BACHELOR OF SCIENCE (BIOTECHNOLOGY)

REGULATIONS

ELIGIBILITY FOR ADMISSION:

Candidates seeking admission to the first year Degree course shall be required to have passed PUC/12th Std. / 10+2/ its equivalent with at least Biology and Chemistry as two optional subjects.

DURATION OF THE COURSE:

The duration of the course is THREE academic years divided into six semesters under Choice Based Credit System.

OBJECTIVES OF THE COURSE:

- The three year B.Sc., program is intended to help the students to be the innovative and versatile personalities in the field of Life Science with quality education and provide the skilled manpower required by Research and Development, Institutions of higher learning and Industry.
- The programme deals with broad area of living things used into technological sector for the betterment of human welfare.
- It is designed to develop a sustained interest among the students and enthusiasm to learn and develop the concepts in Biotechnology in logical and stepwise manner.
- After completion of the course, the students can able to acquire the necessary theoretical and practical competencies in Biotechnology to enable them to undertake higher studies in recognized Institutions of higher learning and engage gainful self-employment.

SCHEME OF EXAMINATION

Subject Code	Subject	Hours of Instruc-tion	Exam Dura-tion	Maximum Marks			Credit Points
				CA	CE	Total	
First Semester							
Part I							
15UTALA101/ 15UHILA101/ 15UMMLA101/ 15UFRLA101	Tamil I/ Hindi I/ Malayalam I/ French I	5	3	25	75	100	3
Part II							
15UENLA101	Foundation English I	5	3	25	75	100	3
Part III							
15UBTM101	Core I: Concepts of Cell Biology	5	3	25	75	100	5
15UCHBTA101	Allied I: Chemistry	3	3	25	75	100	3
15UBTMP101	Core Practical I	3	3	40	60	100	2
15UCHBTAP101	Allied Practical I: Volumetric and organic analysis	3	3	40	60	100	2
Part IV							
15UVE101	Value Education I: Yoga	2	3	25	75	100	2
		26				**700**	**20**
Second Semester							
Part I							
15UTALA201/ 15UHILA201/ 15UMMLA201/ 15UFRLA201	Tamil II/ Hindi II/ Malayalam II / French II	5	3	25	75	100	3
Part II							
15UENLA201	Foundation English II	5	3	25	75	100	3
Part III							
15UBTM201	Core II : Principles of Genetics	5	3	25	75	100	5
15UBCBTA201	Allied II: Biochemistry	3	3	25	75	100	3
15UBTMP201	Core Practical II	4	6	40	60	100	2
15UBCBTAP201	Allied Practical II: Biochemistry	3	3	40	60	100	2

Part IV							
15UVE201	Value Education II: Environmental Studies	2	3	25	75	100	2
		27				**700**	**20**
Third Semester							
Part I							
15UTALA301/ 15UHILA301/ 15UMMLA301/ 15UFRLA301	Tamil III/ Hindi III/ Malayalam III / French III	5	3	25	75	100	3
Part II							
15UENLA301	Foundation English III	5	3	25	75	100	3
Part III							
15UBTM301	Core III: Biological Techniques	5	3	25	75	100	5
15UMBBTA301	Allied III: Microbiology	3	3	25	75	100	3
15UBTMP301	Core Practical III	4	3	40	60	100	2
15UMBBTAP301	Allied Practical III: Microbiology	3	3	40	60	100	2
Part IV							
15UBTSBC301	SBC I: Calculations for Biologist (100% Internal Evaluation)	1	3	100	-	100	2
	NMEC I	2	3	25	75	100	2
Non Credit							
15ULS301	Career competency Skills I	1	-	-	-	-	-
		29				**800**	**22**
Diploma*							
Fourth Semester							
Part I							
15UTALA401/ 15UHILA401/ 15UMMLA401/ 15UFRLA401	Tamil IV/ Hindi IV/ Malayalam IV / French IV	5	3	25	75	100	3
Part II							
15UENLA401	Foundation English IV	5	3	25	75	100	3

Part III							
15UBTM401	Core IV: Immunology	5	3	25	75	100	5
15UCSBTA401/ 15UMABTA401	Allied IV: Computer fundamentals and office automation/ Mathematics and statistics for Biology	3	3	25	75	100	3
15UBTMP401	Core Practical IV	3	6	40	60	100	2
15UCSBTAP401/ 15UMABTAP401	Allied Practical IV: Office automation techniques/ Statistical software	2	3	40	60	100	2
Part IV							
15UBTSBC401	SBC II: Biosafety and Bioethics (100% Internal Evaluation)	2	3	100	-	100	2
	NMEC II	2	3	25	75	100	2
Non Credit							
15ULS401	Career competency Skills II	1	-	-	-	-	-
		28				**800**	**22**
Diploma*							
Fifth Semester							
Part III							
15UBTM501	Core V :Molecular Biology	5	3	25	75	100	5
15UBTM502	Core VI : Industrial Biotechnology	5	3	25	75	100	5
15UBTM503	Core VII : Tissue Culture Technology	5	3	25	75	100	5
15UBTM504	Core VIII : Food and Agricultural Biotechnology	5	3	25	75	100	5
15UBTM505	Core IX : Ecobiotechnology	5	3	25	75	100	5
15UBTMP501	Core Practical V	3	6	40	60	100	2
Part IV							
15UBTSBC501	SBC III: IPR for Lifescience (100% Internal Evaluation)	2	3	100	-	100	2

15UBTFT501	Field Training (100% Internal Evaluation)		-	100	-	100	2
Part V							
15UBTE501	Extension Activity		-	-	-	-	2
		30				**800**	**33**
Sixth Semester							
Part III							
15UBTM601	Core X : Recombinant DNA Technology	5	3	25	75	100	5
15UBTM602	Core XI : Large scale Manufacturing process	5	3	25	75	100	5
15UBTM603	Core XII : Medical Biotechnology	5	3	25	75	100	5
15UBTM604	Core XIII : Entrepreneurial Biotechnology (Self Study and 100% Internal Evaluation)	-	3	100	-	100	4
15UBTMP601	Core Practical VI	3	6	40	60	100	2
15UBTPR601	Project & Viva-Voce (In-house Entrepreneurial Group Project)	8	-	40	60	100	4
Part IV							
15UBTSBC601	SBC IV: Basics of Research (100% Internal Evaluation)	2	3	100	-	100	2
		28				**700**	**27**
Grand Total						**4500**	**144**

* A Diploma Course during Third and Fourth semester is mandatory for all students.

NON-MAJOR ELECTIVE COURSE (NMEC)

The Department offers the following two subjects during III and IV semesters as Non Major Elective Courses for the students of other departments.

S.No	Subject Code	Semester	Subject
1.	15UBTN301	III	Drugs at your home
2.	15UBTN401	IV	Biotechnology in daily life

DIPLOMA COURSE

During the third and fourth semester student shall undergo a diploma course.

S.No	Code	Subject	Duration
1.	15UBTD401	Bioinformatics	90 hours (45 Hours in each semester)
2.	15UBTDP401	Bioinformatics Practical	

FIELD TRAINING:

The students should visit the field of their interest and they have to submit the report which will be evaluated by the subject experts in the department.

TOTAL CREDIT DISTRIBUTION

S.NO	COMPONENT	TOTAL NUMBER OF SUBJECTS	TOTAL MARKS	CREDITS
1.	PART I: Language	4	400	12
2.	PART II: Foundation English	4	400	12
3.	PART III : Major	19(13t + 6p)	1900	76
4.	PART III : Allied	8(4t + 4p)	800	20
5.	PART III : Major Field training + project	2	200	6
6.	PART-IV: Value Education	2	200	4
7.	PART-IV: SBC	4	400	8
8.	PART-IV: NMEC	2	200	4
9.	PART-V: Extension Activity	-	-	2
	TOTAL	45	4500	144

FOR COURSE COMPLETION

Student shall complete:

- Language papers (Tamil/Hindi/Malayalam/French and English) in I, II, III and IV semesters.
- Value Education Yoga and Environmental Studies in I and II Semester.
- One Diploma course in their II year of study.
- Non Major Elective Course in III and IV semesters.
- Skill Based Course in III, IV, V and VI semesters.
- Extension activity in V semester.
- Self study and Internal Evaluation subjects in VI Semester.
- Project work in the VI semester.

15UBTM101	CORE I: CONCEPTS OF CELL BIOLOGY	SEMESTER I

Total Hours: 50

OBJECTIVE:

1. To study the basic concepts and functions of cells and their organelles.

CONTENTS

UNIT – I **(10 Hours)**

Discovery of Cell, Cell as a basic unit of living systems: the cell theory, Origin and evaluation of Cell, Diversity of Cell size and shape – Classification, structure and function of prokaryotic and Eukaryotic cell, Comparison of microbial, plant and animal cells.

UNIT – II **(10 Hours)**

Structure and functions of cell wall, plasma membrane, Mitochondria, Endoplasmic reticulum, chloroplast, plastids, vacuoles, peroxisomes (glyoxysomes), lyzosome and ribosomes, Golgi apparatus, Biogenesis of mitochondria and chloroplast.

UNIT – III **(10 Hours)**

Nuclear ingredients: Nuclear Membrane, Nature of the genetic material, Histone proteins. DNA Packaging in Eukaryotic cells, Structure and ultra-structure of Chromosomes– Polytene and Lamp-brush Chromosomes.

UNIT – IV **(8 Hours)**

Cytoskeleton and cell motility: Microtubules, microfilaments and intermediate elements, Cell Locomotion; Amoeboid, Flagella, Cilia and Cytoplasmic streaming.

UNIT – V **(12 Hours)**

Overview of Cell Cycle – steps in cell cycle, cell cycle check points. Mitosis and Meiosis, Cellular basis of development: Gametogenesis, Fertilization, Events during Fertilization, Early Embryonic Development. Cell death- types- Necrosis and apoptosis (Regulatory aspects not needed).

TEXT BOOK:

1. *Gupta, P.K, and Jangir M.L.*, 2003. **Cell Biology: Fundamentals and Application.** Student Edition, India.

REFERENCE BOOKS:

1. *Geoffrey M. Cooper and Hausman R.E*. 2007. **The Cell - A Molecular Approach.** [Fourth Edition]. ASM Press, Washington, D.C.

2. *Sadava, D.E*. 2004. **Cell Biology: Organelle Structure and Function.** Reprint, [First Edition]. Panima Publishing Corp., India.

3. *Karp G*. 2007. **Cell and Molecular Biology: Concepts and Experiments.** [Fourth Edition]. John Wiley and Sons, INC, New York.

15UCHBTA101/ 15UCHMBA101	ALLIED I : CHEMISTRY (For B.Sc Biotechnology and Microbiology)	SEMESTER – I

Total hours: 30

OBJECTIVES:

- To understand the fundamentals of atomic structure and chemical bonding and electrochemistry.
- To understand the basics of nucleic acids and vitamins.
- To understand the chemistry of rubber, cement and explosives.
- To understand the principles involving in the volumetric analysis.

CONTENTS

UNIT-I **(6 Hours)**

Atomic structure

Aufbau principles-Hund's rule-atomic orbitals (s, p and d orbitals) - their pictorial representation- electronic configurations of elements. **Chemical bonding:** Kossel -Lewis approach to chemical bond formation-types of bonding-Ionic Bonds-Covalent Bond-Co-ordinate Bond- Hybridization - shapes of covalent molecules and bonds- Hydrogen Bond- types of hydrogen bond with examples.

UNIT-II **(6 Hours)**

Nucleic acids - Types of sugars – Nucleosides and Nucleotides –Types of nucleic acids - Structure and functions of DNA and RNA-differences between RNA and DNA.

Vitamins- classification, biological importance of vitamins A, B_1, B_2, B_6,B_{12}, D and C– Sources and deficiency disorders

UNIT-III **(6 Hours)**

Rubber-Natural and synthetic rubber – composition of natural rubber – Neoprene rubber, styrene butadiene rubber (SBR). Vulcanization – Uses of rubber. **Cement** – Manufacture of Portland cement – Setting of cement - Special cements –Mortars and Concretes. **Chemical Explosives**-Origin of explosive, preparation and chemistry of nitrocellulose, TNT, gunpowder-Classification of Propellants and Rocket fuels – Properties of a good propellant.

UNIT-IV **(6 Hours)**

Electrochemisty-definition-electrode-electrolyte-Faraday's laws Conduction in metals and in electrolyte solutions-measurement of conductance. Variation of equivalent and specific conductance with dilution-Ostwalds dilution law. Onsagar equation (no derivation) Significance and limitations. Ionic mobility – transport number – determination by Hittorf and moving boundary methods- Kohlrausch law and its applications.

UNIT-V **(6 Hours)**

Volumetric analysis-Terminology- basic requirements of a titration reaction- standard solution- primary standard- expressing concentration of standard solution- acid-base titration –types and their indicators. Errors-types of errors-Determinate-Indeterminate errors-Normal error curve- Accuracy – Precision- relative and standard deviation-Methods for minimizing errors- introduction to Significant figures.

TEXT BOOK:

1 Madan, R.L. 2010. **Chemistry for degree students**, S.Chand and Co., New Delhi

REFERENCE BOOKS:

1. *Mukherjee, S.M. Singh, S.P.* and *Kapoor, R.P.* 1985. **Organic Chemistry.** [First Edition], New Age International (P) Ltd. Publishers, New Delhi.

2. *Puri, B.R., Sharma, L.R.* and *Pathania, M.S.* 1998. **Principles of Physical Chemistry.** Shoban Lal Nagin Chand and Co., New Delhi.

15UBTMP101	CORE PRACTICAL I	SEMESTER I

CELL BIOLOGY

LIST OF EXPERIMENTS

1. Introduction to Laboratory Guidelines and Laboratory Safety
2. Operation and Maintenance of Microscope
3. Preparation of Flow Chart from a Standard Procedure
4. Micrometry
5. Haemocytometer – Yeast cell counting
6. TS of Stem, Root and Leaf
7. Mitosis
8. Meiosis
9. Mounting Buccal Epithelium
10. Wet mount of onion epidermis
11. Observation of cyanobacteria – wet mount preparation
12. Simple staining of Bacterial cell and DPX mount
13. Tetrazolium test
14. Chironomous – Salivary gland chromosome – squash preparation

REFERENCE BOOK:

1. Aneja, K.R. 2003. **Experiments in Microbiology, Plant pathology and Biotechnology.** [Fourth Edition]. New age international.

15UCHBTAP101/ **15UCHMBAP101**	**ALLIED PRACTICAL I: VOLUMETRIC AND ORGANIC ANALYSIS** **(For B.Sc Biotechnology & Microbiology)**	**SEMESTER – I**

OBJECTIVES:

- To understand the principles of quantitative analysis.
- To understand the qualitative analysis of simple organic Compounds.

CONTENTS

1. Quantitative analysis

1. Estimation of $KMnO_4$.
2. Estimation of Hydrochloric acid.

2. Qualitative analysis

Organic analysis of Carbohydrate, Phenol, Acid, ketone, aldehyde and Amide.

Reference Book:

1. *Venkateswaran V, Veeraswamy R., Kulandaivelu A.R.* 1997.**Basic Principles of Practical Chemistry**, New Delhi, Second edition, Sultan Chand & Sons.

15UVE101	VALUE EDUCATION I: YOGA மனவளக்கலையோகா	SEMESTER - I

Total Hours: 30

CONTENTS

UNIT - I **(6 Hours)**

YOGA AND PHYSICAL HEALTH

1:1Physical Structure-Three bodies- Five limitations

1:2Simplified Physical Exercises - Hand Exercises - Leg Exercises- Breathing Exercises – eye Exercises - Kapalapathi

1:3Maharasanas 1-2– massages – acu-puncture – Relaxation

1:4Yogasanas-Suriya Namaskar – Padamasana –Vajrasanas – Chakrasanas(Side) – Viruchasanas –Yoga muthra –Patchimothasanas-Ustrasanas–Vakkarasanas Salabasanas.

UNIT - II **(6 Hours)**

ART OF NURTURING THE LIFE FORCE AND MIND

2:1Maintaining the youthfulness - postponing the ageing process

2:2 Sex and spirituality– significance of sexual vital fluid – Married Life–Chastity.

2:3 Ten Stages of Mind

2:4 Mental Frequency – Methods for Concentration

UNIT - III **(6 Hours)**

SUBLIMATION

3:1 Purpose and Philosophy of life

3:2 Introspection – Analysis of Thought

3:3 Moralization of Desires

3:4 Neutralization of Anger

UNIT - IV **(6 Hours)**

HUMAN RESOURCESDEVELOPMENT

4:1 Eradication of worries
4:2 Benefits of Blessings
4:3 Greatness of Friendship
4:4 Individual Peaceand World Peace

UNIT - V **(6 Hours)**

LAW OF NATURE

5:1 Unified Force – Cause and Effect System
5:2 Purity of thought and Deed and Genetic Centre
5:3 Love and Compassion
5:4 Cultural Education –Five fold Culture

TEXT BOOK:

1. Manavalakalai Yoga – World Community Service Center
   VethathiriPathippagam,
   156, Gandhij Road, Erode – 638 001.
   PH: 0424 – 2263845.

REFERENCE BOOKS:

1. Yoga for Modern Age
2. Journey of Consciousness
2. Simplified Physical Exercises – World Community Service Center
   VethathiriPathippagam,
   156, Gandhij Road, Erode – 638 001.
   PH: 0424 – 2263845.

15UBTM201	CORE II: PRINCIPLES OF GENETICS	SEMESTER II

Total Hours: 50

OBJECTIVE :

1. To study the basic principles of genetics, mutations and gene related diseases.

CONTENTS

UNIT – I **(10 Hours)**

Basic concepts of genetics: - Introduction, Branches-transmission genetics, molecular genetics and population genetics. Growth of genetics: – from Mendel genetics to genetic engineering, Scope and importance of genetics.

UNIT – II **(10 Hours)**

Mendelian genetics: - Mendel's experiment, principle of segregation, monohybrid crosses- dominance, recessiveness and co-dominance, Principles of independent assortment, Epistasis.

UNIT – III **(10 Hours)**

Molecular genetics: - DNA as genetic material, experimental evidences- Transformation. RNA as genetic material, Structure of DNA – Watson and Crick double helical model, forms of DNA.

UNIT – IV **(10 Hours)**

Population genetics:- Introduction, genetic variation, the Hardy Weinberg law, inbreeding, outbreeding and assertive mating, changes in allele frequency- Mutation, migration, selection, and random genetic drift.

UNIT – V **(10 Hours)**

Chromosomal aberration in humans: - Euploidy and aneuploidy- Down syndrome, Turner's syndrome, Klinefelter syndrome.

Mendelian inheritance in humans – Recessive traits (Albinism), dominant traits (Achondroplasia).

TEXT BOOK:

1. *Russel, P.J.* 1998. **Genetics. [**Fifth Edition]. The Benjamin /Cummings Publishing company, Inc.

REFERENCE BOOKS:

1. *Gardner E.J, Simmons, M.J and Snustad. D.P*. 2005. **Principles of Genetics.** [Eighth Edition]. John Wiley and Sons, INC, New York.

2. *Weaver R.F* and *Hedrick P.W*, 1995. **Basic genetics.** [Second Edition]. Wm.C.Brown Publishers.

15UBCBTA201	ALLIED II : BIOCHEMISTRY (BIOMOLECULES)	SEMESTER II

Total Hours: 39

OBJECTIVE:

To enable the learners to have a strong foundation in the structural and metabolic aspects of biomolecules which is the basic requirement of all life sciences.

CONTENTS

UNIT – I **(8 Hours)**

Carbohydrates: Introduction, classification, monosaccharide - Structure, stereo isomers and structural isomers, mutarotation and chemical reactions- reduction, oxidation and phenyl hydrazine. Oligosaccharides – Disaccharides - Structure and importance of sucrose, lactose. Polysaccharides - Structure and importance of homopolysaccharides – Starch and Glycogen. Heteropolysaccharides - Hyaluronic acid and Heparin.

UNIT – II **(8 Hours)**

Amino acids: Classification, Structure and properties. Essential, Non- essential and Non-protein amino acids.

Protein: Classifications and Functions: Structural organization of Proteins - Primary, secondary, tertiary and quaternary structure. Forces involved in stabilization of tertiary structure of proteins.

UNIT – III **(8 Hours)**

Lipids: Classification. Triacylglycerol – Structure, physical & chemical properties. Phospholipids - Structure of lecithin. Phospholipids in cell membrane – Fluid Mosaic model. Derived lipids. Essential fatty acids, Saturated and unsaturated fatty acids: Structure. Sterol – Structure of Cholesterol.

UNIT – IV **(8 Hours)**

Enzymes – Definition. IUB classification with examples. Active site - Definition, Mechanism of enzyme action - Lock & key model and induced fit hypothesis. Factors affecting enzyme activity (pH, Temperature and substrate concentration).

UNIT – V **(7 Hours)**

Vitamins - Classification, Sources, daily requirements, physiological functions and deficiency of fat and water soluble vitamins.

TEXT BOOK:

1. *Jain, J. L.* 2002. **Fundamentals of Biochemistry.** [Fifth Edition]. S. Chand & Company Ltd., New Delhi.

REFERENCE BOOK:

1. *Deb, A. C.* 2000**. Fundamentals of Biochemistry.** Books and Allied (P) Ltd., Calcutta.

15UBTMP201	CORE PRACTICAL II	SEMESTER II

GENETICS

LIST OF EXPERIMENT

1. Isolation of Genomic DNA from yeast – large scale spool out DNA
2. Estimation of DNA using spectrophotometer
3. Isolation of mutants by replica plating
4. Isolation of mutants by Gradient plate methods (Streptomycin)
5. Chemical Mutagenesis
6. Mutagenesis by radiation exposure
7. Bacterial Conjugation – Transfer of Antibiotic-resistant plasmid
8. Monohybrid and Di hybrid ratio
9. Morphology of *Drosophila*
10. Karyotyping
11. *Neurospora*
12. *Arabidopsis*

REFERENCE BOOK:

1. *Gregore Koliantz, Daniel B. Szymanski* , 2006. **Genetics: A Laboratory Manual** ASA-CSSA-SSSA publisher.

2. Murray, R.G.F., Wood , W.A. and Krieg, N.B. 1994. **Methods for General and Molecular Bacteriology**. American society for Microbiology.

15UBCBTAP201	ALLIED PRACTICAL II: BIOCHEMISTRY (BIOMOLECULES)	SEMESTER II

LIST OF EXPERIMENT

Qualitative Analysis of Biomolecules

1. Carbohydrates: Glucose, fructose, xylose, sucrose, lactose, Starch.
2. Amino acids: Tyrosine, Tryptophan, Histidine, Methionine, Cysteine.
3. Proteins: Solubility test, coagulation test, ninhydrin test, Biuret test, Folin's Phenol, precipitation by metals.
4. Lipids: Solubility, grease spot, Oil spot, emulsification, halogenations, colour reactions.

Quantitative Analysis of Biomolecules

1. Estimation of Glycine by formal titration method.
2. Determination of Saponification value.

REFERENCE BOOKS:

1. *Sadasivam, S. and Manickam, A*. 2010. **Biochemical Methods.** [Second Edition]. New Age International (P) Ltd., New Delhi.

2. *Jayaraman, J*. 2008. **Laboratory Manual in Biochemistry**. [First Edition reprint]. New Age International (P) Ltd., New Delhi.

15UVE101	VALUE EDUCATION II: ENVIRONMENTAL STUDIES	SEMESTER II

Total Hours: 30

CONTENTS

UNIT - I **(6 Hours)**

Environment– Definition– Scope– Structure and function of ecosystems- producers, consumers and decomposers- Energy flow in the ecosystem- Ecological succession– food chain, food webs and ecological pyramids– Conceptof sustainable development.

UNIT - II **(6 Hours)**

Natural resources: Renewable- air, water, soil, land and wildlife resources. Non–renewable – Mineral coal, oil and gas. Environmental problems relatedtothe extraction and use of natural resources.

UNIT - III **(6 Hours)**

Biodiversity– Definition – Values – Consumption use, productive social, ethical, aesthetic and option values threats to biodiversity – hotspots of biodiversity– conservation of bio- diversity: insitu Ex – situ. Bio–wealth - National and Global level.

UNIT - IV **(6 Hours)**

Environmental Pollution: Definition– causes, effects and mitigation measures– Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution– Nuclear hazards – Solid wastes acid rain– Climate change and global warming environmental laws and regulations in India– Earth summit.

UNIT - V **(6 Hours)**

Population and environment – Population explosion – Environment and human health – HIV/AIDS – Women and Child welfare – Resettlement and Rehabilitation of people, Role of information technology in environmental health – Environmental awareness.

TEXTBOOK:

1. Department of Biochemistry. Environmental Studies (Study Material). Published by K.S.Rangasamy College of Arts & Science (Autonomous). Tiruchengode.

REFERENCE BOOK:

1. *Erach Bharucha*. 2005. **Textbook of Environmental studies**. Universities press. PVT. Ltd.

15UBTM301	CORE III : BIOLOGICAL TECHNIQUES	SEMESTER III

Total Hours: 50

OBJECTIVE:

1. To study the basic techniques and principles of instrumentation.

CONTENTS

UNIT – I **(9 Hours)**

Basics of Bioinstrumentation, care and general maintenance of laboratory instrumentation, Basic principles of pH meter, Laminar flow chambers, Hot air oven, Incubator and oxygen electrodes.

UNIT – II **(9 Hours)**

Introduction, principles and applications of spectroscopy:– Colorimeter, Spectrophotometer, UV-visible spectrophotometer, Atomic absorption spectroscopy.

UNIT – III **(10 Hours)**

Principles, types and applications of Chromatography – Paper Chromatography, Thin Layer Chromatography, column chromatography, Ion Exchange Chromatography, High Performance Liquid Chromatography, Gas Chromatography.

UNIT – IV **(12 Hours)**

Principles, types and applications of Electrophoresis – Agarose Gel Electrophoresis, Poly Acrylamide Gel Electrophoresis, Iso-electric focusing Blotting techniques. Separation techniques: Centrifugation – principles and types of centrifuges – simple, ultra centrifuge, density gradient centrifugation, Diffusion, Dialysis, osmosis and reverse osmosis.

UNIT – V **(10 Hours)**

Radioisotopes: Introduction and their biological applications. Radioactive Decay – Principles, Types, measurements and applications of Giger Muller Counter, Solid and Liquid Scintillation Counter, Autoradiography and Radio Immuno Assay.

TEXT BOOK:

1. *Boyer.R.F*, 1993. **Modern Experiments in Biochemistry.** [Second Edition]. The Benjamin/ Cummings Publishing Company, Red wood City, California.

REFERENCE BOOKS:

1. *Upadhyay*. 2005. **Biophysical Chemistry.** Himalaya Publications.

2. *Wilson. K and Walker,* 2003. **Practical Biochemistry.** [First Edition]. Cambridge University Press.

15UMBBTA301/ 15UMBBCA301	ALLIED III: MICROBIOLOGY (For B.Sc Biotechnology and Biochemistry)	SEMESTER III

Total Hours: 45

OBJECTIVE:

1. To learn the basics of Microbiology.
2. To acquire the basic knowledge on staining, sterilization and antimicrobial chemotherapy.

CONTENTS

UNIT - I **(9 Hours)**

Definition of Microbiology – Scope and Branches of Microbiology – Contributions – Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Alexander Fleming.

UNIT - II **(10 Hours)**

Microscopy – Simple and compound microscope – Dark field microscope – Phase contrast microscope – Fluorescence microscope – Electron microscope. Principles and types of stain – Simple, differential and special staining (Endospore, Capsular).

UNIT - III **(9 Hours)**

Media preparation – Liquid media, Solid Media, Selective Media, enriched, enrichment and Differential Media; Isolation of pure culture – Pour, Spread plate and Streak plate methods.

UNIT - IV **(8 Hours)**

Sterilization – Principles – dry heat – moist heat – Radiation - UV rays – gamma rays Filtration- Depth, membrane and HEPA filters. Disinfection and disinfective agents. Chemicals – Alcohol, Aldehydes, Phenol.

UNIT - V **(9 Hours)**

Antimicrobial chemotherapy-Antibiotics-mode of action of cell wall, Protein and nucleic acid synthesis inhibitors - antibiotic susceptibility test – Kirby-Bauer & Stokes methods.

TEXT BOOK:

1. *Pelczar Jr .M.J. Chan, E.C.S and N.R. Kreig.* 1995. **Microbiology**. Tata Mc Graw Hill New Delhi.

REFERENCE BOOKS:

1. *Lansing, M. Prescott., John P. Harley, Donald A. Klein*. 2005. **Microbiology**. [Sixth Edition]. Mc Graw Hill Inc. New York.

2. *Sale, A.J.* 1992. **Fundamental Principles of Bacteriology.** [Seventh Edition]. Mc Graw Hill Inc, New York.

15UBTMP301	CORE PRACTICAL III	SEMESTER III

BIOLOGICAL TECHNIQUES

LIST OF EXPERIMENT

1. Principles and operation of pH meter – calibration and buffer preparation
2. Principles and operation of colorimeter and spectrophotometer (Application: Chlorophyll estimation)
3. Determination of Km and Vmax
4. Principles and operation of centrifuge
5. Paper Electrophoresis
6. Principles of Diffusion and Osmosis (through semi-permeable membrane)
7. Haemolysis
8. Paper chromatography (plant extract)
9. Identification of amino acids by Thin-layer chromatography method

REFERENCE BOOK:

1. *David T. Plummer*. 1988. **Practical Biochemistry**. [Third Edition]. Tata McGraw Hill Publishers, New Delhi.

15UMBBTAP301/ 15UMBBCAP301	**ALLIED PRACTICAL III : MICROBIOLOGY**	**SEMESTER III**

LIST OF EXPERIMENT

1. Handling and maintenance of bright field Microscopy.
2. Staining methods – Simple staining.
3. Gram's staining.
4. Acid – fast staining.
5. Spore staining.
6. Media preparation – Liquid and Solid Media.
7. Pure Culture Techniques: Streak Plate Method.
8. Pour plate method.
9. Spread plate method.
10. Antibiotic Susceptibility test – Kirby-- Bauer method.

REFERENCE BOOKS:

1. *Sundararaj, T.***Microbiology Laboratory Manual.** Dr.A.L.Mudaliyar Post Graduate Institute of Basic Medical Sciences, Chennai.
2. *Kannan, N.* **Laboratory manual in General Microbiology.** Panima publishing corporation, New Delhi.
3. *Benson.* **Microbiological applications laboratory manual in general microbiology.** [Eighth Edition]. The McGraw-Hill Companies.

15UBTSBC301	SBC I: CALCULATIONS FOR BIOLOGIST	SEMESTER III

Total Hours: 25

OBJECTIVES:

1. To develop the student skills.
2. To acquire the basic knowledge about the scientific calculations.

CONTENTS

UNIT I **(5 Hours)**

Scientific notation and metric prefixes: Significant digits, exponents and scientific notation, converting numbers from scientific notation to decimal notation. Adding, subtracting, multiplying and dividing numbers written in scientific noatation, Metric prefixes.

UNIT II **(5 Hours)**

Solutions, mixtures and media: Dilutions calculation, concentrations by a factor of X, preparing percent solution, Moles and Molecular weight, Molarity – Diluting Molar solutions, converting Molarity to Percentage, Converting Percentage to Molarity, Normality.

UNIT III **(5 Hours)**

Cell growth: Bacterial growth curve – Manipulating cell concentration, linear graph, logarithms, Calculating generation time, Semilog graph, Measuring cell concentrations on Hemocytometer.

UNIT IV **(5 Hours)**

Quantitation of Nucleic acid, Proteins and PCR calculations: Quantitation of nucleic acid by UV spectrometry – dsDNA, ssDNA, RNA. Quantitation of protein by measuring at 280nm. Quantitating protein at A_{280} in nucleic acid contamination. PCR calculations – template and amplification, Calculating T_m, DNA Polymerase – Calculating Polymerase error rate.

UNIT V **(5 Hours)**

Centrifugation - Relative centrifugal force (g Force), converting g Force to RPM, calculating sediment times. Allels and Genotypes – calculating allele and genotype frequency.

TEXT BOOK:

1. *Frank H. Stephenson*, **Calculations for Molecular biology and Biotechnology** – Academic press 2003.

15ULS301	CAREER COMPETENCY SKILLS I	SEMESTER III

Total Hours: 15

OBJECTIVE:

To enhance employability skills and to develop career competency

UNIT – I **(3 Hours)**

Speed Maths: Squaring of Numbers - Multiplication of Numbers – Finding Square Roots - Finding Cube Roots - HCF, LCM - Decimals - - Averages - Powers and Roots.

UNIT – II **(3 Hours)**

Problems on ages- Ratio and proportion- Chain rule-Percentages- Simple and Compound Interest.

UNIT – III **(3 Hours)**

Time and Work- Time and Distance- Problems on Trains

UNIT – IV **(3 Hours)**

Analogies - Sentence Formation - Sentence Completion - Sentence Correction - Idioms & Phrases - Jumbled Sentences-- Reading Comprehension –Deriving conclusions

UNIT – V **(3 Hours)**

Tenses- Articles and Preposition - Change of Voice - Change of Speech - Synonyms & Antonyms - Phrasal Verbs-One Word Substitution- Odd Man Out - Spelling & Punctuation

15UBTM401	CORE IV: IMMUNOLOGY	SEMESTER IV

Total Hours: 50

OBJECTIVE:

1. To understand the basic principles of immune system and its response.

CONTENTS

UNIT – I **(10 Hours)**

Milestones in Immunology, Immunity: Types – innate and acquired immunity, Cells of immune system, Primary and secondary lymphoid organs.

UNIT – II **(10 Hours)**

Antigens - antigenicity and immunogenicity. Immunoglobulin –basic structure, function and classes, Hybridoma technology - Production of Monoclonal antibody, Complement systems.

UNIT – III **(10 Hours)**

Antigen –Antibody interaction, Precipitation – Mancini method and Ouchterlony method, Immunoelectrophoresis, Agglutination- Haemagglutination and Bacterial agglutination, Immunofluorescence, ELISA.

UNIT – IV **(10 Hours)**

MHC complex – structure and function of MHC, Antigen processing and presentation– Cytosolic pathway and Endocytic pathway, Cytokines – types and functions.

UNIT – V **(10 Hours)**

Hypersensitivity – definition and its types, Autoimmunity – Organ specific and systemic autoimmune disease, Transplantation immunology – immunologic basis of graft rejection, Vaccines – Live vaccine, killed vaccine, whole organism vaccine and purified macromolecule vaccine.

TEXT BOOK:

1. *Kindt, Goldsby and Osborne*. 2006 **Kuby Immunology.** [Sixth Edition]. W.H.Freeman Publication.

REFERENCE BOOKS:

1. *Ian R Tizard,* 2006. **Immunology an introduction. [**Fourth Edition]. Advanced Immunology David male.

2. *Kalus D. Elgert*, 2004. **Immunology understanding the Immune system.** [Second Edition]. Wiley- Blackwell Publication.

3. *Tristram G. Parslow, Daniel P. Stites, Abba I.Terr and John B. Imboden,* 2007**. Medical Immunology.** [Tenth Edition].Tata Mc Graw Hill Publication.

15UCSBTA401/ 15UCSCHA401	**ALLIED IV:COMPUTER FUNDAMENTALS AND OFFICE AUTOMATION (For the students of B.Sc., Biotechnology and Chemistry)**	**SEMESTER IV**

Total hours: 30

OBJECTIVES:

On completion of the course the students shall have knowledge on:

1. Computer and Internet.
2. Office Package for various Applications

CONTENTS

UNIT - I **(6 Hours)**

Introduction to Computers: History and Generations of Computers-Characteristics of Computers-Applications of Computers-Classification of Computers-Organization of Computer System-Computer Hardware-Software Definition, Role and Categories. **The Processor:** The Central Processing Unit. **Computer Memory and Storage:** What is Computer's Memory? Primary Memory (Main Memory)-Read Only Memory-Auxiliary Memory.

UNIT - II **(6 Hours)**

The Input-Output Media: Inputs and Outputs: CRT Monitors-Flat Panel Monitors-Keyboards-Graphics and Graphical Terminals-Printers. **Introduction to the Internet:** A Brief History of the Internet- TCP/IP-IP Address and Domain Name System (DNS)-Client-Server Architecture-Electronic Mail (Email)-File Transfer Protocol (FTP)-World Wide Web (WWW).

UNIT - III **(6 Hours)**

Introduction to Microsoft Office Word 2007: Working with Documents in Microsoft Word 2007-Saving the File- Formatting the Text- Alignment of Text- Applying Fonts-Spell Checking- Consulting Thesaurus- Assign a Character Style- Borders and Shading-Closing of the File-Save as Option- Printing your Document- Editing the Document-Editing Tools- Auto Correct- AutoFormat- Find and Replace- Find- Replace Text- Page Numbering- Header and Footer- Foot Notes and End Notes- Splitting Panes- Tiling of

the Document- Using Mail Merge in Word 2007- Opening Screen of Microsoft Word Screen.

UNIT - IV **(6 Hours)**

Introduction to Microsoft Office Excel 2007: Understanding Spreadsheets-Creating a Worksheet in Excel 2007-Copying Formula-Formulas that Make Decisions-Styles-Functions in Excel-Using Auto calculate-References-Sum Function-Average Function-Creating Charts in Excel-Auditing a Workbook-Comments Inserting-Outlines-Worksheet Fitting on a Page-Function Wizard-Goal Seeking-Scenarios Manager-Creating a Pivot Table Report-Typing with AutoFill-Formatting Numbers and Labels-Changing the Size of Rows and Columns-Adding and Deleting Rows and Columns-Inserting (and Removing) Page Breaks-Applying Themes-Add or Remove a Sheet Background-Convert Text to Columns-Protect Worksheet or Workbook Elements-Functions in Excel.

UNIT - V **(6 Hours)**

Working with Microsoft Office PowerPoint 2007: Creating Presentation from Template-Creating a New Presentation-PowerPoint Views-Entering the Text-Moving the Text-Changing the Color-Adding Graphics to a Slide-Reordering Slides-Duplicating Slides-Deleting Slides-Adding a Animated Cartoon to a Slide-Adding Slide Transitions-Adding Text Transitions-Viewing a Presentation-Making Slide Shows-Hiding a Slide-Notes, Handouts and Masters for Presentation-Packing Presentation to Go-Add a Caption to a Picture in a Photo Album-Overview of Creating a Photo Album-Add a Picture to a Photo Album-Change the Appearance of a Picture in a Photo Album.

TEXT BOOKS:

1. *Atul Kahate.* 2008**. Information Technology. [**Third Edition]. Tata McGraw-Hill Edition Ltd, New Delhi. (UNIT I, II)
2. *Law Point.* 2008. **Microsoft Office 2007**. [First Edition]. Ashok Lodha Publication, Kolkata. (UNIT III, IV and V)

REFERENCE BOOKS:

1. *Alexis Leon and Mathews Leon***. 1999. Introduction to Computers.** [First Edition]**.** LeonTechworld, New Delhi.

2. *Dennis, P. Curtin, Kim Foley, Kunal Sen and Cathleen Morin.* 2001**. Information Technology: The Breaking Wave.** [Nineth Reprint]. Tata McGraw-Hill Edition, New Delhi.

3. *Sanjay Saxena.* 2007. **MS-Office 2000 for Everyone**. [Second Reprint]. Vikas Publishing House Pvt Ltd., New Delhi.

15UMABTA401	ALLIED IV: MATHEMATICS AND STATISTICS FOR BIOLOGY (For B.Sc, Biotechnology)	SEMESTER IV

Total Hours: 30

OBJECTIVE:

1. To understand the concepts of Mathematics and Statistics and to apply these concepts in biology.

CONTENTS

UNIT – I **(6 Hours)**

Theory of Equations: Formation of quadratic and cubic equations and solution of quadratic and cubic equations (Statement and problems only)

Problems using Logarithm and Simplification - Problems using Ratio and Proportions.

UNIT – II **(6 Hours)**

Sphere: Area of sphere – Surface area of sphere – Volume of sphere - Cone: Area of cone – Surface area of cone – Volume of cone.

Cylinder: Area of cylinder – Surface area of cylinder – Volume of cylinder.

UNIT – III **(6 Hours)**

Measures of Central Tendency: Mean, Median and Mode only – Merits and demerits – Empirical relation. Measures of Dispersion: Range, Standard Deviation and Co-efficient of variation only - Merits and Demerits.

UNIT – IV **(6 Hours)**

Correlation – Types of correlation – Karl Pearson's Correlation Coefficient - Rank correlation - Regression – Simple regression equations.

UNIT – V **(6 Hours)**

Population and sample – Sampling Methods – Standard Error – Test of significance – Hypothesis – Simple Hypothesis – Small sample Tests based on t and F distribution

with regard to mean, difference of mean and difference of variance - Chi-Square test of independent of attributes.

TEXT BOOKS:

1. *Agarwal, R.S,***Quantitative Techniques,** 2008. S.Chand and Company New Delhi. (For Units I and II).

2. *Gurumani, N.* 2005. **An Introduction to BioStatistics**. [Second Edition]. MJP Publishers, Chennai. (For Units III, IV and V).

15UBTMP401	CORE PRACTICAL IV	SEMESTER IV

IMMUNOLOGY

LIST OF EXPERIMENT

1. Types of Blood cells
2. WBC countings
3. RBC countings
4. Preparation of serum and plasma
5. ABO grouping
6. WIDAL Test (Slide and Tube methods)
7. RA test
8. Ouchterlony Double Diffusion
9. Radial Immunodiffusion
10. Immunoelectrophoresis
11. Enzyme Linked Immunosorbent Assay (ELISA)

REFERENCE BOOK:

1. *Ramnik Sood*. 2006. **Medical Laboratory Technology**. Jaypee Brothers Medical Publishers Ltd., New Delhi.

15UCSBTAP401/ 15UCSCHAP401	**ALLIED PRACTICAL IV: OFFICE AUTOMATION TECHNIQUES (For the students of B.Sc., Biotechnology and Chemistry)**	**SEMESTER IV**

LIST OF PRACTICALS:

INTERNET

1. Creating E-mail ID and Working with Basic Options.

MS – Word

2. Creating a Personal Profile.
3. Designing a Document for Lab Requirements using following options
    - Font styles.
    - Page layout, Page Setup (Setting Margins, Changing Page Size, Changing Page Orientation and Applying Page Background).
    - Table.
4. Creating a Document for topic presentation with following options
    - Single and Double Column.
    - Page numbers.
    - Headers and Footers.
    - Date and time, Pictures and Shapes.
5. Mail Merge – Invitation to Multiple Recipients for Conducting Seminar in the Department.

MS-Excel

6. Entering Data for Stock Analysis and Formatting the Cells.
7. Working with Sorting and Filtering.
8. Creating a Chart for an Experiment with sample data.
9. Stock Maintenance for Lab Equipments.

MS- PowerPoint

10. Creating a Presentation for the given topic.
11. Creating a Presentation for the Department Profile.
12. Creating a Presentation with Animation effects.

15UMABTAP401	**ALLIED PRACTICAL IV - STATISTICAL SOFTWARE (For B.Sc, Biotechnology)**	**SEMESTER IV**

OBJECTIVES:

1. To give a good grip on concepts in analyzing the data using Statistical Software.
2. This course provides a sound knowledge about test of Significance, Correlation and Regression.

LIST OF PRACTICALS:

1. Diagrams and graphs
2. Measures of Locations
3. Measures of Dispersion
4. Correlation co-efficient (Karl Pearson & Rank Method)
5. Regression lines
6. Small sample test(t and F)
7. Chi-Square test for independence of attributes

TEXT BOOK:

1. *Sheridan J Coakes, Lyndall Steed and PetaDzidic.* **SPSS 13.0 Version forWindows Analysis without Anguish**. John Wiley & Sons, Australia.

REFERENCE BOOKS:

1. *Andy Field*. 2006. **Discovering Statistics Using SPSS**. [Second Edition]. SAGE Publications.

2. *Robert H.Carver*, *Jane Gradwohl Nash*. 2007. **Doing Data Analysis With SPSS Version-14**. Thomson Brookscole.

15UBTSBC401	SBC II: BIOSAFETY AND BIOETHICS	SEMESTER IV

Total Hours: 25

OBJECTIVES:

1. To develop the student skills to work in the laboratory and to learn the basic ethics.
2. To acquire the basic knowledge on about the laboratory chemicals, containments and issues regarding the rDNA .

CONTENTS

UNIT - I **(5Hours)**

Biosafety - Definition of Biosafety. Biosafety for human health and environment. Social and ethical issues.

UNIT - II **(5Hours)**

Risk and risk assessments, biosafety level, Basic laboratory, laboratory design, General guidelines for rDNA research activities – containment facilities and biosafety practices.

UNIT - III **(5Hours)**

Guidelines for research in transgenic plants and applications. Use of genetically modified organisms and their release in to the environment.

UNIT - IV **(5Hours)**

Environmental safety of genetically modified organisms, Special procedures for r-DNA based products, safety issues in genetically modified foods and organisms.

UNIT - V **(5Hours)**

Bioethics in Biotechnology - Society, Risks, Ethics. ELSI of Biotechnology, Transgenic plants and animals. Genetic modifications-recombinant foods, Recombinant therapeutic products for human health care.

REFERENCE BOOK:

1. *Satheesh, M.K.* 2011. **Bioethics and Biosafety**. I.K. International, New Delhi.

15ULS401	CAREER COMPETENCY SKILLS II	SEMESTER IV

Total Hours: 15

OBJECTIVE:

To enhance employability skills and to develop career competency

UNIT – I **(3 Hours)**

A to Z Placement Terms-Assertiveness and Self Confidence-Career Opportunities-Skill set (Industry Expectations)

UNIT – II **(3 Hours)**

Principles of Communication (LSRW)-Describing Objects / Situations / People-Information Transfer - Picture Talk - News Paper and Book Review

UNIT – III **(3 Hours)**

Self Introduction - Situational Dialogues / Role Play (Telephonic Skills) - Oral Presentations- Prepared -'Just A Minute' Sessions (JAM)

UNIT – IV **(3 Hours)**

Dress code- Body Language- - Manners and Etiquettes -Resume Writing

UNIT – V **(3 Hours)**

Presentation Skills **–** Group Discussion - Interviewing Techniques- Mock Interview

15UBTM501	CORE V : MOLECULAR BIOLOGY	SEMESTER V

Total Hours: 50

OBJECTIVE:

1. To know the molecular basis of cell and to obtain knowledge about various molecular mechanisms.

CONTENTS

UNIT – I **(10 Hours)**

Molecular basis of life – an introduction, Central dogma of molecular biology, DNA replication – Evidences for semiconservative model, DNA replication in prokaryotes and Eukaryotes – initiation, elongation and termination, Rolling circle model and theta model.

UNIT – II **(10 Hours)**

Mutation – Definition, mutagen, types of mutation – insertion and deletion, Point mutation – sense, mis-sense, and non-sense mutation.

DNA repair mechanism – Excision repair, recombination repair, and SOS repair. Recombination - Homologous and Holliday model.

UNIT – III **(10 Hours)**

Transcription in prokaryotes – RNA polymerase, and promoters, Transcription in Eukaryotes – RNA polymerase, promoters, enhancers, and silencer, Mechanism of Transcription- initiation, elongation and termination, Post transcriptional modifications-capping, poly adenylation and splicing.

UNIT – IV **(10 Hours)**

RNA – structure and function of rRNA, mRNA and tRNA, Genetic code, Wobble hypothesis, Translation in prokaryotes and Eukaryotes - Post translational modification.

UNIT – V **(10 Hours)**

Regulation of gene expression – operon model, Transposons – types, Oncogenes – proto oncogene and tumor suppressor genes.

TEXT BOOKS :

1. *Rastogi S.C.*, 2006. **Molecular Biology.** CBS Publishers and Distributors, New Delhi.

REFERENCE BOOKS:

1. *Harvey Lodish*, 2004. **Molecular Cell Biology.** [Fifth Edition]. W.H. Freeman and Company. New York.

2. *Ajoy paul*, 2007. **Text book of Cell and Molecular Biology**. Books and Allied Pvt. Ltd., Kolkatta.

3. *Robert F.Weaver*, 1999. **Molecular Biology.** [First Edition]. Mc Graw Hill Publication Company, USA.

15UBTM502	CORE VI : INDUSTRIAL BIOTECHNOLOGY	SEMESTER V

Total Hours: 50

OBJECTIVE:

To learn about the various bioprocess and engineering technology and to implement in industries.

CONTENTS

UNIT – I **(10 Hours)**

History and scope of Industrial Biotechnology, Isolation and Screening of industrially important microorganism, Strain development, Substrates for industrial fermentation.

UNIT – II **(10 Hours)**

Industrial sterilization methods, Design of bioreactor, Parts and their functions. Types of bioreactor. Methods of fermentation –- Batch, fed batch, continuous fermentation, Growth kinetics.

UNIT – III **(10 Hours)**

Fermentors operations and applications – common measurements and control systems – speed, temperature, gas supply, pH, Dissolved oxygen and foam control.

UNIT – IV **(10 Hours)**

Production of Organic acids – Citric acid and Lactic acid, Aminoacids – Glutamic acid and Lysine, Enzymes –Amylase, and Protease, Antibiotics – β lactam antibiotics.

UNIT – V **(10 Hours)**

Separation of microbial cells and suspended solids, Intracellular product recovery, Cell disruption, Centrifugation, Chromatography, Solvent extraction, distillation, crystallization, Evaporation and drying.

TEXT BOOK:

1. *Crueger, W, and Crueger, A*. 2002. **A Text Book of Industrial Microbiology.** [Second Edition]. Science Tech Publishers, USA.

REFERENCE BOOKS:

1. *Shuler, M.L. and Kargi . F.* 2004. **Bioprocess Engineering: Basic Concepts.** [Second Edition]. Prentice Hall. Pvt. Ltd., New Delhi.

2. *Aiba, S, Humphrey, A.E and Millis, N.F*, 1973. **Biochemical Engineering**. [Second Edition]. Academic Press. New York.

3. *Stanbury, P.F, Hall.S, and Whitaker,A.* 1995. **Principles of Fermentation Technology.** [Second Edition]. Elsevier Science Ltd.

4. *El- Mansi E.M.T., Bryce C.F.A., Demain A. L. Allman A. R.,* 2007. **Fermentation Microbiology and Biotechnology.** [Second Edition]. CRC Press.

15UBTM503	CORE VII : TISSUE CULTURE TECHNOLOGY	SEMESTER V

Total Hours: 50

OBJECTIVE:

1. To know about the basics of tissue culture techniques and to learn the application of the technique in plants and animals.

CONTENTS

UNIT – I **(8 Hours)**

Principles of plant tissue culture, Laboratory organization, Sterilization techniques, Tissue culture media, and Growth regulators.

UNIT – II **(12 Hours)**

Callus and suspension culture, Micropropagation, meristem culture, Somatic embryogenesis, Protoplast isolation, Somatic hybridization and Cybridization, Somaclonal variations.

UNIT – III **(10 Hours)**

Direct gene transformation of plants, Agrobacterium and viral mediated gene transfer. Promoters, selectable markers and reporter genes used in plant gene expression vectors.

UNIT – IV **(10 Hours)**

Introduction and scope of Animal cell culture, Setting up the laboratory, Equipments- Laminar-flow hood, CO_2 Incubators, Inverted microscope, Cryostorage containers, Preparation of Media- defined media and supplements.

UNIT – V **(10 Hours)**

Biology of Cultured cells, Primary culture – Isolation of tissues and disaggregation methods. Subculture and Cell lines. Applications of Animal cell culture technology – somatic cell fusion, transgenic fish and sheep.

TEXT BOOK:

1. *Bhojwani, S.S., and Razdan, M.K.* 2008. **Plant Tissue Culture – Theory and Practice**. Elsevier Publishers, New Delhi. (**UNIT I - III**)
2. *BIOTOL-Biotechnology by open learning*, 1995. **Invitro cultivation of Animal cells.** British Library Cataloguing in Publishing data. (**UNIT IV &V**)

REFERENCE BOOKS:

1. *Slater,A, Scott.N and Fowler.M.* 2008. **Plant Biotechnology – The Genetic Manipulation of Plants.** [Second Edition]. Oxford Publications, Oxford, UK.

2. *Chawla, H.S.*1998. **Biotechnology in Crop Improvement.** International Book Distribution Co, New Delhi.

3. *Freshney, R.I.,* 2005. **Culture of Animal Cells: A Manual of Basic Technique.** [Fifth Edition]. John Wiley and Sons , New Jersey.

15UBTM504	CORE VIII : FOOD AND AGRICULTURAL BIOTECHNOLOGY	SEMESTER V

Total Hours: 50

OBJECTIVES:

1. To get knowledge in the field of Food process technology and its application.
2. To learn the application of Biotechnology in the field of Agriculture.

CONTENTS

UNIT – I **(10 Hours)**

Constituents of food and dietary sources of food – Carbohydrates, Lipids, Proteins, Water, Vitamins and Minerals, Significance of micro-organisms in food, Intrinsic and extrinsic factors of food that affect microbial growth.

UNIT – II **(10 Hours)**

Role of microbes in food industry – Production of culture for food fermentation, food fermentation- Bread, malt beverages, fermented vegetables, pickles, fermented dairy products (cheese), Soy Sauce, Idli.

UNIT – III **(10 Hours)**

Principles and methods of food preservation: Asepsis removal, Anaerobic conditions, Preservation by temperature, evaporation and drying, food additives, radiation, Pasteurization, Blanching, Canning.

UNIT – IV **(10 Hours)**

Introduction and scope of Agricultural biotechnology, Role of microbes in agriculture - Carbon cycle, Nitrogen cycle, Sulfur cycle and Phosphorous cycle. Biofertilizers – *Rhizobium*, *Azotobacter*, and *Azospirillum*, Biopesticide – Bt and NPV.

UNIT – V **(10 Hours)**

Genetically modified crops: viral resistance plants, pest resistance (*Bt* gene approach), herbicide tolerance, saline tolerance, golden rice, Flavr Savr ^{R}

TEXT BOOK:

1. *Frazier, W.S. and Weshoff, D.C.,* 1988. **Food Microbiology**. [Fourth Edition]. McGraw Hill Book Co., New York. (**UNIT I - III**)
2. *G. Rangaswami and D.J. Bagyaraj,* 1998. **Agricultural Microbiology**. [Second Edition]. Prentice, Hall of India Pvt. Ltd., New Delhi. (**UNIT IV - V)**

REFERENCE BOOKS:

1. *James, M.J.,* 1987. **Modern Food Microbiology**. [Fourth edition]. CBS Publishers and Distributors.
2. *Michael P. Doyle, Larry R. Beuchat & Thomas J. Montville*. 1997. **Food Microbiology Fundamentals and Frontiers**. ASM Press.
3. *Bernard.R. Glick and Jack J. Pasternak,* 2007. **Molcular Biotechnology.** [Third Edition]. ASM Press Washington.
4. *Toledo, R.T.,*1980. **Fundamentals of Food Processing.** [Third Edition]. AVI Publishing Company, USA.

15UBTM505	CORE IX : ECOBIOTECHNOLOGY	SEMESTER V

Total Hours: 50

OBJECTIVE:

1. Understanding of the environment and advancing through the applications of Biotechnology to protect the environment.

CONTENTS

UNIT – I **(10 Hours)**

Environmental Biotechnology- definition and history, Microbes in relation to environment - viruses, Bacteria, Fungi and Protozoa, Bacteriology of water and sewage.

UNIT – II **(10 Hours)**

Biotechnological methods of pollution detection - General bioassay and molecular techniques for monitoring the environment, Biosensor in environmental analysis, Biosystems for conventional waste water treatment – Activated sludge, rotating biological contractor, Fluidized beds and Anaerobic digester.

UNIT – III **(10 Hours)**

Biotechnology in CO_2 reduction – Higher plants and algal photosynthesis, Biological calcification, eutrophication, Solid waste management and biological phosphorous removal.

UNIT – IV **(10 Hours)**

Biomechanisms of metal chelation and detoxifications, Metal pollution and its Bioabatement– Plants and microbes, Biodegradation – aerobic, anaerobic, sequential degradation, Xenobiotics - Biodegradation of Herbicides, pesticides and hydrocarbons.

UNIT – V **(10 Hours)**

Eco friendly bio-products for environmental health – Bioenergy and Biofuels, Sources, Advantages, Biodegradable plastics, Future energy needs and direction of research.

TEXT BOOK:

1. *Chatterji, A.K,* 2002. **Introduction to Environmental Biotechnology**. Prentice-Hall of India Pvt. Ltd., New Delhi.

REFERENCE BOOKS:

1. *Rittmann, B. E. And McCarty P. L.* 2001. **Environmental Biotechnology Principles and Applications**. McGraw Hill,USA.
2. *Alan Scragg,* 2005. **Environmental Biotechnology**. [Second Edition]. Pearson Education Ltd, England.
3. *Sharma, P.D.* 2009. **Ecology and Environment**. Rastogi Publications, Meerut, U.P, India.

15UBTMP501	CORE PRACTICAL V	SEMESTER V

Molecular Biology, Industrial Biotechnology, Food and Agricultural Biotechnology, Ecobiotechnology Laboratory

LIST OF EXPERIMENTS

1. Isolation of Genomic DNA from Bacteria
2. Protein estimation by Lowry's method
3. Column Chromatography – silica gel
4. Cell disruption – sonication and Lytic enzyme methods
5. SDS – PAGE
6. Fermentor - demonstration
7. Immobilization of enzyme
8. Wine production and alcohol estimation
9. MBRT
10. Water quality analysis (MPN test)
11. Determination of Dissolved oxygen.
12. Chemical Oxygen Demand
13. TS of root nodule

REFERENCE BOOKS:

1. *Harley Prescott.* **Laboratory exercises in microbiology.** [Fifth Edition]. The Mcgraw-Hill companies.
2. *Kannan, N.* **Laboratory manual in General Microbiology.** Panima publishing corporation, New Delhi.
3. *Benson.* **Microbiological applications laboratory manual in general microbiology.** [Eighth Edition]. The McGraw-Hill Companies.
4. *Joseph Sambrook and David W. Russell*, 2001. **Molecular cloning – A laboratory manual Volume 1 to 3**. [Third Edition]. Cold Spring Harbor Laboratory Press, New York.

15UBTSBC501	SBC III: IPR FOR LIFESCIENCE	SEMESTER V

Total Hours:25

OBJECTIVES:

1. To develop the student skills to work in the laboratory.
2. To acquire the basic knowledge on about the laboratory chemicals, containments and issues regarding the rDNA .

CONTENTS

UNIT - I **(5 Hours)**

IPR – IPR and its types, WTO, GATT, TRIPS, WIPO.

UNIT - II **(5 Hours)**

Patents – History of Patents, Kinds of patent, Invention, novelty, terms of a patent, specifications, filling patent applications.

UNIT - III **(5 Hours)**

Patents in Biotechnology – Biotechnology products, Biotechnology Process, Patenting microorganisms, multicellular organism, patenting genes, patenting cells and tissue.

UNIT - IV **(5 Hours)**

Design – industrial design, essential requirement, duration of registration, Trade secret – importance objectives, meaning benefits of registering a trademark, functions, trade mark.

UNIT - V **(5 Hours)**

Copy rights – coverage by copy rights, filing copyright in India, infringement.
Plant breeder's rights. Open source Biotechnology, pros and cons of open source.

REFERENCE BOOK:

1. *U. Sathyanarayana.* 2010. **Biotechnology**. Books and Allied (P) LTD.

15UBTM601	CORE X : RECOMBINANT DNA TECHNOLOGY	SEMESTER VI

Total Hours: 50

OBJECTIVE:

1. To introduce gene cloning and r-DNA techniques to undergraduates.

CONTENTS

UNIT – I **(10 Hours)**

Recombinant DNA technology –history and scope, Enzymes in recombinant DNA technology – DNA manipulative enzymes, DNA Modifying enzymes, Restriction endonucleases and Ligases.

UNIT – II **(10 Hours)**

Plasmids: Definition, classification. Plasmid vectors – pBR322 & pUC vectors. Vectors for cloning - lambda phage vectors, Phagemids, Cosmids, YAC and BAC vectors.

UNIT – III **(10 Hours)**

Construction of cDNA library and genomic library, screening of gene libraries – screening by DNA hybridization, immunological assay and protein activity.

UNIT – IV **(10 Hours)**

Expression of cloned genes in *E.coli* & yeast. Production of recombinant insulin, somatostatin, TPA and factor VIII.

UNIT – V **(10 Hours)**

DNA sequencing – types and application, PCR and its variations, Forensic analysis – DNA finger printing.

TEXT BOOK:

1. *Brown, T.A.* 2006. **Gene cloning and DNA analysis an Introduction.** [Fourth Edition]. Blackwell Publication.

REFERENCE BOOKS:

1. *Brown.T.A.* 2005. **Genomes.** [Third Edition]. Garland Science Pub., New York.

2. *Primrose ,S.B. and Twyman,R.M.* 2006. **Principles of gene manipulation and genomics** [Seventh Edition]. Blackwell Publication.

3. *Reece,R.J.* 2004. **Analysis of Genes and Genomes**. John wiley & Sons. Inc.

15UBTM602	CORE XI : LARGE SCALE MANUFACTURING PROCESS	SEMESTER VI

Total Hours: 48

OBJECTIVE:

1. To introduce Scale up process and Bioethics for undergraduates.

CONTENTS

UNIT – I **(8 Hours)**

Introduction to concepts of Bioprocess engineering, Definition of Bioprocess engineering, Overview of Bioprocesses with their various components, Scales of operation and their global impact on Bioprocesses.

UNIT – II **(10 Hours)**

Introduction to simple engineering calculations, Mass and energy balances. Fermenters, Bioreactors: Constructions, Design and Operation Materials of Constructions, Welding, Surface treatment, Components of the fermenters and their specifications.

UNIT – III **(10 Hours)**

Air and media sterilization: Principles of media sterilization, decimal reduction, design of sterilization cycle using kinetics of thermal depth of microbes. Equipments used in sterilization; Batch and Continuous.

UNIT – IV **(10 Hours)**

Media for large scale process and their optimization: constituent of media, their estimation and quantification, Design of media and costing of media.

UNIT – V **(10 Hours)**

Measurement and control of Bioprocesses parameters. Cell growth, pH, temperature, substrate consumption, product formation, measurement of oxygen and carbon dioxide uptake.

TEXT BOOKS:

1. *Stanbury. P.R and Whitaker,* 2002. **Principles of fermentation technology**. Elsevier Science Ltd.

REFERENCE BOOKS:

1. *Pauline M Doran*. 1995. **Bioprocess Engineering Principles**. Academic press.
2. *Shuler M.L., and Kargi F.*, 2004. **Bioprocess Engineering: Basic Concepts** [Second Edition]. Prentice Hall. Pvt. Ltd., New Delhi.
3. *Patel A.H*. 2005. **Industrial Microbiology.** [Fifth edition]. Mac Millan India Ltd, New Delhi.
4. *Crueger, W, and Crueger, A*.2002. **A Text Book of Industrial Microbiology**. [Second Edition]. Science Tech Publishers, USA.

15UBTM603	CORE XII: MEDICAL BIOTECHNOLOGY	SEMESTER VI

Total Hours : 52

OBJECTIVE:

1. To understand the application of Biotechnology in the field of medicine**.**

CONTENTS

UNIT – I **(9 Hours)**

Medical Biotechnology- Need and Scope, Genetic disease and its classification, Molecular basis of single gene disorder, lysosomal storage disease, single gene disorder with non classical patterns of inheritance- mutation in mitochondrial genes, trinucleotide repeat expansion disorder.

UNIT – II **(10 Hours)**

DNA in disease diagnosis and medical forensics – Detecting infectious disease: detection and identification of microorganisms – sample preparation, bacterial targets of molecular based tests. Antimicrobial agents,Molecular epidemiology, virus – nucleic acid blotting techniquefor virus detection.

Molecular detecting of inherited disease – Molecular diagnosis of single gene disorders i) Factor V ii) Cystic fibrosis.

UNIT – III **(12 Hours)**

Molecular oncology: Classification of neoplasms, molecular basis of cancer, Analytical targets for molecular testing, Gene rearrangements in Lukemia and lymphoma. DNA based tissue typing: HLA polymorphism.

UNIT – IV **(11 Hours)**

Pharmaceutical products from recombinant DNA technology. Human protein replacements – Insulin and Human growth hormone. Therapeutic agents – tissue plasminogen activator and interferons. Recombinant vaccines – Subunit vaccine, attenuated recombinant vaccine and vector recombinant vaccine.

UNIT – V **(10 Hours)**

Stem Cells therapy and tissue engineering strategies in regenerative medicine – Introduction, Basic component of tissue engineering –Native cells, embryonic stem cells,

placental and amniotic fluid stem cells. Tissue engineering for specific tissues and organ.

TEXT BOOK:

1. *Lela Buckingham* and *Maribeth L. Flaws.* 2007. **Molecular diagnostics- Fundamentals, methods and clinical applications.** FA Davis Company. Philadelphia.

REFERENCE BOOKS:

1. *Jean-Louis Sersa.* 2002. **Diagnostic techniques in genetics**. John wiley and sons, Ltd.
2. *Danny L. Wiedbrauk* and *Daniel H. Farka.*, 1995. **Molecular Methods for virus detection**. Academic press.
3. *Brown.T.A*. 2005. **Genomes.** [Third Edition]. New York : Garland Science Pub.
4. *Primrose ,S.B.* and *Twyman,R.M.* 2006. **Principles of gene manipulation and genomics**. [Seventh Edition]. Blackwell Publication.
5. *Sathyanarayana, U*. 2009. **Biotechnology**. Books and Allied Private Ltd, Kolkatta.
6. *Reece,R.J.* 2004. **Analysis of Genes and Genomes**. John wiley & Sons. Inc.

15UBTM604	CORE XIII :ENTREPRENEURIAL BIOTECHNOLOGY	SEMESTER VI

OBJECTIVE:

1. To have *entrepreneur* students capable of starting their own businesses or going to work.

CONTENTS

UNIT - I

Mushroom cultivation – Substrate – composting – spawn – Cropping - Harvesting. Diseases and control Nutritive value, Single cell proteins – spirulina production – uses.

UNIT – II

Biofertilizers and Biopesticides – quality control and marketing. Vermi culture- solid waste management and its applications.

UNIT – III

Animal breeding - Maintenance and care of laboratory animals – mice, rabbit, guinea pig, chickens, Laboratory animals ethics – Anaeshesia and Euthanasia – Ethical guidelines for use of Animals in scientific Research – in-vitro systems to replace animals.

UNIT – IV

Silk worm; types, culturing, harvesting and marketing.
Apiculture – Honey bee types, rearing, honey collection and storage.

UNIT – V

Plant tissue culture technique –medicinal plant, soilless agriculture – coir pith and hydroponics. Certification procedures – organic certification and CIB certification.

REFERENCE BOOKS:

1. *Krishnmoorty, S., Marimuthu, T. and Nakkeran, S.* 2005. **Mushroom Biotechnology**. TNAU Press, Coimbatore, India. **(UNIT I)**
2. *Keshav Trehan*, 1997. **Biotechnology.** New age International Pvt. Ltd., Publication. **(UNIT III & IV)**

3. *N.S. Subbarao,* 1995. **Soil Microorganisms and plant growth.** Oxford and IBH Co.Pvt. Ltd., Publication. **(UNIT II & V)**

15UBTMP601	CORE PRACTICAL VI	SEMESTER VI

RECOMBINANT DNA TECHNOLOGY AND TISSUE CULTURE TECHNOLOGY

LIST OF EXPERIMENT

1. Isolation of plasmid DNA
2. Restriction Digestion
3. Ligation of digested
4. Blotting of DNA from agarose gel
5. Bacterial Transformation
    a. Competent Cell preparation
    b. Transformation of pUC Vector in to a competent cell.
6. Polymerase Chain Reaction (Demostration and Hands on programming)
7. Preparation of medium for plant tissue culture technology
8. Sterilization of explants and Callus induction
9. Micropropagation
10. Media preparation for Animal Cell Culture
11. Primary culture of Chick embryo fibroblast
12. Determination of viability of cells using Trypan blue stain

REFERENCE BOOKS:

1. *Joseph Sambrook and David W. Russell*, 2001. **Molecular cloning – A laboratory manual Volume 1 to 3**. [Third Edition]. Cold Spring Harbor Laboratory Press, New York.
2. Aneja, K.R. 2003. **Experiments in Microbiology, Plant pathology and Biotechnology.** [Fourth Edition]. New age international.
3. *Cappucino, J.G and Sherman, N.* 2012. **Microbiology – A laboratory manual.** [Seventh Edition]. Pearson Education Inc.
4. *Freshney, R.I.,* 2005. **Culture of Animal Cells: A Manual of Basic Technique.** [Fifth Edition]. John Wiley and Sons , New Jersey.

15UBTSBC601	SBC IV: BASICS OF RESEARCH	SEMESTER VI

Total Hours: 25

OBJECTIVE:

1. To develop the basic knowledge about the research for the students.

CONTENTS

UNIT - I **(5 Hours)**

Research – Planning and Classification, Components of research report, Essential steps in research.

UNIT - II **(5 Hours)**

Problem Identification & Formulation, Research Question, Investigation Question, Measurement Issues, Hypothesis - Qualities of a good Hypothesis, Null Hypothesis & Alternative Hypothesis.

UNIT - III **(5 Hours)**

Literature collection, Literature citation, Different systems for citing reference- Name, year systems.

UNIT - IV **(5 Hours)**

Journals – Standard of Research journals – impact factors – citation index, search scientific information – google, pubmed – Scientific information.

UNIT - V **(5 Hours)**

Component of Research report - Report, Table, Figures, Format of Thesis.

REFERENCE BOOK:

1. *Gurumani, N.* 2006. **Research Methodology**. MJP Publishers.

15UBTN301	NMEC I: DRUGS AT YOUR HOME	SEMESTER III

Total hours: 30

OBJECTIVE:

1. To know about the nutritional and medicinal properties of some plants.

CONTENTS

UNIT – I: Herbs **(6 Hours)**

Medicinal value of *Aloe vera,* Mint, Tulsi, Lettuce, Curry leaf, Coriander, leaves of Drumstick and neem.

UNIT – II: Cereals and Pulses **(6 Hours)**

Nutritive and medicinal value of Wheat, Ragi, Millet, Maize, Green gram, Bengal gram, Black gram, Horse gram and Red gram.

UNIT - III: Rhizome **(6 Hours)**

Medicinal value of Potato, Beet root, Carrot, Radish, Onion, Tapioca, Ginger, Garlic and Turmeric.

UNIT – IV: Vegetables **(6 Hours)**

Nutritive and medicinal value of Brinjal, Bottle guard, Ribbed guard, Bitter guard, Cluster beans, Cabbage, Drumstick, Lady's finger, Goose berry.

UNIT – V: Fruits and nuts **(6 Hours)**

Medicinal properties of Mango, Jack fruit, Banana, Papaya, Guava, and Grapes
Nutritive value of Cashew nut, Ground nut, Mustard and Sesame.

REFERENCE BOOKS:

1. *Ivan A. Ross.,* 2005. **Medicinal plants of the World, Chemical constituents, Traditional and Modern Medicinal uses**. Volume: 3. Humana Press, Towota, New Jersey.
2. *Vaidyaratnam P.S.,* 2010. **Indian Medicinal Plants.** Volume: 1. University Press.
3. *Kurain J.C.,* 2003. **Plants that heal**. Oriental Watchman Publishing house, Pune, India.

15UBTN401	NMEC II: BIOTECHNOLOGY IN DAILY LIFE	SEMESTER IV

Total Hours: 30

OBJECTIVE:

1. To understand the basics about Biotechnology and its day to day application in daily life.

CONTENTS

UNIT - I **(6 Hours)**

Introduction to Biotechnology – Origin and Evolution of Biotechnology, Old biotechnology and New biotechnology.

UNIT - II **(6 Hours)**

Food Biotechnology - Introduction, products, curd, idly, pickles, cheese, wine.

UNIT – III **(6 Hours)**

Pharmaceutical Biotechnology – Introduction to antibiotics, uses and abuses of antibiotics. Vaccines – introduction, vaccine against common disease, vaccination schedule, edible vaccine.

UNIT – IV **(6 Hours)**

Stem cells- introduction and application, Transgenic animals – fish and chicken.

UNIT - V **(6 Hours)**

Agricultural Biotechnology – Genetically modified crops, pros and cons – Bt cotton and Bt brinjal, Golden rice, SCP, Spirulina and mushroom.

REFERENCE BOOKS:

1. *Daan J. A. Crommelin, Robert D. Sindelar, and Bernd Meibohm,* 2008. **Pharmaceutical Biotechnology – Fundamentals and applications.** Informa healthcare USA, Inc.
2. *Glick R. Bernard* and *Pasternak J Jack.* 2007. **Molecular Biotechnology**. [Third Edition]. ASM press, Washington D.C.

15UBTD401	DIPLOMA COURSE : BIOINFORMATICS	SEMESTER III & IV

Total Hours: 30

OBJECTIVE:

1. To understand and gain both the theoretical and practical concepts in Bioinformatics.

CONTENTS

UNIT – I **(10 Hours)**

Internet basics; connecting to the internet; Downloading and saving files (Notepad, MS Word); Email: Create, attachment and sending process. World Wide Web, Web browsers; HTTP, HTML, URL, Biological network – NCBI: features, tools.

UNIT – II **(10 Hours)**

Introduction to single letter code and symbols used in nucleotides and amino acids, Bioinformatics – Introduction, Applications & its importance, Biological Database– classification and Properties, Data Formats (FASTA, GENBANK, PDB), Format conversion.

UNIT – III **(10 Hours)**

Sequence Database: GENBANK and EMBL – divisions, retrieval system, and depositing system, PIR and SWISSPROT – Features, Sequence retrieval and depositing system, Human Genome Database. Literature Database: OMIM, Pubmed and Medline.

TEXT BOOKS:

1. *Attwood T. K.* and *Parry-Smith D J.* 2005. **Introduction to Bioinformatics**. [First Edition]. Pearson Education.
2. *Kothekar V*. and *Nandi T.* 2007. **An Introduction to Bioinformatics**. [Second Edition]. Duckworth press- Bioscience Publishers, New Delhi.

REFERENCE BOOKS:

1. *Andreas D Baxevanis* and *Francis B F.* 2002. **Bioinformatics- A Practical Guide to Analysis of Genes & Proteins**. John Wiley Publications.
2. *David W Mount. 2004*. **Bioinformatics: Sequence and Genome Analysis**. CSHL.
3. *LP Editorial Board*. 2008. **MS-OFFICE 2007**. [First Edition]. LawPoint Publications.

15UBTD401	DIPLOMA COURSE : BIOINFORMATICS	SEMESTER III & IV

Total Hours: 30

OBJECTIVE:

1. To understand and gain both the theoretical and practical concepts in Bioinformatics.

CONTENTS

UNIT – I **(10 Hours)**

Sequence analysis – sequence alignment, Local/Global alignment, Basics of scoring matrices (BLOSUM), Pairwise alignment – principle, methods, applications, Similarity search with Blast, Multiple Alignment – principle, methods, applications, Clustal W.

UNIT – II **(10 Hours)**

Protein Structural Classification, Structural Database (PDB, SCOP), primary structural analysis: concept & tools (ProtParam), secondary structure prediction: chou-fasman and GOR method. Tertiary structure prediction (Homology Modeling).

UNIT – III **(10 Hours)**

Phylogenetic Analysis: concept, Rooted and Unrooted tree, Tree construction methods- Distance method (UPGMA), Tools for tree construction, PCR primer design and *in silico* PCR amplification.

TEXT BOOKS:

1. *Attwood T. K.* and *Parry-Smith D J.* 2005. **Introduction to Bioinformatics**. [First Edition]. Pearson Education.
2. *Kothekar V*. and *Nandi T.* 2007. **An Introduction to Bioinformatics**. [Second Edition]. Duckworth press- Bioscience Publishers, New Delhi.

REFERENCE BOOKS:

1. *Andreas D Baxevanis* and *B F Francis.* 2002. **Bioinformatics- A Practical Guide to Analysis of Genes & Proteins**. John Wiley Publications.
2. *David W Mount. 2004*. **Bioinformatics: Sequence and Genome Analysis**. CSHL.
3. *LP Editorial Board*. 2008. **MS-OFFICE 2007**. [First Edition]. LawPoint Publications.

15UBTDP401	DIPLOMA COURSE : BIOINFORMATICS PRACTICAL	SEMESTER III & IV

LIST OF PRACTICALS

1. Basics of Internet Searching and downloading process.
2. Database file formats- (EMBL, FASTA, and Genbank)
3. Searching & analyzing GENBANK database.
4. Searching & analyzing Swiss Prot database.
5. Structural data analysis with PDB.
6. Pubmed database search.
7. Sequence similarity search using BLAST program.
8. Phylogenetic tree construction. (Clustal W)
9. PCR Primer designing with primer3 tool.
10. Casein protein secondary structural feature analysis.

REFERENCE BOOKS:

1. *Attwood T. K.* and *Parry-Smith D J.* 2005. **Introduction to Bioinformatics**. [First Edition]. Pearson Education.
2. *Kothekar V.* and *Nandi T.* 2007. **An Introduction to Bioinformatics**. [Second Edition]. Duckworth press- Bioscience Publishers, New Delhi.
3. *Andreas D Baxevanis* and *B F Francis.* 2002. **Bioinformatics- A Practical Guide to Analysis of Genes & Proteins**. John Wiley Publications.
4. *David W Mount. 2004*. **Bioinformatics: Sequence and Genome Analysis**. CSHL.
5. *LP Editorial Board*. 2008. **MS-OFFICE 2007**. [First Edition]. LawPoint Publications.

GUIDELINES

1. SUBMISSION OF RECORD NOTE BOOKS AND PROJECT DISSERTATION:
Candidates appearing for Practical Examinations and Project Viva-Voce shall submit Bonafide Record Note Books/ Dissertation prescribed for Practical/ Project Viva-Voce Examinations, otherwise the candidates will not be permitted to appear for the Practical/ Project Viva-Voce Examinations.

2. PASSING MINIMUM AND INTERNAL MARK DISTRIBUTION (Theory, practical and project)

2.A(i). THEORY
The candidate shall be declared to have passed the Examination, if the candidate secure not less than 40 marks put together out of 100 in the Comprehensive Examination in each Theory paper with a passing minimum of 30 marks in External out of 75.

Marks Distribution
Comprehensive Examination (CE) - 75 marks
Continuous Assessment (CA) - 25 marks

***Internal Marks Distribution** [CA- Total Marks: 25]*

Attendance	: 5 Marks
Assignment	: 5 Marks
Internal Examinations	: 15 Marks
Total	**: 25 Marks**

2.A(ii). THEORY (If Internal Evaluation is for 100Marks)
The candidate shall be declared to have passed the Examination, if the candidate secures not less than 40 marks out of 100 in the Continuous assessment (Internal Evaluation only).

***Internal Marks Distribution** [CA- Total Marks: 100]*

Attendance	:10 Marks
Assignment	: 30Marks (3 Assignments Compulsory)
Internal Examinations	: 60 Marks
Total	**: 100 Marks**

2.B. PRACTICAL

The candidate shall be declared to have passed the Examination, if the candidate secure not less than 40 marks put together out of 100 in the Comprehensive Examination in each Practical paper with a passing minimum of 24 marks in External out of 60.

Marks Distribution

Comprehensive Examination (CE) - 60 marks
Continuous Assessment (CA) - 40 marks

***Internal Marks Distribution* [CA- Total Marks: 40]**

Experiment	: 10 Marks
Attendance	: 5 Marks
Record	: 5 Marks
Internal Examinations	: 20 Marks
Total	**: 40 Marks**

2.C. FIELD TRAINING:

The students should visit the field of their interest and they have to submit the report which will be evaluated by the subject experts in the department. Maximum marks allotted to the report submission are 100 in which the students should secure the minimum of 40.

2.D. PROJECT WORK/DISSERTATION

- The project work shall be carried out by group of students in the VI semester and has to complete the work at the end of VI Semester.
- Upon completion of the project work/dissertation the candidate will be required to appear for a Viva- Voce conducted by an external examiner.
- The Student has to attend 3 reviews before completing his/her Project.
- All three reviews will be reviewed by subject experts.
- A candidate failing to secure the prescribed passing minimum in the dissertation shall be required to re-submit the dissertation with the necessary modifications.
- The assessment of student's performance in a semester is calculated by Continuous Internal Assessment (CA) for 40 marks and External Assessment for 60 marks.

The candidate shall be declared to have passed the Examination, if the candidate secure not less than 40 marks put together out of 100 in the Comprehensive Examination in Project with a passing minimum of 24 marks in External out of 60.

Internal Mark Distribution **[CA - Total Marks: 40]**

1. Research work done	:	10 Marks
2. Attendance	:	5 Marks
3. Record/Observation	:	5 Marks
4. Review	:	20 Marks
Total	**:**	**40 Marks**

External Mark Distribution **[CE- Total Marks: 60]**

1. Research work done	:	20 Marks
2. Project report	:	20 Marks
3. Presentation	:	10 Marks
4. Viva-Voce	:	10 Marks
Total	**:**	**60 Marks**

3. QUESTION PAPER PATTERN AND MARK DISTRIBUTION

THEORY

Question Paper Pattern and Mark Distribution **(For 75 marks)**

1. **PART – A (10 x 2 = 20 Marks)**
Answer ALL questions
Two questions from each UNIT

2. **PART – B (5 x 5 = 25 Marks)**
Answer ALL questions
One question from each UNIT with Internal Choice

2. **PART – C (3 x 10 = 30 Marks)**
Answer ANY THREE questions
Open Choice – 3 out of 5 questions
One question from each UNIT

PRACTICAL

Major Practical Distribution

Question Paper Pattern and Mark Distribution **(For 60 marks)**

S.No	Component	Mark
1	Major	1x25=25
2	Minor	1x15=15
3	Spotters	5x02=10
4	Viva-Voce	10
	Total	**60**

Key for evaluation of Practical Examination

1. **Major (25 Marks)**
   Procedure : 15 Marks
   Performance : 05 Marks
   Result : 05Marks

2. **Minor (15 Marks)**
   Procedure : 10 Marks
   Performance : 03 Marks
   Result : 02 Marks

3. **Spotters** : 5x2=10 Marks

4. **Viva – Voce** **:** 10 Marks

Computer Practical Distribution

Internal Marks Distribution ***[CA- Total Marks: 40]***

Experiment	: 10 Marks (10-12 Experiments)
Attendance	: 5 Marks
Record	: 5 Marks
Internal Examinations	: 20 Marks
Total	**: 40 Marks**

External Marks Distributions **[CE- Total Marks: 60]**

For each practical question the marks shall be awarded as follows:

i.	Aim	: 5 Marks
ii.	Algorithm/Flowchart	: 10 Marks
iii.	Writing the Source Code	: 15 Marks
iv.	Test and debug the Source Code	: 15 Marks
v.	Dislaying the Output	: 10 Marks
vi.	Result Declaration	: 5 Marks
	Total	**: 60 Marks**

GUIDELINES FOR CAREER COMPETENCY SKILLS

METHODOLOGY OF ASSESSMENT

1. On Line Objective Examination (Multiple Choice questions)- Semester III

- 100 questions-100 minutes
- Twenty questions from each UNIT.
- On line examination will be conducted at the end of the III Semester.

2. Viva – Voce Semester IV

- A Student has to come in proper dress code and he/she should bring 2 copies of Resume for the Viva - Voce.
- A student may be asked to
    - Give Self Introduction
    - Submit the resume to the examiner(s) and answer the questions based on it.
    - Speak on any given topic for at least two minutes.
    - Give a presentation for 10 minutes on a topic of their choice.
    - Sit with other students in a Group for a Discussion.