 1998. Banarsidass, Delhi.
6. Principles of Ayurveda, Anne Green, 2000. Thomsons, London.
7. Pharmacognosy, Dr.C.K.Kokate et al. 1999. Nirali Prakashan.

ELECTIVE III

PAPER III

VERMICULTURE

UNIT-I:

Vermicomposting - Definition, introduction and scope: Ecological classification: Humus feeders, Humus formers, leaf mold, top soil and sub soil types.

UNIT-II:

Physical, chemical and biological changes brought by earth worm in soil - burrows - drilosphere - earthworm casts.

UNIT-III:

Optimal conditions for Vermiculture - temperature, moisture, pH, soil type, organic matter, protection from sunlight, rain, predators - food preference.

UNIT-IV:

Basic components for vermiculture - Culture practices - Home - School - Industries - Vermi wash.

UNIT-V:

Composting - Vermicomposting - Required conditions - Methods - Advantages - Cost-Benefit analysis of Vermicomposting.

REFERNCES:

1. Edwards, C.A. and Bohlen, P.J. 1996, Ecology of earthworms-3rd Edition, Chapman and hall.
2. Jsmail, S.A., 1970, Vermicology. The biology of earthworms. Orient Longman, London.
3. Lee, K.E., 1985. Earthworms - Their ecology and relationship with soil and land use, Academic Press, Sydney.

SKILL BASED SUBJECT IV

PAPER IV

FOOD PROCESSING TECHNOLOGY

UNIT-I:

History of microbiology of food - microbial growth pattern, physical and chemical factors influencing structure of micro-organisms - types of micro-organism normally associated with food - mold, yeast and bacteria.

UNIT-II:

Micro-organisms in natural food products and their control - contaminants of foods - stuffs, vegetables, cereals, pulses, oilseeds, milk and meat during handling and processing - biochemical changes caused by micro-organisms - deterioration of various types of food products - food poisoning and microbial toxins.

UNIT-III:

Scope and importance of food processing - principles and methods of food preservation - freezing, heating, dehydration, canning, additives, fermentation, irradiation, extrusion cooking, hydrostatic pressure cooking, dielectric heating, microwave processing.

UNIT-IV:

Introduction to packaging - packaging principles and operation - package functions and design - deteriorative changes in foodstuff and packaging methods for prevention - shelf life of packaged foodstuffs - methods to extend shelf life.

UNIT-V:

Objectives, importance and functions of quality control - methods of quality - assessment of food materials - fruits, vegetables, cereals, dairy products, meat, poultry, egg and processed food products - sampling and specification of raw materials and finished products - statistical quality controls - food regulations, grades and standards - food adulteration, food safety and evaluation.

SUGGESTED READINGS:

1. Rsdel W.B., Copley, M.J. and Morgen, A.I. 1973. Food Dehydration, 2nd Edn. (2 Vol. Set). AVI, Westport.
2. Der, A.E. 1978. Food Processing and Nutrition. Academic Press, London.
3. Lows, P. and Ellis H. 1990. Food Processing. Prentice Hall, Reston Virginia, USA.
4. Jelen, P. 1985. Introduction to Food Processing. Prentice Hall, Reston Virginia, USA.
5. Branen A.L. and Davidson, P.M. 1983. Antimicrobials in Foods. Marcel Dekker, New York.
6. Jay J.M. 1986. Modern Food Microbiology. 3rd Edn. VNR, New York.
7. Charalambous, G. and Inglett, G. 1981. The Quality of Foods and Beverages. (2 vol. set). Academic Press, New York.
8. Furia, T.E. Ed. 1980. Regulatory Status of Direct Food Additives. CRC Press, Florida.
9. Krammer, A. and Twigg, B.A. 1970. Quality Control for the Food Industry. 3rd Edn. AVI, Westport.
10. Pattee, H.E. Ed. 1985. Evaluation of Quality of Fruits and Vegetables. AVI, Westport.
11. Ranganna, S. 1986. Handbook of Analysis and Quality Control for Fruits and Vegetable Products. Tata McGraw Hill, New Delhi.
12. Painy, F.A. and Painy, H.Y. 1983. A Handbook of Food Packaging. Leonard Hill, Glasgow, UK.
13. Scicharow, S. and Griffin, R.C. 1970. Food Packaging. AVI, Westport.

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