DHANALAKSHMI SRINIVASANCOLLEGE OF ARTS & SCIENCE FOR WOMEN
(AUTONOMOUS)
(Nationally Re-Accredited with 'A' Grade by NAAC)
PERAMBALUR 621212
(For the candidates admitted from the academic year 2018-2019 onwards)
B.SC BIOTECHNOLOGY -COURSE STRUCTURE UNDER CBCS

YEAR /SEMESTER	PART	COURSE	TITLE OF THE PAPER	SUBJECT CODE	Inst .Pds/week	credit	Exam hrs	Marks		Total
								Int	Ext	
I Year-I Semester	I	Language Course-I-	Tamil-Cheyyul(Ikkala elakiyam),Sirukathai, Ilakkiya varalaru/Hindi/French/ Arabic/Sanskrit	18U1LT1/ 18U1LH1/ 18U1LF1/ 18U1LA1/ 18U1LS1	6	3	3	25	75	100
	II	English Language Course-I	English for Communication-I	18U1EL1	6	3	3	25	75	100
	III	Core Course-I	Cell biology	18UBT1C1	6	6	3	25	75	100
		Core Course-II	Lab in cell biology	18UBT1C2P	4	3	3	40	60	100
		Allied course-I	Biochemistry	18UBT1A1	3	4	3	25	75	100
	IV	Allied course-II	Lab in Biochemistry and Immunology	18UBT1A2P	3	-	-	-	-	-
		Environmental studies	Environmental studies	18U1EVS	2	2	3	25	75	100
			Allied Botany							
			Total		**30**	**21**				**600**
I Year-II Semester	I	Language Course-II-	Tamil-Cheyyul(Edikala elakiyam),Puthinam/ Hindi/French/Arabic/ Sanskrit	18U2LT2/ 18U2LH2/ 18U2LF2/ 18U2LA2/ 18U2LS2	6	3	3	25	75	100
	II	English Language Course-II	English for Communication-II	18U2EL2	6	3	3	25	75	100
	III	Core Course-III	Microbiology	18UBT2C3	6	5	3	25	75	100
		Core Course-IV	Lab in Microbiology	18UBT2C4P	4	3	3	40	60	100
		Allied course-II	Lab in Biochemistry and Immunology	18UBT1A2P	3	3	3	40	60	100
		Allied course III	Immunology	18UBT2A3	3	3	3	25	75	100
	IV	Value education	Value education	18U2VED	2	2	3	25	75	100
			Total		**30**	**22**				**700**

II Year-III Semester	I	Language Course-III-	Tamil-Cheyyul(Edikala elakiyam),Urainadai,aluval murai madalgal,Elakiyavaralaru/ Hindi/French/Arabic/ Sanskrit	18U3LT3/ 18U3LH3/ 18U3LF3/ 18U3LA3/ 18U3LS3	6	3	3	25	75	100
	II	English Language Course-III	English-English through literature	18U3EL3	6	3	3	25	75	100
	III	Core Course-V	Principles of Genetics and Molecular Biology	18UBT3C5	6	5	3	25	75	100
		Core Course-VI	Lab in Genetics and Molecular biology	18UBT3C6P	4	3	3	40	60	100
		Allied course-IV	Basics of Bioinformatics	18UBT3A4	3	3	3	25	75	100
		Allied lab-V	Lab in Bioinformatics and Biostatistics	18UBT3A5P	3	-	-	-	-	-
	IV	Non Major Elective-I	A) Basics of Biotechnology	18UBT3N1A	2	2	3	25	75	100
			B) Health care Biotechnology	18UBT3N1B						
			C) Process Instrumentation Dynamic and control	18UBT3N1C						
			Total		**30**	**19**				**600**
II Year-IV Semester	I	Language Course-IV-	Tamil-Cheyyul(Sanga illakiyam),Neethi illakiyam,Nadagam,Ellakia varalaru,Pothukatturai/ Hindi/French/Arabic/ Sanskrit	18U4LT4/ 18U4LH4/ 18U4LF4/ 18U4LA4/ 18U3LS3	6	3	3	25	75	100
	II	English Language Course-IV	English-English for competitive exam	18U4EL4	6	3	3	25	75	100
	III	Core Course-VII	Recombinant DNA technology	18UBT4C7	6	6	3	25	75	100
		Core Course-VIII	Lab in Recombinant DNA technology	18UBT4C8P	4	3	3	40	60	100
		Allied course-V	Lab in Bioinformatics and Biostatistics	18UBT3A5P	3	3	3	40	60	100
		Allied course-VI	Biostatistics	18UBT4A6	3	2	3	25	75	100
	IV	Non Major Elective-II	A) Agricultural Biotechnology	18UBT4N2A	2	2	3	25	75	100
			B) Solid Waste Management	18UBT4N2B						
			C) Industrial waste Management.	18UBT4N2C						
			Total		**30**	**22**				**700**

III Year- V Semester	III	Core Course-IX	Forensic Biotechnology	18UBT5C9	6	6	3	25	75	100
		Core Course-X	Animal Biotechnology	18UBT5C10	6	6	3	25	75	100
		Core Course-XI	Plant Biotechnology	18UBT5C11	5	5	3	25	75	100
		Core Course-XII	Lab in FBT, ABT and PBT	18UBT5C12P	3	3	3	40	60	100
		Major Based Elective – I	A) Plant Tissue culture	18UBT5M1A	4	4	3	25	75	100
			B) Marine Biotechnology	18UBT5M1B						
			C) Molecular Modeling and drug design	18UBT5M1C						
		Skill based Elective –I	A) Ethonomedicine	18UBT5S1A	2	2	3	25	75	100
			B) Phytochemical Technique	18UBT5S1B						
			C) Herbs and Drug action.	18UBT5S1C						
		Skill based Elective –II	A) Pharmacognosy	18UBT5S2A	2	2	3	25	75	100
			B) Plant Hormones and Signal transduction	18UBT5S2B						
			C) Biobusiness	18UBT5S2C						
		Soft Skill development	Soft Skill development	18U5SS	2	2	3	25	75	100
			Total		**30**	**30**				**800**
III Year- VI Semester	III	Core Course-XIII	Industrial Biotechnology	18UBT6C13	6	6	3	25	75	100
		Core Course-XIV	Environmental Biotechnology	18UBT6C14	6	6	3	25	75	100
		Core Course-XV	Lab in IBT and EBT	18UBT6C15P	6	4	3	40	60	100
		Major Based Elective – II	A)Industrial Fermentation Technology	18UBT6M2A	6	4	3	25	75	100
			B) Food and beverage Fermentation technology	18UBT6M2B						
			C) Bioresources Technology	18UBT6M2C						
		Major Based Elective – III	A) Metabolic Biotechnology	18UBT6M3A	5	4	3	25	75	100
			B) Pharmaceutical Biotechnology	18UBT6M3B						
			C) Bioconjugate Technology and Applications	18UBT6M3C						
	IV	Gender studies	Gender studies	18U6GS	1	1	3	25	75	100
	V	Extension activities	Extension activities(NCC, NSS, Rotract, YRC,etc)	-		1				
			Total		**30**	**26**				**600**
Grand Total					**180**	**140**				**4000**

MAJOR BASED ELECTIVE

SEMESTER	SUBJECT NAME	SUBJECT CODE
V	Plant Tissue culture Marine Biotechnology Molecular Modeling and drug design	18UBT5MB1A 18UBT5MB1B 18UBT5MB1C
VI	Industrial Fermentation Technology Food and beverage Fermentation technology Bioresources Technology	18UBT6MB2A 18UBT6MB2B 18UBT6MB2C
VI	Metabolic Biotechnology Pharmaceutical Biotechnology Bioconjugate Technology and Applications	18UBT6MB3A 18UBT6MB3B 18UBT6MB3C

NON MAJOR ELECTIVE

SEMESTER	SUBJECT NAME	SUBJECT CODE
III	Basics of Biotechnology Health care Biotechnology Process Instrumentation Dynamic and control	18UBT3N1A 18UBT3N1B 18UBT3N1C
IV	Agricultural Biotechnology Solid Waste Management Industrial waste Management.	18UBT4N2A 18UBT4N2B 18UBT4N2C

SKILL BASED ELECTIVE

SEMESTER	SUBJECT NAME	SUBJECT CODE
V	Ethonomedicine Phytochemical Technique Herbs and Drug action.	18UBT5S1A 18UBT5S1B 18UBT5S1C
V	Pharmacognosy Plant Hormones and Signal transduction Biobusiness	18UBT5S2A 18UBT5S2B 18UBT5S2C

CORE COURSE-I

CELL BIOLOGY

Semester: I Max mark:100(Int:25,Ext:75)
Course code: 18UBT1C1 Credit:6
Total Hours: 90 Exam hrs : 3

OBJECTIVES: This course presents the types and structural details of the basic unit by which all the living things are made of (the cell). On successful completion the subject student should have understand: Structural features, Organelles and the cellular mechanisms.

UNIT I:
BASICS OF CELL BIOLOGY **18**
Cell as a basic unit: Discovery of the cells, Classification of cell types, Development of cell theory, Early chemical investigation in cell biology. Prokaryotic and Eukaryotic cell organization. Difference between plant and animal cell at different level.

UNIT II:
CELLULAR ORGANELLES **18**
Structure and function of Cytoplasmic compartments of the cell: ribosome and protein synthesis, energy flow through mitochondria, chloroplast and photosynthesis, Golgi apparatus, lysozymes and micro bodies, Endoplasmic Reticulum(ER) , cytoskeleton, vacuoles, peroxysomes, lysozomes and Nuclear compartment. Heterochromatin and Euchromatin, Polytene chromosomes.

UNIT III: **18**
CELL STRUCTURE AND FUNCTION
Cell transport phenomenon: membrane architecture. Active and Passive transport, Diffusion and osmosis.

UNIT IV:
CELL DIVISION **18**
Cell division in prokaryotes and eukaryotes: Stages of Cell cycle, Different Stages of mitosis, meiosis, Crossing over and Abnormalities of cell cycle – Cancer, Apoptosis, Stem cell and its application.

UNIT V:
CELLULAR EVENT **18**
Integrative and Specialized cellular events, cell-cell signaling, Specialized cells nerve cells, sperm cells and Ovarian cells, microfilaments, microtubules, muscle cells. Cells of vision, Nucleo-cytoplasmic interaction, cell cloning.

REFERENCES
1. Freifelder D. 1985. Molecular Biology, Narosa Publishing House. New Delhi.
2. Lewin B. 2007. Genes IX. Oxford University Press, London.

3. Ajoy Paul. 2011. Textbook of Cell and Molecular Biology**.** Books and Allied Ltd.

4. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. 2008. Molecular Biology of Cell. 6th Edition. Garland Science, Taylor & Francis group Publishers.

5. Harvey Lodish, Arnold Berk, S Lawrence Zipursky, Paul Matsudaira, David Baltimore, and James Darnell. 1995. Molecular Cell Biology. 3rd Edition. W.H. Freeman Publishers.

CORE COURSE-II

LAB IN CELL BIOLOGY

Semester: I | Max mark:100(Int:40,Ext:60)
Course code: 18UBT1C2P | Credit:3
Total Hours: 60 | Exam hrs : 3

OBJECTIVE

This practical used to know the basic handling of instruments, staining techniques and sterilization , stages of mitosis and meiosis

1. Introduction to principles of sterile techniques and cell propagation
2. Principles of microscopy, phase contrast and fluorescent microscopy
3. Identification of given plant, animal and bacterial cells and their components by microscopy
4. Leishman Staining
5. Micrometry
6. Giemsa Staining
7. Separation of Peripheral Blood Mononuclear Cells from blood
8. Osmosis and Tonicity
9. Tryphan Blue Assay
10. Staining for different stages of mitosis in AlliumCepa (Onion)
11. Staining and observation of meiosis in testes of the grasshopper.

ALLIED COURSE-I

BIOCHEMISTRY

Semester: I | Max mark: 100(Int:25,Ext:75)
Course code: 18UBT1A1 | Credit:4
Total Hours: 45 | Exam hrs : 3

OBJECTIVES: This course presents the chemical reactions or metabolic functions in the living system and their regulations. On successful completion the subject student should have understand: Basic metabolism, Enzymes and their kinetics and Applications of metabolites.

UNIT- I

CARBOHYDRATES **9**

Definition – Structure and Classifications of Carbohydrates – Properties and Biological Functions of Carbohydrates – Monosaccharides, Disaccharides, Polysaccharides, Storage Polysaccharides, Structural Polysaccharides – Glycoproteins, Proteoglycans and Blood Grouping, Storage and Metabolism of Carbohydrates

UNIT- II

PROTEINS AND AMINO ACIDS **9**

Structure and Classification of Amino Acids – Polypeptides – Primary Structure – Types of Bonding– Confirmation – Secondary Structure – Alpha Helix, Beta Sheets, Turns and Loops – Tertiary Structure – Quaternary Structure – Protein Folding. Metabolism of Proteins and Nitrogen Balancing – Introduction to Enzymes – Acids base Balance.

UNIT- III

LIPIDS **9**

Definition – Classification – Structure and Functions of Lipids – Storage Lipids – Membrane Lipids– Fatty Acids – Waxes – Phospholipids – Eicosonoids – Terpenes – Steroids – Structure and Composition of Cell Membrane –Fluid Mosaic Model

UNIT -IV

NUCLEIC ACIDS **9**

Definition –Structure and Types of Nucleic acids – DNA and RNA – Types – Structure and Function – Nucleotides – Nucleosides – Sugars – Circular – Double Helix and Super Coiled DNA–Composition of Eukaryotic and Prokaryotic Genome

UNIT -V **9**

FATTY ACID, NUCLEIC ACID METABOLISM AND OXIDATIVE PHOSPHORYLATION

Overview of Fatty Acid Metabolism – Synthesis and Degradation of Fatty Acids – Nucleic acids – De Novo Synthesis of Nucleotides – Intermediary Metabolism – Oxidative Phosphorylation – Energy Transduction Pathways – Regulation – Light Reactions of Photosynthesis – Secondary Metabolites.

REFERENCES:

1. L. Lehninger. 2004. Principles of Biochemistry, 4th Edition. W.H Freeman and

Company.
2. Boyer.R., (2002) Concepts in Biochemistry 2nd ed. Brooks/cole publishing company New York.
3. David L. Nelson and M. Cox (2003) Lehninger's Principles of Biochemistry, 3rd Ed, Worth publication New York
4. Voet & Voet (1995) Fundamentals of Biochemistry, 2nd Ed, John Wiley and sons inc., New York.
5. Geoffery L Zubay (1995) Principles of Biochemistry, WCB publishers, London
6. Murrey RK., D.K. Granner, P.A. Mayers and V.W. Rodwell, (2003) Harper's Biochemistry, Prentice –Hall Int, Boston
7. Donald Voet and Judith G.Voet. 2004. Biochemistry. 3rd Edition. John Wiley, New York.
8. Stryer. 2002. Biochemistry. 5th Edition. W.H. Freeman and Company.

ALLIED COURSE-II

LAB IN BIOCHEMISTRY AND IMMUNOLOGY

Semester: I | Max mark:100(Int:40,Ext:60)
Course code: 18UBT1A2P | Credit:3
Total Hours: 90 | Exam hrs : 3

OBJECTIVE

This practical used to know the basic handling of volumetric measurement, Quantitative and Qualitative measurement of macro and micro molecules.

BIOCHEMISTRY

1. Demonstration of Use of Volume and Weight Measurements Devices.
2. Titration of Weak Acid-Weak Base.
3. Quantitative test for Carbohydrates.
4. Distinguish Reducing and Non Reducing Sugars.
5. Using Ninhydrin for Distinguishing Imino and Aminoacids .
6. Protein Estimation by Biuret Method.
7. Protein Estimation by Lowry's Method.
8. Protein Estimation by Bradford Colorimetric Methods.
9. Extraction of Lipids and Analysis by TLC.

IMMUNOLOGY

1. Preparation of Antibodies.
2. Antigen- Antibody Reactions.
3. Immuno Diffusion. (Single Radial and Double)
4. Blood Grouping.
5. Preparation of Serum from Blood.
6. Method of Immunization and Bleeding.
7. ELISA- Demonstration.
8. Immunoassay and Typhoid Antibodies.
10. Immunoelectrophoresis (Rocket).
11. Identification of Cells in a Blood Smear
12. Isolation of Monocyte from Blood.

CORE COURSE-III

MICROBIOLOGY

Semester: II | Max mark:100(Int:25,Ext:75)
Course code: 18UBT2C3 | Credit:5
Total Hours: 90 | Exam hrs : 3

OBJECTIVES: This course presents the study of Microorganisms and aimed to give a detailed understanding about types, classification and characterization of microbes and their applications.

UNIT I

FUNDAMENTALS OF MICROBIOLOGY **18**

Microbial Diversity, History and Scope of Microbiology, Branches of Microbiology, Contribution of Scientists in The Field of Microbiology (Antony Von Leewenhoek, Edward, Jenner, Lazarospallanzani, Louis Pasteur, Joseph Lister, Robert Koch, Alexander Flemming and Lwanovsky), Types of Microbes:Structure, Growth and Reproduction of the Various Bacteria, Fungi, Protozoa, Viruses, Viroids, Prions and Parasites.

UNIT II:

MICROBIAL PHYSIOLOGY **18**

Biomoleules – Carbohydrates, Lipids and Proteins; Enzymes – Properties, Nomenclature, Classification and Mechanism of Enzyme action and Factors influencing Enzymes Activity; Nitrogen Metabolism - Nitrogen Fixation (Symbiotic and Asymbiotic), Secondary Metabolism; Fermentation – Fermentative Modes in Microbes; Nutrition - Photo-Autotrophs, Chemoautotrophs, Parasitism, Saprophytism, Mutualism and Symbiosis, Commensalisms, Endozoic Microbes; Microbial Pathogens - Plants, Animals and Humans.

UNIT III:

MICROBIAL TECHNIQUES **18**

Microbiological Media: Types, Preparation, Methods of Sterilization; Enumeration of Microorganisms in Soil, Water and Air; Isolation of Microorganisms from Environment and Infected Tissue; Techniques of Pure Culture, Maintenance and Preservation; Staining: Stains and Types of Staining - Simple Staining, Differential Staining and Structural Staining.

UNIT IV

INSTRUMENTATION OF MICROBIOLOGY **18**

Basic Principles in Microscopy - Resolving Power, Numerical Aperture, Working Distance and Magnification. Principles of Photomicrography. Working Principles and Applications of - Light, Dark, Phase Contrast, Fluorescent and Electron Microscope-(Transmission and Scanning Electron)

UNIT V:

TYPES AND APPLICATION OF MICROBIOLOGY **18**

Production of Enzymes (and Antibiotics; Production of Biofertilizer and Biopesticides; Economic Importance of Moulds and Yeast; Role of Microbes in Biogeochemical cycles.

REFERENCES:

1. Prescott, Harley, Klein. 2003. Microbiology. 5th Edition. Mcgraw Hill Publ.
2. Pelzer, Chan and Kreig. 1986. Microbiology. 5th Edition. Mcgraw-Hill, New Delhi,India.
3. S. Meenakumari. 2009. Microbial Physiology. MJP Publishers, New Delhi.
4. Tortora, G.J., Funke, B.R. And Case, C.L. 2012. Microbiology - an Introduction. 11th Edition. Pearson Education.
5. Edward A. Birge, 1992, Modern Microbiology – Principles and Application.
6. Wm.C. Brown Publishers, Inc. U.S.A.
7. Gerard J. Tortora, Berdell R. Funke, Christine & L. Case, 2001, Microbiology -
8. An Introduction. Benjamin Cummings, U.S.A.
9. Danial Lim, 1998, Microbiology, Mcgraw-Hill Companies, New York.
10. Stephen A. Hill, 1984, Methods In Virology. Blackwell Scientific Publication, London.

CORE COURSE-IV

LAB IN MICROBIOLOGY

Semester: II | Max mark:100(Int:40,Ext:60)
Course code: 18UBT2C4P | Credit:3
Total Hours: 60 | Exam hrs : 3

OBJECTIVE

This course presents the study of Laboratory Rule ,Media preparation and growth measurement of the microbes.

1. Laboratory Rules and Regulations of Microbiology
2. Media Preparation and Sterilization
3. Enumeration of Microorganism from Soil, Water and Spoiled Food-Serial Dilution Technique.
4. Pure Culture Technique—Pour Plate, Spread Plate and Streak Plate Methods.
6. Measurement of Growth of Bacteria.
7. Measurement of Growth of Phage.
8. Staining of Bacteria—Gram's, Spore, Capsule, Acid Fast Bacilli.
9. Fungal Staining --- Wet Mount technique.
10. Identification of Algae, Yeast, Protozoa.
11. Biochemical characterization of Bacteria.

ALLIED COURSE-III

IMMUNOLOGY

Semester: II | Max mark:100(Int:25,Ext:75)
Course code: 18UBT2A3 | Credit:3
Total Hours: 45 | Exam hrs : 3

OBJECTIVE: On Successful Completion the Subject Student should have Understand: Immunity, Antigen, Antibody, Cells of Immune System and Their Function and Regulations.

UNIT I:
INTRODUCTION **9**

Historical Development in Immunology. Immunity-. Humoral and Cell Mediated Response, Primary and Secondary Immune Response. Cells Involved in Immune System. Innate and Acquired Immunity. Mechanisms of Defense.

UNIT II:
ANTIGEN **9**

Antigen- Types and Classifications. Antibody – Structure, Types, Properties and Their Biological Functions, Poly Clonal Sera, Monoclonal Antibody. Primary and Secondary Lymphoid Organs – Thymus, Bone Marrow, Lymph Nodes and Spleen. Lymphocytes Traffic and Regulation, CD Molecules, MHC Complex and its Classification, HLA Typing.

UNIT III:
CMI AND HI RESPONSES **9**

CMI Response - T Cell Development, Maturation, Activation and Differentiation. T Cell Receptor and Determinant. T Cell Subsets. TCR Complex. Antigen Processing and Presentation. HI Response - B Cell: B Cell Development, Maturation, Activation and Differentiation. B Cell Receptor and Determinants. B Cell Subsets. Immunoglobulins - Basic Structure, Classes & Subclasses of Immunoglobulins, Antigenic Determinants. Generation of Antibody Diversity.

UNIT IV
VACCINOLOGY **9**

Active, Passive and Combined Immunization. Live, Killed, Attenuated, Plasma Derived, Sub Unit, Recombinant DNA, Protein Based, Plant-Based, Peptide, Anti-Idiotypic And Conjugate Vaccines – Production & Applications. Role and Properties of Adjuvants & ISCOMS

UNIT V:
CLINICAL IMMUNOLOGY **9**

Immunity to Infection. - Bacteria, Viral, Fungal and Parasitic; Hypersensitivity – Type I, II, III and IV; Autoimmunity; Transplantation Immunology; Tumor & Cancer Immunology and Immunotherapy; Immunodeficiency

REFERENCES

1. E. Riot. 2011. Essential Immunology 12th Edition. Wiley & Blackwell.
2. Janeway et al. 1999. Immunobiology. 4th Edition. J Current Biology publications.
3. D. M. Weir, John Stewart. 1997. Immunology. 8th Edition. Churchill Livingstone.

4. P.J.Delves, I S.J.Artin, I D.R.Burton and I I.M.Roitt. 2006. Essential Immunotechnology. 12th Edition. Wiley & Blackwell.
5. Richard M. Hyde. 2012. Microbiology and Immunology. 3rd Edition. Springer Science & Business Media.
6. Brostoff J, Seaddin JK, Male D, Roitt IM., 2002. Clinical Immunology. 6th Edition. Gower Medical Publishing.
7. Paul. 1999. Fundamental of Immunology. 4th Edition. Lippencott Raven.

CORE COURSE-V

PRINCIPLES OF GENETICS AND MOLECULAR BIOLOGY

Semester: III | Max mark:100(Int:25,Ext:75)
Course code: 18UBT3C5 | Credit: 5
Total Hours: 90 | Exam hrs : 3

OBJECTIVES: The course provides information regarding genes their structure and genetic drifting. Further the chromosomal variation are also explained genetics gene expression and regulation.

UNIT I:

GENES, CHROMOSOMES & HEREDITARY 18

Definition and scope of Genetics.DNA as a Genetic material: Transforming Principle, Biochemical Characterization of Transforming Principle, Hershey and Chase Experiment, Properties of Genetic Material. Cellular Reproduction (Cell Division): Significance and Types of Cell Division. Mendelism: Basic Principles.

UNIT II

GENE INTRACTION **18**

Gene interaction, Epistasis, lethality and lethal genes, Sex determination and sex linkage in diploids, linkage and crossing over, gene mapping. Chromosomal theory of inheritance, maternal effects.

UNIT III

CHROMOSOMAL VARIATIONS **18**

Chromosomal variation in number, Changes in Chromosomal structure, Chromosomal aberrations, Genetics of Heamoglobin, Transposable elements in prokaryotes and eukaryotes.

UNIT IV

STRUCTURE OF GENE **18**

Fine structure of Gene, cistron, recon, Structure of Eukaryotic gene, Experimental evidence for DNA as the genetic material, cytoplasmic genetic systems- mitochondria and chloroplast DNA, Plasmids- F, R and Col plasmids. Relation between genes and polypeptides.

UNIT V

GENETIC DRIFTING **18**

Population genetics, calculating gene frequency, factors affecting gene frequency. Genetic control of Development in Drosophila and Arabidopsis. Genetic drift, Shift, Pedigree analysis and genetic counseling.

REFERENCE:

1. D.L.Hartl (1991) Basic Genetics. Jones and Bartett publishers, Burlington.
2. Friedfelder (1987) Microbial genetics. Jones and Bartett publishers, Burlington.
3. Watson (1987) Molecular Biology of the genes 4th Ed. Benjamine /cummings coins.
4. James Darnell, Harvey Lodish, and David Baltimore (1993) Molecular cell biology 2nd Ed. Scientific American Books,New York.

CORE COURSE-VI

LAB IN GENETICS AND MOLECULAR BIOLOGY

Semester: III
Course code: 18UBT3C6P
Total Hours: 60

Max mark:100(Int:40,Ext:60)
Credit: 3
Exam hrs : 3

1. Extraction of DNA and RNA
2. Estimation of DNA and RNA.
3. Isolation of Plasmid DNA.
4. Mutagenesis in Bacteria: The Ames test
5. Transformation in *E. coli.*
6. Biochemical characterization of selected bacteria.
7. Evaluation of transduction
8. Isolation of phage from sewage and determination of phage titre
9. Replica plate technique
10. Mutant isolation by gradient plate technique.

ALLIED COURSE-IV

BASICS OF BIOINFORMATICS

Semester: III | Max mark:100(Int:25,Ext:75)
Course code: 18UBT3A4 | Credit: 3
Total Hours: 45 | Exam hrs : 3

OBJECTIVES: The course structure of the course provides an in-depth knowledge o all the necessary concepts related to bioinformatics, basic engineering, information technology and computer languages.

UNIT I:
INTRODUCTION
Introduction and history of bioinformatics – Internet, World Wide Web, Web browser, EMB net, NCBI. File transfer protocol. Search engines.

UNIT II:
BIOLOGICAL DATABASE AND ITS TYPES
General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL). Protein databases (Primary, Composite, and Secondary). Specialized Genome databases: (SGD, TIGR, and ACeDB). Structure databases (CATH, SCOP, and PDBsum)

UNIT III:
GENOMICS
Genomic resources, Gene structure and DNA sequences. EST searches, gene hunting, gene finders, Expression analysis- SAGE, cDNA library, EST, Microarray – DNA sequencing and sequence alignment – RFLP, SNP, RAPD, Human Genome Project, RNA analysis.

UNIT IV:
PROTEOMICSs
Proteomics – proteome analysis - SDS PAGE **–** 2D gel electrophoresis, Mass spectrophotometry, protein – protein interaction, protein – DNA interaction. Enzyme – Substrate interaction, pathway analysis

UNIT V:
APPLICATIONS
Application aspects – Drug database-Microbial Databases– target searchings – drug designing – Docking Studies (Basics) E- cell, phylogenetic analysis, PERL, Chemoinformatics

REFERENCES:

1. T.K.Attwood, D.J.Parry-smith D.J. Delhi (2004) Introduction to Bioinformatics. Pearson Education, Singapore.
2. K.Mani and N.Vijayaraj (2002) Bioinformatics for Beginners. Kalaikathir Achchagam, Coimbatore.
3. Pennington and Dunn (2002) Proteomics. Viva books publishers, New Delhi
4. A.D. Baxevanis and B.F.F. Ouellette (2002) Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins 2nd Ed. John Wiley and Sons publishers, New York.

ALLIED COURSE-V

LAB IN BIOINFORMATICS AND BIOSTATISTICS

Semester: III | Max mark:100(Int:40,Ext:60)
Course code: 18UBT3A5P | Credit: 3
Total Hours: 45 | Exam hrs : 3

1. Collection of data, sampling designs, tabulation and Graphical representation.
2. To find Mean, Mode, Median, Co-efficient of variance.
3. 't' Test, chi square, statistical error, standard deviation also, to be practically done through SPSS programme [statistical Package for Social Sciences].
4. Study of Nucleic acid sequence databanks – GenBank, EMBL nucleotide sequence databank, DDBJ.
5. Study of Protein Structure and Classification databases – PDB, SCOP and CATH.
6. Multiple alignment – Clustal W, BLAST.
7. Evaluation of protein structure by Swiss PDB viewer and RASMOL.
8. Simulation Techniques - GROMACS

CORE COURSE VII

RECOMBINANT DNA TECHNOLOGY

Semester: IV | Max mark:100(Int:25,Ext:75)
Course code: 18UBT4C7 | Credit: 6
Total Hours: 90 | Exam hrs : 3

OBJECTIVES: The course provides information regarding the enzyme, strategis and techniques. The ethical issues involved in the recombinant DNA technology is also discussed.

UNIT I:
INTRODUCTION **18**

Restriction and Modification systems of Bacteria. Restriction enzyme: DNA Polymerases, DNALigase, methylase, Taq polymerase, polynucleotide kinase, alkaline phosphotase, revese transcriptase, DNasel, S1nuclease, RNase H, terminal deoxynucleotidyl transferase, RNA polymerase.

UNIT II:
PROBES **18**

Types and methods in probe construction, methods of labeling gene probes, identification of recombinant DNA. Construction of DNA libraries and genomic libraries, protein engineering.

UNIT III:
CLONING STRATEGIES **18**

Introduction of cloned genes into the host cells: Transformation, transduction, Particle gun, electroporation, liposome mediated and co-cultivation.

UNIT IV:
RECOMBINANT DNA TECHNIQUES **18**

Recombinant DNA techniques: Anti sense technology, terminator gene technology, site directed mutagenesis, Human genome project, hybridization techniques-southern, Western and Northern blotting, Chromosome walking. PCR, RFLP, RAPD, DNA finger printing, Micro array and sequencing, gene therapy, DNA sequencing.

UNIT V:
ETHICAL ISSUES **18**

Public acceptance issues for biotechnology: Case studies/experiences from developing and developed countries. Biotechnology and hunger: Challenges for the Indian Biotechnological research and industries. The Cartagena protocol on biosafety. Biosafety management: Key to the environmentally responsible use of biotechnology. Ethical implications of biotechnological products and techniques. Social and ethical implications of biological weapons.

REFERENCES:

1. Ernst.L.Winnacker (2003) From genes to Clones 2nd Ed. Panima publishing corporation, New Delhi.
2. James.D.Watson (2001) Recombinant DNA technology 2nd Ed. WH Freeman and company, New York.
3. Glick and Pasternak (1996) Molecular Biotechnology. Panima publishing corporation,New Delhi.
4. BrownT.A. (1998) Introduction to gene cloning 3rd Ed. Stanley Thomas Publishing Ltd, London.
5. PrimroseS.B. (2003) Principles of gene manipulation 6th Ed. Blackwell Science Ltd, Germany.
6. The Secretariat of the Convention on Biological Diversity (2000) Cartagena Protocol on Biosafety.
7. M.R. Dano (1994) Biological Warfare in the 21st century. Brassies London.

CORE COURSE VIII

LAB IN RECOMBINANT DNA TECHNOLOGY

Semester: IV
Course code: 18UBT4C8P
Total Hours: 60

Max mark:100(Int:40,Ext:60)
Credit: 3
Exam hrs : 3

1. Isolation of Genomic DNA—Bacteria, Plant and Animal.
2. Isolation of Plasmid DNA.
3. Isolation of RNA.
4. Restriction Digestion.
5. Isolation of Phage DNA.
6. Transformation.

Demonstration.

7. Southern blotting
8. Northern blotting
9. Western blotting
10. PCR
11. Construction of restriction Map of plasmid DNA

ALLIED COURSE VI

BIOSTATISTICS

Semester: IV
Course code: 18UBT4A6
Total Hours: 45

Max mark:100(Int:25,Ext:75)
Credit: 2
Exam hrs : 3

OBJECTIVES: This course helps the students to understand the statistical approach of biology and its applications in the biological field.

UNIT I:
INTRODUCTION
Statistics – definition, functions and its limitations Collection, classification, tabulation of data, diagrammatic and graphical representation of data .

UNIT II:
CENTRAL TENDENCY
Measures of central tendency - mean, median, mode, geometric mean, harmonic mean – Advantages and Limitations.

UNIT III
DISPERSION
Measures of dispersion – range, quartile deviation, decile, percentile mean deviation, standard deviation, variance, coefficient of variation, skewness – kurtosis .

UNIT IV:
CORRELATION
Correlation - Types, scatter diagram - Karl Pearson's method, Spearman's Rank method, concurrent deviation method, Regression equations and their properties (simple problems).

UNIT V:
TEST OF SIGNIFICANCE
Test of significance for small samples - Students't' test - to test the significance of sample mean, difference between two sample mean, Analysis of variance –meaning and assumptions - one way and two way classification. Probability, Definitions of various terms used in probability, Addition and multiplication rule, Conditional probability, Independence of events, Baye's theorem (simple problems).

REFERENCES
1. Norman T. J. Bailey, (2009) Statistical methods in Biology. University press, Cambridge
2.Rastogi, Fundamentals of Biostatistics, Anne Books, India.
3. Sokal, R.R. and F.J. Rohlf (1981). Biometry. W.K. Freeman. San Francisco.
4. Zar, J.H (2003) Biostatistical Analysis. Pearson Education (Singapore) Pvt. Ltd., Indian Branch, New Delhi.

CORE COURSE IX

FORENSIC BIOTECHNOLOGY

Semester: V | Max mark:100(Int:25,Ext:75)
Course code: 18UBT5C9 | Credit: 6
Total Hours: 90 | Exam hrs : 3

OBJECTIVES: This course helps the students to understand the Sequencing of DNA and the Methods used in this field.

UNIT I

INTRODUCTION **18**

History of DNA fingerprinting and DNA polymorphism.Genes and DNA markers in forensic DNA analysis.Introduction to Polymerase Chain Reaction and its applications.HLA typing and it's forensic importance.

UNIT II **18**

FUNDAMENTALS OF DNA SEQUENCING

Use of RFLP, RAPD, AFLP in forensics.STR genotyping, Result of STR marker analysis and its interpretation.Single Nucleotide Polymorphism (SNP) and its applications in forensic investigation.

UNIT III **18**

LCN TYPING.

Mitochondrial DNA – introduction and use in Forensic investigation.

Y-STR analysis and its significance in establishing paternal relationships. Non-human DNA analysis.

UNIT IV

POPULATION OF GENETICS **18**

Concept of population structure, Hardy-Weinberg equilibrium, Phylogenetic tools. Paternity/ maternity indices, sibshipindices. Population Genetics in Forensic DNA typing. Forensically important databases – BOLD, Hapmap, STRBase, DNA databases

UNIT V

POLICIES AND LAWS **18**

Introduction to Quality, Quality Assurance, Quality control. Definition of Accreditation, History and development of ISO. Importance of accreditation in Forensic science laboratories. Intellectual Property Rights, IPR policy of Government of India. Patent: Qualification (novel, commercial and non-obvious), jurisdiction of patent laws, Indian and international patent laws, filing procedures.

REFERENCES

1. J. M. Butler (2014) Advanced Topics in Forensic DNA Typing- Methodology, Academic Press.
2. J m butler (2005) Forensic DNA typing - biology, technology and gentics of STR markings, Academic Press
3. John Butler (2014) Advanced Topics in Forensic DNA Typing: Interpretation,Academic Press.
4. W.J. Tilstone, M.L. Hastrup and C. Hald (2013).Fisher's, Techniques of Crime SceneInvestigation, CRC Press, Boca Raton.

CORE COURSE X

ANIMAL BIOTECHNOLOGY

Semester: V | Max mark:100(Int:25,Ext:75)
Course code: 18UBT5C10 | Credit: 6
Total Hours: 90 | Exam hrs : 3

OBJECTIVES: This course provides basic information regarding animal tissue culture, animal products, production & improvement of them.

UNIT I:

ANIMAL CELL CULTURE **18**

Animal cell culture: Fundamentals. facilities and applications. Media for Animal cells. Biology of cultured cells, measurement of growth, cell synchronization, senescence and apoptosis

UNIT II:

TYPES OF CELL CULTURE **18**

Types of cell culture: Primary cell culture, secondary culture, cell transformation, cell lines, stem cell cultures, cell viability and cytotoxicity. Organ culture. Cryopreservation Insect cell lines

UNIT III:

GENETIC ENGINEERING IN ANIMALS **18**

Genetic engineering in animals: methods of DNA transfer into animal cells- Calcium phosphate co precipitation, Micro-injection, Electroporation, Liposome encapsulation, Biological vectors. Hybridoma technology, Vaccine production.

UNIT IV:

EMBYOLOGY **18**

Embyology: Collection and preservation of embryo, culture of embryos, culture of embryonic stem cells and its applications. Gametogenesis and fertilization in animals, Molecular events during fertilization, Genetic regulations in embryonic development.

UNIT V:

TRANSGENICS **18**

Transgenics: Transgenic animals. Production and recovery of products from animal tissue cultures: cytokines, Plasminogen activators, Blood clotting factors, Growth hormones.

REFERENCES:

1. E.J. Murray (Ed) (1991) Gene Transfer and Expression Protocols – Methods in Molecular Biology Vol.7. Humana Press,Totowa, NJ.
2. Watson, J.D., N.H.Hopkins, T.W.Roberts, J.A.Steitz and A.M. Weiner (1987) Molecular Biology of Gene. Benjamin Cummins, San Franscisco.
3. Watson, J.D., M. Gilman, J. Witkouski and M.Zoller (1992) Recombinant DNA. Scientific American Books, New York.
4. Puller A(1993) Genetic Engineering of Animals. VCH Publishers, New York.
5. Balinsky, B.I (1975). An Introduction to Embryology. Saunders, Philadelphia.

CORE COURSE XI

PLANT BIOTECHNOLOGY

Semester: V | Max mark:100(Int:25,Ext:75)
Course code: 18UBT5C11 | Credit: 5
Total Hours: 75 | Exam hrs : 3

OBJECTIVES: This course is designed to make the understand about crop development, Callus culture, Biotechnological applications of plants.

UNIT I:
CROP IMPROVEMENT – CONVENTIONAL METHOD **15**

Conventional methods of crop improvement- Selection, mutation, polyploidy and clonal selection.

UNIT II:
PLANT GENOME ORGANIZATION **15**

Plant genome organization, gene families in plant. Organization of chloroplast genome, nucleus-encoded and chloroplast encoded genes for chloroplast proteins. Organization of mitochondrial genome- nuclear and mitochondrial encoded genes for mitochondrial proteins, cytoplasmic male sterility. Seed storage proteins and heat shock proteins.

UNIT III:
PLANT TISSUE CULTURE **15**

Plant tissue culture. Callus culture, organogenesis, meristem culture, anther, pollen, embryo culture and their applications .somatic hybridization Somatic embryogenesis and cybrids, Biopriming Technology.

UNIT IV:
NITROGEN FIXATION **15**

Symbiotic nitrogen fixation in legumes -Biochemistry and molecular biology, gene rearrangement and nitrogen fixation in cyanophytes. Agrobacterium and Crown gall tumors. Ti plasmid vectors for plant transformation, agro-infection. Classification of plant viruses, molecular biology of plant stress response.

UNIT V: **15**
TRANSFORMATION

Direct transformation of plants by using physical methods, Genetic engineering in plants-selectable markers, reporter genes and promoters used in plant vectors. Genetic engineering of plants for virus resistance, pest resistance, herbicide tolerance, delay of fruit ripening, resistance to fungi and bacteria. Production of antibodies, viral antigens and peptide hormones in plants. Importance of RFLP in plant breeding. Management aspect of plant genetic engineering, tagging and cloning of plant genes.

REFERENCES

1. Grierson,D., and S.N. Covey (1988) Plant Molecular Biology. Blackie& Sons. Ltd. Glascow.

2. Lycett, G.W. and D. Grierson (Eds) (1990) Genetic Engineering of Crop Plants. Heinemann, London.

3. Chrispeeds, M.J. and D.F. Sadava (1994). Plants, Genes and Agriculture.. Jones and Bartlett, Boston.

4. Mantel. S. H, Mathews. J. A, Mickee. R.A.(1985) An Introduction to Genetic Engineering in Plants. Blackwell Scientific Publishers, London.

5. Marks. J.L. (Ed.)(1989). A Revolution on Biotechnology. Cambridge Univ.Press, Cambridge.

6. Dodds J.H.(1985). Plant Genetic Engineering. Cambridge Univ.Press, Cambridge.

7. Bernard R Glick. and J.J. Pasternak (2002). Molecular biotechnology, Principle and Applications of Recombinant DNA. ASM Press, Washington, D.C.

9. Monica A. Hughes (1996) Plant Molecular Genetics. Addison Wesley Longman, Harlow, England.

CORE COURSE XII

LAB IN FORENSIC BIOTECHNOLOGY ANIMAL BIOTECHNOLOGY, PLANT BIOTECHNOLOGY

Semester: V
Course code: 18UBT5C12P
Total Hours: 45

Max mark:100(Int:40,Ext:60)
Credit: 3
Exam hrs : 3

LAB IN FORENSIC BIOTECHNOLOGY

1. Restriction Fragment Length Polymorphism.
2. Random Amplified Polymorphic DNA.
3. Polymerase Chain Reaction
4. DNA Finger Printing
5. Blotting Techniques

LAB IN ANIMAL BIOTECHNOLOGY

1. Preparation of tissue culture medium
2. Preparation of single cell suspension from spleen and thymus.
3. Cell counting and viability
4. Cryopreservation and thawing
5. Preparation of metaphase chromosome from cultured cell.

LAB IN PLANT BIOTECHNOLOGY

1. Surface sterilization
2. Micropropagation – Direct and Indirect Organogenesis
3. Protoplast Isolation and culture
4. Cytological examination of regenerated plants

CORE COURSE XIII

INDUSTRIAL BIOTECHNOLOGY

Semester: VI | Max mark:100(Int:25,Ext:75)
Course code: 18UBT6C13 | Credit: 6
Total Hours: 90 | Exam hrs : 3

OBJECTIVES: The course is designed to gain knowledge on Industrial importance of Biotechnology, importance of Enzymes, upstream and downstream processing & to learn the Industrial applications of Biotechnology.

UNIT I:
INTRODUCTION **18**

Principles of Microbial growth – introduction, the ways of growing microorganisms, ways to increase yield of microbes, Batch, fed-batch and continuous cultures (definition and kinetics).

UNIT II:
BIOREACTOR **18**

Bioreactor / Fermenter – types, working & operation of Bioreactors, Fermenters (Stirred tank, bubble columns, airlift. Bioreactors, Static, Submerged and agitated fermentation), advantages & disadvantages of solid substrate & liquid fermentations, Quality Control.

UNIT III: **18**
UPSTREAM AND DOWNSTREAM PROCESS

Upstream processing (Strain selection, Sterilization), Downstream processing – extraction, separation, concentration, recovery & purification, operations (Insulin, Vitamins, Metabolites.

UNIT IV:
ENZYME TECHNOLOGY **18**

Enzyme technology – nature of enzymes, application of enzymes, limitations of microbial cells used as catalysts in fermentation, multi-enzyme reactors, cloning strategy for enzymes, technology of enzyme production, industrial applications of immobilized enzymes, Quality Control.

UNIT V:
APPLICATIONS **18**

Biotechnology in specific medical & industrial applications - microbial process for immunization (Production of monoclonal antibodies), Delerioration of Microbial culture selection with high yield potential, Quality Control.

REFERENCES

1. Sullia S. B& Shantharam S (1998) General Microbiology, Oxford & IBH Publishing Co. Pvt. Ltd.

2. Bisen P.S (1994) Frontiers in Microbial Technology, 1st Edition, CBS Publishers.

3. Glaser A.N & Nilaido.H (1995) Microbial Biotechnology,W.H Freeman & Co.

4. Prescott & Dunn (1987) Industrial Microbiology 4th Edition, CBS Publishers & Distributors.

5. Prescott & Dunn (2002) Industrial Microbiology, Agrobios (India) Publishers.

6. Crueger W. & Crueger A. (2000) A text of Industrial Microbiology, 2nd Edition, Panima Publishing Corp.

CORE COURSE XIV

ENVIRONMENTAL BIOTECHNOLOGY

Semester: VI | Max mark:100(Int:25,Ext:75)
Course code: 18UBT6C14 | Credit: 6
Total Hours: 90 | Exam hrs : 3

OBJECTIVES: The course is designed to make the student understand about Ecosystem, Natural cycles, impact of various environmental pollution, remedies and role of genetic engineering in environmental biotechnology.

UNIT I: **18**

INTRODUCTION

Scope – Branches of ecology – Abiotic factors – water – soil – temperature – light. Biotic factors – Animal relationship – symbiosis – commensalisms – mutalism – Antagonism – Antibiosis – Parasitism – Predation – competition.

UNIT II:

ECOSYSTEM **18**

Ecosystem –Definition –structure – pond ecosystem – primary production –secondary production – food chain – food web – trophic levels – energy flow – pyramid of biomass– pyramid of energy. Biogeochemical cycle: Nitrogen and Phosphorous.

UNIT III:

ENVIRONMENTAL POLLUTION **18**

Pollution – types – sources – effects – Air-water – land – Noise – Thermal – Pesticide – Radioactive – green house effect, ozone and its importance – global warming – Acid rain– Bio accumulation – Bio magnification. Biological control. Principles of environment Impact. Assessment and environmental monitoring.

UNIT IV:

BIOREMEDIATION **18**

Environmental impact of pollution and measurement methods -Composting of organic wastes, microbial bioremediation of oil spills; Waste water treatment - sewage treatment and common industrial effluent treatment ; Concepts of bioremediation (in-situ and ex-situ), Bioremediation of toxic metal ions – biosorption and bioaccumulation principles. Concepts of phytoremediation; Microbial biotransformation of pesticides and xenobiotics; Microbial leaching of ores and Rhizospheric soil – direct and indirect mechanisms.

UNIT V:

GENETIC ENGINEERING IN ENVIRONMENTAL BIOTECHNOLOGY **18**

Genetically engineered microorganisms in environmental health-Genetically engineered plants and microorganisms in agriculture. Genetically engineered bacteria in bioremediation of pesticides, insecticides oil spills-Hazards of genetically engineered microorganisms, plants and animals-Policies of genetic engineering research.

REFERENCES:

1. Groombridge, B (Ed.) (1992) Global Biodiversity – Status of the Earth's Living Resources. Chapman & Hall, London.
2. UNEP (1995) Global Biodiversity Assessment , Cambridge Univ. Press, Cambridge.
3. Virchow, D (1998). Conservation & Genetic Resources , Springer – Verlag, Berlin.
4. Gary K.Meffe and Ronald Carroll C (1994) Principles of Conservation Biology, SinauerAssociates, Inc., Massachusetts.
5. Clarke, G.L (1954) Elements of Ecology, John Wiley & sons. N.Y.
6. Kendeigh, S.c.(1961) Animal Ecology. Prentice Hall.
7. Odum, E.P (1971). Fundamentals of Ecology. W.B.Saunders company, Philadelphia.
8. Rastogi, V.B. and M.S. Jayaraj, (1989). Animal ecology and distribution of animals, Kedamath Ramnath.
9. Sharma, P.D (1990) Ecology and environment. Rsatogi publications, Meerut.
10. Southwick, C.H (1976) Ecology and the quality of environment D.Van.Nostrand Co.,
11. Verma P.S. and V.K. Agarwal (1996) Principles of Ecology S.Chand. & co., New Delhi.

CORE COURSE XV

LAB IN INDUSTRIAL BIOTECHNOLOGY AND ENVIRONMENTAL BIOTECHNOLOGY

Semester: VI
Course code: 18UBT6C13
Total Hours: 90

Max mark:100(Int:40,Ext:60)
Credit: 6
Exam hrs : 3

LAB IN INDUSTRIAL BIOTECHNOLOGY

1. Media formulation - Sterilization of bioreactors.
2. Isolation of industrially important microorganisms (amylase, pectinase, cellulase) for microbial process & maintenance of bacterial & fungal cultures.
3. Determination of thermal death point and thermal death time of microorganisms
4. Microbial production of Penicillin, wine and Beer
5. Production of amylase, cellulose, pectinase, wine and beer in a bioreactor.
6. Cell and enzyme immobilization.
7. Growth kinetics- Effect of pH and temperature on growth kinetics (Demonstration)

.

LAB IN ENVIRONMENTAL BIOTECHNOLOGY

8. Water Analysis: Measurement of Total Solids, Total-dissolved solids, Total-suspended solids, dissolved oxygen, total hardness, chloride, turbidity, nitrite, nitrate, COD, BOD, fluoride and total nitrogen.
9. Air Analysis: Suspended particles, So_2, oxides of nitrogen, H_2S –Field Visit
10. Treatment studies of effluent using aeration techniques.
11. Microbial assessment of air quality (open plate and air sample)

MAJOR BASED ELECTIVE I

A. PLANT TISSUE CULTURE

Semester: V | Max mark:100(Int:25,Ext:75)
Course code: 18UBT5M1A | Credit: 4
Total Hours: 60 | Exam hrs : 3

OBJECTIVES: The objective of the course is to give students knowledge regarding plant biotechnology processes, including breeding of healthy plants, plants with improved characteristics and plants for biomolecule production..

UNIT I: **12**

BASIC TECHNIQUES

Basic techniques and tools: Establishment of plant tissue culture lab: equipment, culture vessels, surface sterilization of various explants, pretreatment of explant, subculture and repeated transfer of explants and cultures.

UNIT II:

TISSUE CULTURE MEDIA **12**

Composition of various tissue culture media and their preparation- Establishment of callus, suspension cultures, organogenesis and embryogenesis,- Meristem tip culture- Hardening of plants.

UNIT III:

TECHNIQUES IN PLANT TISSUE CULTURE **12**

Techniques of anther, embryo and ovule culture- Protoplast isolation, culture and fusion.- Artificial seed (synthetic seed) - Cell line selection using selection pressure- Production of secondary metabolites- Cryopreservation.

UNIT IV:

CELL CULTURES **12**

Isolation and characterisation of nuclei and nucleoli, isolation and functional analysis of mitochondria, chloroplast. Preparation and analysis of genetic material -cell autoradiography, aspetic technique and media preparation of primary cultures, maintenance of secondary culture - cell line propogation -cells in suspension.

UNIT V:

ANALYTICAL TECHNIQUES **12**

Analysis of biosynthesis of cellular components by radioactive labeling of cultured cells. Plant cell structure and organisation of cell groups in tissue system. Mass culture of plant cell suspension, somaclones, mericloning, micropropagation.

REFERENCES:

1. Marchan,D.J (1964) Handbook of Cell and Organ Culture (2nd ed).Burgess Pub.Co., Minneapolis, USA.
2. Shanmugam (2013) Laboratory Manual of Cell Biology,Macmillan, India.
3. Dixon, L.A. and R.A. Gonzales (1995) Plant cell culture – A Practical Approach. Revan Press, New York.
4. Quak, F (1981). Plant Tissue Culture: Methods and Applications in Agriculture. Academic Press, New York.

B. MARINE BIOTECHNOLOGY

Semester: V | Max mark:100(Int:25,Ext:75)
Course code: 18UBT5M1B | Credit: 4
Total Hours: 60 | Exam hrs : 3

OBJECTIVES: The objective of this course is to gain knowledge on marine microbial diversity and its importance. The importance of marine microbes, marine flora, fauna and microbial metabolites is to be made clear.

UNIT I:
INTRODUCTION **18**
Introduction to marine environment;Zonation-Organic Adaptation.

UNIT II:

MARINE FLORA

Phytoplankton, seaweeds, sea grasses and mangroves-their characteristics and identification; Biology.

UNIT III:

MARINE FAUNA **18**

Marine fauna-zooplankton; major marine invertebrates; vertebrates and marine mammals-characteristics and identification, Biology

UNIT IV:
MARINE MICROBES **18**
Marine microbes – Types, classification, methods of culturing and identification; methods of preservation, Cycles of Marine Ecosystem, Leaching and Biofouling.

UNIT V:
MARINE PHARMACOLOGY **18**
Marine pharmacology – Microbial metabolites; Metabolites from marine flora and fauna.

REFERENCES
1. Bhakuni, D.S., Rawat, D.S. (2005). Bioactive Marine Natural Products. Springer.

2. Qubiroga, H.(2006) Marine biodiversity, Springer, 353pp.

3. Attaway, D.H. and Z. Oskar (1993) Marine Biotechnology Vol I. Pharmaceutical and bioactive natural products. Springer publications, Plenum Press, USA. 524pp.

4. Fingerman, M., Nagabhushanam, R and M. Thompson (1998) Recent advances in marine biotechnology. Vol. 2.

C. MOLECULAR MODELING & DRUG DESIGN

Semester: V | Max mark:100(Int:25,Ext:75)
Course code: 18UBT5M1C | Credit: 4
Total Hours: 60 | Exam hrs : 3

OBJECTIVES: The course is designed to make the student learn about the basics of drug design, Processes involved in drug design and the Statistical techniques.

UNIT I
INTRODUCTION
Introduction to drug designing, drug design to discovery and development, drug metabolism, toxicity and pharmacokinetics, toxicology considerations, problems and drawbacks on drug discovery and development. **12**

UNIT II
IDENTIFICATION AND VALIDATION STRATEGIES
Drug Target classification, identification and validation strategies, Design and development of combinatorial libraries for new lead generation

UNIT III **12**
STRUCTURE BASED DRUG DESIGN
Structure-based design – 'de novo' design methodologies 3D-database searching techniques, docking, Ramachandran Plot.

UNIT IV
QSAR
QSAR: Statistical techniques behind QSAR, classical QSAR, molecular descriptors 3D QSAR and COMFA, Pharmacophore Modelling.

UNIT V **12**
MOLECULAR DYNAMICS
Basic principles of molecular modeling, molecular dynamics simulation techniques.

REFERENCES

1. R.Leach (1996) Molecular Modeling Principles and Application, 2nd edition,Longman Publications.
2. D. Baxivanis and Foulette (2001) Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Wiely Indian Edition.
3. T K Attwood, D J parry-Smith (2005)Introduction to Bioinformatics, Pearson Education, 1st Edition, 11th Reprint .

MAJOR BASED ELECTIVE II

A. INDUSTRIAL FERMENTATION TECHNOLOGY

Semester: VI
Course code: 18UBT6M2A
Total Hours: 90

Max mark:100(Int:25,Ext:75)
Credit: 4
Exam hrs : 3

OBJECTIVES: It is to make the student learn about the Industrial Fermentation Processes and the Production of Industrially important Products.

UNIT I
BASICS OF INDUSTRIAL FERMENTATION **18**

Introduction to industrial fermentations: Types of fermentation process – Microbial growth metabolism: Microbial metabolites – screening – strain development, preservation methods – Product development: regulation and safety -use of Process flowcharts and block diagrams.

UNIT II **18**
PRODUCTION OF PRIMARY METABOLITES

Production of primary metabolites: Organic acids fermentation:Citric acid – Acetic acid – Lactic acid – Amino acids:L-glutamic acid – L-lysine – Ltryptophan– Solvents:Acetone-Butanol – Ethanol.

UNIT III
PRODUCTION OF SECONDARY METABOLITES

Antibiotic production: Classification-Carbohydrate containing **18**
antibiotic:Streptomycin – Macro cyclic lactones: Erythromycin – Quiones: Tetracycline – Amino acid containing antibiotic:Penicillin – Peptide antibiotic: Bacitracin – Industrial Enzyme production: α-amylase – Cellulase – Protease – Lipase, Vitamins: Cyanaocobalamin – Riboflavin Fermentation.

UNIT IV
FOOD AND BEVERAGE FERMENTATION **18**

Food fermentations: Cheese – yogurt – sauerkraut – soy sauce- Food flavoring agents: MSG – γ-decalactone – Food preservative: Nisin – Food colorants:*Monascus* pigments fermentation – Production of single cell protein: Bel – symba – pekilo – pruteen processes - Beverages: Brewing process – Wine and Cider production.

UNIT V **18**
PRODUCTION OF COMMERCIAL PRODUCTS

Recombinant protein production: Insulin – interferon – Production of nucleosides and nucleotides: 5’ IMP – 5’ GMP – Enzyme biotransformations: Types- steriod – antibiotic transformations-Biopolymers: Xanthan gum – PHA – PHB – Agrochemicals: *Bacillus thuringenesis* insecticide production.

REFERENCES

1. Yuan Kun Lee (2006) Microbial Biotechnology: Principles and Applications. World Scientific Publishing.

2. Michael J. Waites (2001)Industrial Microbiology: An Introduction. Blackwell Science.

3. Samuel Cate Prescott, Cecil Gordon Dunn, Gerald Reed (1983) Prescott & Dunn's Industrial Microbiology.CBS Publishers.

4. Patel.A.H (1985) Industrial Microbiology. MacMillan Publishers.

5. Ratledge, Colin and Bjorn Kristiansen (2001) Basic Biotechnology" 2nd EdN, Cambridge University Press,.

6. Henry J. Peppler, D. Perlman (1979) Microbial Technology: Microbial processes.Volume I, Academic Press.

7. L.E.Casida JR (1968) Industrial Microbiology", New Age international Publishing.

B. FOOD AND BEVERAGE FERMENTATION TECHNOLOGY

Semester: VI | Max mark:100(Int:25,Ext:75)
Course code: 18UBT6M2B | Credit: 4
Total Hours: 90 | Exam hrs : 3

OBJECTIVES: The objective of the course is to make the student learn about the Food Fermentation and the Preservation techniques.

UNIT I

THE SCIENCE UNDERPINNING FOOD FERMENTATIONS **18**

Microorganisms: microbial metabolism– nutritional needs – environmental impacts – metabolic events – **Fermenters:** Downstream processing – Some general issues for a number of food stuffs.

UNIT II

FOOD PRESERVATION **18**

Preservation by Moist Heat: Heat Resistance of microorganisms and spores – Decimal reduction time (D values) – 12D concept – Thermal Death Time curves – Unit of lethality – determination of process lethality requirements – effective F values – Preservation by low temperature: The behavior of microorganisms under freezing and refrigeration environment – Growth and lethal effects of low temperature treatments on microorganisms in raw and processed foods. Preservation by drying, Chemicals and ionizing irradiation– Pulsed electric field (PEF) method.

UNIT III

TECHNOLOGY OF FERMENTED BEVERAGES **18**

Fermented products: Beer – Kefir-Mead-KVASS-Wine – Distilled alcoholic beverages – Flavoured spirits and sake.

UNIT IV

TECHNOLOGY OF FERMENTED FOOD PRODUCTS **18**

Fermented food products: Vinegar – cheese – yoghurt and other fermented milk products – bread – Meat: sausage, bologna, Fermented vegetables: Sauerkaurt – Kimchi – Soya sauce – Miso Natto.

UNIT V

FOOD SANITATION **18**

Basic principles of food plant sanitation: cleaning chemicals and sanitizers in the food industry – Indicator organism – coliform bacteria – Hazard Analysis and Critical Control Point (HACCP) Program – Good manufacturing Practices(GMP's)and microbiological standards.

REFERENCES

1. Charles W.Bamforth (2005) Food, fermentation and microorganisms.Blackwell
2. Publishing,.
3. Frazier, W.C. and Dennis.D.Westhoff (1978) Food Microbiology", 3rd Edn, Tata McGraw Hill Publishing,.
4. Zeki Berk (2009) Food Process Engineering and Technology.Academic Press,.
5. James.M.Jay, Martin.J.Loessner, David.A. Golden (2005) Modern Food Microbiology", 7th Edn,.
6. Paul SinghR., Dennis R. Heldman (2009) Introduction to Food Engineering", 4th Edn, Academic Press,

C. BIORESOURCE TECHNOLOGY

Semester: VI | Max mark:100(Int:25,Ext:75)
Course code: 18UBT6M2C | Credit: 4
Total Hours: 90 | Exam hrs : 3

OBJECTIVES

The course makes the student understand about about the Energy source, Products and the Bioconversion Technologies.

UNIT I

RENEWABLE ENERGY SOURCE **18**

Hydropower, geothermal power, solar power, wind power – Biofuel -Biomass - Feed stocks (agricultural crops, bioenergy crops, agricultural waste residues, wood residues, waste stream)

UNIT II

FUEL TECHNOLOGY AND BIOCONVERSION **18**

History - Definition of biofuel, applications of biofuel (transport, direct electricity generation, home use and energy content of biofuel) - Bioconversion of lignocellulosics, cellulose saccharification, pretreatment technologies (air separation process, mechanical size reduction, autohydrolysis) - Pulping and bleaching – Enzymatic deinking.

UNIT III

BIOGAS **18**

Biogas plant, feed stock materials, biogas production, factors affecting methane formation - Role of methanogens – Biohydrogen production - Oxygen sensitivity problems in hydrogenenases

UNIT IV

BIO ETHANOL AND BUTANOL **18**

Advantages of ethanol over fossil fuels, production of ethanol from cellulosic materials, ethanol recovery - Biobutanol production, energy content and effects on fuel economy - Octane rating, air fuel ratio, specific energy, viscosity, heat of vaporization -Butanol fuel mixtures

UNIT V

BIODIESEL **18**

Production of biodiesel, oil extraction from algae by chemical solvents, enzymatic, expeller press - Osmotic shock and ultrasonic assisted extraction - Applications of biodiesel, environmental benefits and concerns

REFERENCES

1. Baker, K. H., Herson, S.D (1993) Bioremediation (Advanced Science and Technology) 1st Ed. MGH, New York.
2. Waites, M.J., Organ, N.L.M., Rokeyand, J.S., Higton, G. (2002) Industrial Microbiology – An Introduction 1st Ed, Blackwell Science. Indian edition. New Delhi.
3. Larroche,C., Pandey,A., Dussap, C.G (2006)Current topics on Bioprocess in food Industry, Asiatech publishers Inc, New Delhi.

MAJOR BASED ELECTIVE III

A. METABOLIC BIOTECHNOLOGY

Semester: VI
Course code: 18UBT6M3A
Total Hours:75

Max mark:100(Int:25,Ext:75)
Credit: 4
Exam hrs : 3

OBJECTIVES

The objective of the course is to make the student understand about the Biosynthesis of primary & secondary metabolites, Bioconversion etc and its relevance to Industrial applications.

UNIT I

INTRODUCTION **15**

Induction-jacob monod model, catabolite regulation, glucose effect, camp deficiency, feed back regulation, regulation in branched pathways, differential regulation by isoenzymes, concerted feed back regulation, cumulative feed back regulation, amino acid regulation of RNA synthesis, energy charge, regulation, premeability control passive diffusion, active transport group transportation.

UNIT II

SYNTHESIS OF PRIMARY METABOLITES **15**

Alteration of feed back regulation, limiting accumulation of end products, feedback, resistant mutants, alteration of permeability, metabolites.

UNIT III

BIOSYNTHESIS OF SECONDARY METABOLITES **15**

Precursor effects, prophophase, idiophase relationship, enzyme induction, feedback regulation, catabolite regulation by passing control of secondary metabolism, producers of secondary metabolites.

UNIT IV BIOCONVERSIONS **15**

Advantages of bioconversions, specificity, yields, factors important to bioconversion, regulation of enzyme synthesis, mutation, permeability, co-metabolism, avoidance of product inhibition, mixed or seqencial bioconversions, conversion of insoluble substances.

UNIT V

REGULATION OF ENZYME PRODUCTION 10 **15**

Strain selection, improving fermentation, recognising growth cycle peak, induction, feed back repression, catabolite repression, mutants resistant to repression, gene dosage.

REFERENCE

1. Wang D.I.C., Cooney C.L., Demain A.L., Dunnil.P., Humphery A.E., Lilly M.D (1980) Fermentation And Enzyme Technology.John Wiley And Sons.,
2. Stanbury P.F and Whitaker A (1984) Principles Of Fermention Technology", Pergamon Press,.

B. PHARMACEUTICAL BIOTECHNOLOGY

Semester: VI | Max mark:100(Int:25,Ext:75)
Course code: 18UBT6M3B | Credit: 4
Total Hours:75 | Exam hrs : 3

OBJECTIVES

The objective of the course is to make the student understand about the Pharmaceutical Industrial Processes and the Products and its application.

UNIT I

INTRODUCTION **15**

History of the Pharmaceutical Industry – Current Status and Future Prospects of biopharmaceuticals – Drug Discovery – Drug Development – Pharmaceuticals of Animal, Plant and Microbial Origin – Sources of Biopharmaceuticals

UNIT II

THERAPEUTIC PROTEINS: GROWTH FACTORS, HORMONES AND CYTOKINES **15**

Bioactivity of Expressed Proteins – Synthesis and Secretion of Recombinant Proteins – Xenotransplantation – Discovery, Biological Roles and Properties of Naturally produced Hormones: Insulin, Erythropoietin, Somatotropin and Interferons - Development of Recombinant Human Insulin, Erythropoietin, Growth Hormone and Interferons

UNIT III

RECOMBINANT BLOOD PRODUCTS, THERAPEUTIC ENZYMES, VACCINES AND ANTIBODIES **15**

Introduction – Haemostasis: Coagulation Pathway, Clotting Disorders and Blood-clotting Factors – Anticoagulants: Hirudin and antithrombin – Thrombolytic agents: Tissue Plasminogen Activator, Streptokinase, Urokinase and Albumin – Therapeutic Enzymes: Asparaginase, Urate Oxidase and Superoxide Dismutase – Vaccines: Traditional Vaccine Preparations, Recombinant Vaccines and Peptide Vaccines – Adjuvant Technology – Polyclonal and Monoclonal antibodies

UNIT IV

NUCLEIC ACID- AND CELL-BASED THERAPEUTICS **15**

Introduction - Basic approach to gene therapy - Retroviral, Adenoviral and non-Viral Vectors – Gene Therapy and Genetic Disease – Gene Therapy and Cancer – Gene-based Vaccines – Antisense Technology – Cell and Tissue-based Therapies: Stem Cells and Adult Stem Cells.

UNIT V

PRODUCT ANALYSIS **15**

Introduction – Protein based Contaminants – Product Potency and Determination of Protein Concentration – Detection of Protein based Impurities – Immunological Approaches to Detection of Contaminants – Endotoxin and Other Pyrogenic Contaminants – Viral Assays – Miscellaneous Contaminants

REFERENCES

1. Gary W (2007) Pharmaceutical Biotechnology: Concepts and Applications, John Wiley & Sons Ltd., Sussex, England,.
2. .S. Purohit, H.N. Kakrani and A.K. Saluja (2006) Pharmaceutical Biotechnology, Jodhpur, India.
3. Kayser, O. and Müller R. H (2004) Pharmaceutical Biotechnology: Drug Discovery and Clinical Applications Wiley-VCH.
4. Dutton, R. and Scharer, J (2007) Advanced Technologies in Biopharmaceutical Processing, Blackwell Publishing.

C. BIO CONJUGATE TECHNOLOGY AND APPLICATIONS

Semester: VI | Max mark:100(Int:25,Ext:75)
Course code: 18UBT6M3C | Credit: 4
Total Hours:75 | Exam hrs : 3

OBJECTIVES

The course is designed to make the student learn about enzymes, nucleic acids and target specificity. Student also gets familiarized with the industrial applications of this technology.

UNIT I

FUNCTIONAL TARGETS **15**

Modification of Amino Acids, Peptides and Proteins – Modification of sugars, polysaccharides and glycoconjugates – modification of nucleic acids and oligonucleotides.

UNIT II

CHEMISTRY OF ACTIVE GROUPS **15**

Amine reactive chemical reactions – Thiol reactive chemical reactions – carboxylate reactive chemical reactions – hydroxyl reactive chemical reactions – aldehyde and ketone reactive chemical reactions – Photoreactive chemical reactions.

UNIT III

BIOCONJUGATE REAGENTS **15**

Zero length cross linkers – Homobifunctional cross linkers – Heterobifunctional cross linkers – Trifunctional cross linkers – Cleavable reagent systems – tags and probes.

UNIT IV

ENZYME AND NUCLEIC ACID MODIFICATION AND CONJUGATION **15**

Properties of common enzymes – Activated enzymes for conjugation – biotinylated enzymes – chemical modification of nucleic acids – Biotin labeling of DNA- Enzyme conjugation to DNA – Fluorescent of DNA.

UNIT V

BIOCONJUGATE APLICATIONS **15**

Preparation of Hapten-carrier Immunogen conjugates - Antibody modification and conjugation – immunotoxin conjugation techniques – liposome conjugated and derivatives- Colloidal – gold labeled proteins – modification with synthetic polymers.

REFERENCES

1. G.T. Hermanson (1999) Bioconjugate Techniques, Academic Press.

NON MAJOR ELECTIVE I

BASICS OF BIOTECHNOLOGY

Semester: III | Max mark:100(Int:25,Ext:75)
Course code: 18UBT3N1A | Credit: 2
Total Hours: 30 | Exam hrs : 3

OBJECTIVES

This course provides an understanding of biotechnology, carefully blending science, consumer applications, regulatory information. A comprehensive overview of the basic science underlying the principles of biotechnology is also explained.

UNIT 1
INTRODUCTION **6**

Historical perspective on Science, technology, and society-Advancement of mankind due to science and its relevance in present day living conditions.

UNIT II **6**
BASIC CONCEPTS ABOUT CELL

Cell: basic unit of life-Molecular components of cell-Expression of genetic information-Protein structure and function-Cell metabolism-Cells maintain their internal environments-Cells respond to external environments-Cells grow, reproduce, and differentiate

UNIT III
ORGANISMS TO ECOSYSTEMS **6**

Patterns of Genetic Inheritance--From Genotype to Phenotype-Evolutionary Mechanisms Ecological Interactions

UNIT IV **6**
BIOTECHNOLOGY-APPLICATIONS AND ISSUES

Basic concepts about biotechnology-Research applications-Biotechnology toolbox Biotechnology in the research laboratory

UNIT V **6**
COMMERCIAL APPLICATIONS OF BIOTECHNOLOGY

Moving Science from the Laboratory into Society-Risks and Regulations -Health Care Applications -Medical Biotechnology in Society - Biotechnology in the Food Industry-Ecology and Evolution in Agriculture-Biotechnology and Sustainable Agriculture-Environmental Sustainability and Biotechnology

REFERENCES

1. Helen Kreuzer and Adrianne Massey (2005) Biology and Biotechnology: Science, Applications, and Issues , ASM Press.

B. HEALTHCARE BIOTECHNOLOGY

Semester: III | Max mark:100(Int:25,Ext:75)
Course code: 18UBT3N1B | Credit: 2
Total Hours: 30 | Exam hrs : 3

OBJECTIVES

The course is designed to make the student learn about the therapeutic agents such as Proteins, Enzymes, Hormones and its application. They also get the knowledge about the Production of vaccines and the Gene therapy techniques.

UNIT I

SIMPLE PROTEINS AND THERAPEUTIC AGENTS **6**

Proteins as therapeutic agents - Choice of expression systems and optimizing gene expression - Applications, delivery and targeting of therapeutic proteins – Regulatory aspects of therapeutic proteins

UNIT II

HORMONES, RECOMBINANT BLOOD PRODUCTS &ENZYMES AS THERAPEUTIC AGENTS **6**

Insulin, Glucagon, Human growth hormones - Gonadotrophins - Haemostasis –Anticoagulants - Thrombolytic agents - Enzymes of therapeutic value - Asparaginase - Dnase–Glucocerebrosidase – Galactosidase - Urate oxidase – Laronidase - Superoxide dismutase -Debriding agents Digestive aids

UNIT III

MONOCLONAL ANTIBODIES & VACCINES **6**

Introduction to monoclonal antibodies - Development of monoclonal antibodies – Expression of antibody molecules - Purification of monoclonal antibodies - Clinical uses of monoclonal antibodies - Hybrid human - Mouse antibodies - Production of recombinant monoclonal antibodies, Bacterial polysaccharides, proteins and toxins as vaccines – Recombinant vaccines-subunit, attenuated and vector vaccines - Multivalent vaccine development against AIDS

UNIT IV **6**

CYTOKINES & GENE THERAPY

Interferons- Engineering human interferons -Tumour necrosis factor – interleukins Haemopoietic growth factors - Gene therapy – in search of the perfect disease - Gene therapy – the real diseases - Delivery systems for gene therapy - Gene therapy in the clinic

UNIT V

PEPTIDES & ANTISENSE OLIGONUCLEOTIDES **6**

The nervous system- Immune responses to peptides - Neurological diseases - The use of peptides in the treatment of neurological disease -The science of antisense - Requirements of a genetic drug- Mechanisms of action of antisense molecules - Animal models and oligonucleotides-Clinical trials- towards the next generation of antisense drugs

REFERENCES

1. Ratledge, C., Kristiansen, B (2001) Basic Biotechnology 2nd Ed. Cambridge University Press, USA.
2. Walsh, G (2007) Pharmaceutical Biotechnology: Concepts and Applications, John Wiley & Sons, England.

C. PROCESS INSTRUMENTATION DYNAMICS AND CONTROL

Semester: III | Max mark:100(Int:25,Ext:75)
Course code: 18UBT3N1C | Credit: 2
Total Hours: 30 | Exam hrs : 3

OBJECTIVES

The students gains the knowledge in designing a control system and identifying the alternative control configuration for a given process plant or entire plant.

UNIT I **6**

Laplace transformation, transform of standard functions, derivatives and integrals, inversion, theorems in Laplace transformation, application .Open-loop systems, first order systems and their transient response for standard input functions, first order systems in series, linearization and its application in process control, second order systems and their dynamics, transfer function for chemical reactors and dynamics.

UNIT II **6**

Closed loop control systems, development of block diagram for feed-back control systems, servo and regulator problems, Transfer function for controllers and final control element, principles of pneumatic and electronic controllers, transportation lag, transient response of closed-loop control systems and their stability.

UNIT III **6**

Introduction to frequency response of closed-loop systems, control system design by frequency, Bode diagram, stability criterion, Nyquist diagram; Tuning of controller settings.

UNIT IV **6**

Controller mechanism ,introduction to advanced control systems, cascade control, feed forward control, control of distillation towers and heat exchangers, introduction to microprocessors and computer control of chemical processes.

UNIT V **6**

Principles of measurements and classification of process control instruments, measurements of temperature, pressure, fluid flow, liquid weight and weight flow rate, viscosity and consistency, pH, concentration, electrical and thermal conductivity, humidity of gases, composition by physical and chemical properties and spectroscopy.

REFERENCES

1. Coughnowr and Koppel (1986) Process Systems Analysis and Control. McGraw-Hill, New York.

NON MAJOR ELECTIVE II

A. AGRICULTURAL BIOTECHNOLOGY

Semester: IV | Max mark:100(Int:25,Ext:75)
Course code: 18UBT4N2A | Credit: 2
Total Hours: 30 | Exam hrs : 3

OBJECTIVES: This course is designed to provide an idea about the basic principles and techniques involved in plant tissue culture and to understand the concepts of crop improvement and achievements of biotechnology in Agricultural sector.

UNIT I:

CONVENTIONAL CROP IMPROVEMENT **6**

Crop improvement – Selection, mutation, polyploidy and clonal selection; Advantages of biotechnological methods over conventional methods of crop improvement.

UNIT II:

PLANT TISSUE CULTURE **6**

Basic techniques and tools in Plant Tissue Culture.Establishment of plant tissue culture lab: equipment, culture vessels,surface sterilization of various explants, pretreatment of explant, subculture and repeated transfer of explants and cultures.Composition of various tissue culture mediaand their preparation. Establishment of callus, suspension cultures, organogenesis and embryogenesis, Meristem tip culture, Hardening of plants, Techniques of anther, embryo and ovule culture.Protoplast isolation, culture and fusion. Artificial seed (synthetic seed)

UNIT III:

PLANTS AS BIOREACTORS **6**

Use of bioreactors in plant production & Scale-up Marker assisted selection – introduction to markers (RFLP, AFLP, microsatellites, RAPD, QTL), generation of maps using markers, case studies of MAS, virus indexing.

UNIT IV:

TRANSGENICS IN CROP IMPROVEMENT **6**

Genetic engineering in plants, Genetic engineering of plants for pest resistance, Herbicide resistance. Resistance to fungi and Bacteria, Delay of fruit ripenning. Regulation of gene expression in plant development. Plant hormones and phytohormone. Seed storage proteins.

UNIT V:

HERBAL AND NURSERY TECHNOLOGY **6**

Economic value of herbals and herbal drugs. Identification, cultivation and micropropagation of herbals, biotechnological exploitation. Vegetative cuttings – selection of cuttings, collection season, treatment of cuttings, rooting medium- planting of cuttings. Hardening of plants – Green houses – mist chamber, shed root, shade house and glass home.

REFERENCES

1. Hou CT, Shaw JF (2009) – Biocatalysis and agricultural biotechnology, CRC Press, USA
2. Raw at H (2008) Agricultural biotechnology, 1st Ed. Oxford Book Co, India.
3. Kumar HD (2005) Agricultural biotechnology Daya Publ House, India
4. Newbury HJ (2009) Plant molecular breeding , John Wiley and Sons., USA.
5. S.S. Bhojwani and S.P. Bhatnagar (2009) Embryology of Angiosperms, Vikas Publ House, India.
6. Ashwani Kumar, Shekhawat NS (2009) – Plant tissue culture and molecular markers: theor role in improving crop productivity (IK International)
7. H K Das (2010), Biotechnology 4th Ed , Wiley India Pvt. Limited, India.

B. SOLID WASTE MANAGEMENT

Semester: IV | Max mark:100(Int:25,Ext:75)
Course code: 18UBT4N2B | Credit: 2
Total Hours: 30 | Exam hrs : 3

OBJECTIVES: This course provides idea about the sources of solid wastes and the technologies used to manipulate them and the Process involved for their storage.

UNIT I
SOURCES AND TYPES OF MUNICIPAL SOLID WASTES **6**
Sources and types of solid wastes - Quantity - Factors affecting generation of solid wastes; characteristics - methods of sampling and characterization; Effects of improper disposal of solid wastes - public health effects

UNIT II
ON-SITE STORAGE AND PROCESSING **6**
On-site storage methods - Materials used for containers - on-site segregation of solid wastes - public health and economic aspects of storage - options under Indian conditions – Critical Evaluation of Options

UNIT III
COLLECTION AND TRANSFER **6**
Methods of Collection - types of vehicles - Manpower requirement - collection routes; transfer stations - selection of location, operation and maintenance; options under Indian conditions

UNIT IV
OFF-SITE PROCESSING **6**
Processing techniques and Equipment; Resource recovery from solid wastes - composting, incineration, Pyrolysis - options under Indian conditions

UNIT V
DISPOSAL **6**
Dumping of solid waste; sanitary land fills - site selection, design and operation of sanitary landfills - Leachate collection and treatment. Principle of solid waste management – social and economic aspects; Public awareness; Role of NGOs; Legislation

REFERENCES

1. Hilary Theisen and Samuel A (1993) George Tchobanoglous, Vigil Integrated Solid Waste Management, McGraw-Hill Publishers.
2. Manual on Municipal Solid Waste Management (2000) CPHEEO, Ministry of Urban Development, Government of India, New Delhi.
3. R.E.Landreth and P.A.Rebers (1997) Municipal Solid Wastes - problems and Solutions, Lewis Publishers.
4. Bhide A.D and Sundaresan B.B (1993) Solid Waste Management in Developing Countries, INSDOC.

C. INDUSTRIAL WASTEWATER MANAGEMENT

Semester: IV | Max mark:100(Int:25,Ext:75)
Course code: 18UBT4N2C | Credit: 2
Total Hours: 30 | Exam hrs :3

OBJECTIVES: The course is designed to impart knowledge on sources and characteristics of various industrial wastes and strategies for its prevention and control

UNIT I
INTRODUCTION **6**

Industrial scenario in India- Industrial activity and Environment - Uses of Water by industry - Sources and types of industrial wastewater - Industrial wastewater and environmental impacts - Regulatory requirements for treatment of industrial wastewater - Industrial waste survey - Industrial wastewater generation rates, characterization and variables – Population equivalent - Toxicity of industrial effluents and Bioassay tests

UNIT II
INDUSTRIAL POLLUTION PREVENTION **6**

Prevention Vs Control of Industrial Pollution - Benefits and Barriers - Source reduction techniques - Waste Audit - Evaluation of Pollution prevention options – Environmental statement as a tool for pollution prevention - Waste minimization Circles

UNIT III **6**
INDUSTRIAL WASTEWATER TREATMENT

Equalisation - Neutralisation - Oil separation - Flotation - Precipitation - Heavy metal Removal - Refractory organics separation by adsorption - Aerobic and anaerobic biological treatment - Sequencing batch reactors - High Rate reactors – Chemical oxidation – Ozonation Photocatalysis - Wet Air Oxidation - Evaporation - Ion Exchange – Membrane Technologies - Nutrient removal

UNIT IV
WASTEWATER REUSE AND RESIDUAL MANAGEMENT **6**

Individual and Common Effluent Treatment Plants - Joint treatment of industrial wastewater Zero effluent discharge systems – Quality requirements for Wastewater reuse – Industrial reuse - Disposal on water and land - Residuals of industrial wastewater treatment - Quantification and characteristics of Sludge - Thickening, digestion, conditioning, dewatering and disposal of sludge - Management of RO rejects

UNIT V
CASE STUDIES **6**

Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for Textiles - Tanneries - Pulp and paper – metal finishing- Petroleum Refining - Pharmaceuticals - Sugar and Distilleries - Food Processing - fertilizers - Thermal Power Plants and Industrial Estates

REFERENCES

1. Eckenfelder W.W (1999)Industrial Water Pollution Control, McGraw-Hill,

2. Arceivala, S.J., Wastewater (1998) Treatment for Pollution Control, Tata McGraw-Hill,

3. Frank Woodard (2001) Industrial waste treatment Handbook, Butterworth Heinemann, New Delhi.

4. Paul L (2000) Bishop Pollution Prevention: - Fundamentals and Practice, McGraw-Hill International

SKILL BASED ELECTIVE I
A. ETHNOMEDICINE

Semester: V | Max mark:100(Int:25,Ext:75)
Course code: 18UBT5S1A | Credit: 2
Total Hours: 30 | Exam hrs : 3

OBJECTIVES

The course is designed to make the students gain the knowledge about the traditional plants present in our society and their importance

UNIT I **6**

ETHNOMEDICINE

Definition, history and its scope –Inter disciplinary approaches in ethnobotany – Collection of ethnic information.

UNIT II **6**

IMPORTANCE OF MEDICINAL PLANTS

Role in human health care – health and balanced diet (Role of proteins, carbohydrates, lipids and vitamins).

UNIT III **6**

TRIBAL MEDICINE

Methods of disease diagnosis and treatment – Plants in folk religion – *Aegle marmelos, Ficus benghalensis, Curcuma domestica, Cyanodon dactylon and Sesamum indicum.*

UNIT IV

MEDICINAL PLANTS OF TAMIL NADU **6**

Traditional knowledge and utility of some medicinal plants in Tamilnadu – *Solanum trilobatum, Cardiospermum halicacabum, Vitex negundo, Adathoda vasica, Azadirachta indica, Gloriosa superba, Eclipta alba, Aristolochia indica, Phyllanthus fraternus* and *Boerhaavia diffusa.*

UNIT V

PLANTS IN DAY TODAY LIFE **6**

Ocimum sanctum, Centella asiatica, Solanum trilobatum, Cassia auriculata, Aloe vera. Nutritive and medicinal value of some fruits (Guava, Sapota, Orange, Mango, Banana, Lemon, Pomegranate) and vegetables - Greens (*Moringa, Solanum nigrum*) Cabbage.

REFERENCE:

1. R.K.Sinha & Shweta Sinha (2001). Ethnobiology .Surabhe Publications – Jaipur.

2. D.C. Pal & S.K. Jain (1998), Tribal medicine –Naya Prakash, Bidhan Sarani.

3. S.K. Jain (1995) Contribution to Indian Ethnobotany –3rdEd, Scientific publishers, P.B.No.91, Jodhpur, India.

B. PHYTOCHEMICAL TECHNIQUES

Semester: V | Max mark:100(Int:25,Ext:75)
Course code: 18UBT5S1B | Credit: 2
Total Hours: 30 | Exam hrs : 3

OBJECTIVES

The main objective is to make the learner explore the structural complexity and diversity of pharmaceutically relevant plant metabolites. A overview of different classes of metabolites present in plants is also presented.

UNIT I

OVERVIEW OF PLANT SECONDARY METABOLITES 6

Drugs from plants - Insecticides and rodenticides- Industrially important Plant products Essential oils, Fatty oils & waxes, Fibers & Fiber Plants, Forest Products: ood and cork, Forest Resources, Gums & Resins, Rubber and Other Latex Products, Tanning, Dye & Processing Materials.

UNIT II

METABOLITES DERIVED FROM THE SHIKMATE CHORISMATE PATHWAY 6

Plant acids, fatty acids and lipids, alkanes and related hydrocarbons, polyacetylenes, sulphur compounds, Nitrogen compounds-amino acids, amines, alkaloids, cyanogenic glycosides, inoles, purines, pyrimidines and cytokinins, chlorophylls.

UNIT III

METABOLITES DERIVED FROM THE MALONIC AND MEVALONIC ACID PATHWAYS 6

Phenols and phenolic acids, phenylpropanoids, flavonoid pigments, anthocyanins, flavaonols and flavones, tanins, quinines, essential oils, diterpenoids and gibberellins, triterpenoids, steroids and catotenoids.

UNIT IV

CONVENTIONAL METHODS IN PLANT ANALYSES 6

Introduction- selection of plants and plant parts - methods of extraction and isolation, methods of separation, methods of identification, analysis of results and application

UNIT V

ADVANCES IN PLANT ANALYTICAL TECHNIQUES 6

GC - HPLC- HPTLC-OPLC – NMR-MS Microarray- RT PCR- RNA SEQ – fluorescence and confocal microscopy - CHN analysis - X ray crystallography

REFERENCES

1. Harbone J. B (2005) Phytochemical Method A guide to modern techniques of plant analysis.
1. Sarker, S. D., Latif, Z. and Gray,A.I (2006) Methods in Biotechnology –Natural Product Isolation" Second Edition, Humana Press
2. Raman N (2006) Phytochemical Techniques. New India Publishing agency .

C. HERBS AND DRUG ACTION

Semester: V | Max mark:100(Int:25,Ext:75)
Course code: 18UBT5S1C | Credit: 2
Total Hours: 30 | Exam hrs : 3

OBJECTIVES

The main objective of the course is to study about the medicinal Plants and its action. The student will understand about the action o Drugs to combat various diseases.

UNIT I
INTRODUCTION 6

Terminologies – Definitions – Classification of medicinal plants based on their effects with special reference to India.

UNIT II
ALLERGENS 6

Types – sources – active principles – Chemical nature – Cell modifiers – Lectins – mutagens, teratogens – Allergic reactions with known examples.

UNIT III
DRUGS FOR NEW AND PSYCOLOGICAL DISORDERS 6

Drugs acting on brain and nervous system – Rheumatic arthritis – Psychoactive drugs – Depressants, Stimulants, hallucinogens – sources, effects, basic mechanism of action.

UNIT IV
DRUGS FOR COMMON DISEASE 6

Cardiovascular diseases – blood pressure – cardiac drugs of plant origins – alkaloids, anticoagulants – basic mechanism of action. Pulmonary / respiratory disorders – asthma – bronchitis – common cold – allergy – Remedy from plants.

UNIT V
DRUGS FOR URINOGENITAL DISORDERS 6

Roots of Withania somnifera – Memory stimulants – Centella asiatica – Drugs for dissolving kidney stones – Musa paradisica (pseudostem) – Antiinflammatory drugs – Cardiospermum – Anticancer drugs – Catharanthus roseus.

REFERENCES

1. Kumar, N.C (1993) An Introduction to Medical botany and Pharmacognosy. Emkay Publications, New Delhi.
2. Rao, A.P (1999) Herbs that heal. Diamond Pocket Books (P) Ltd., New Delhi,

SKILL BASED ELECTIVE II

A. PHARMACOGNOSY

Semester: V | Max mark:100(Int:25,Ext:75)
Course code: 18UBT5S2A | Credit: 2
Total Hours: 30 | Exam hrs : 3

OBJECTIVES

The course provides basic concepts related to discovery and physiological effects of plant growth regulators. It impart an understanding of control of various physiological and developmental mechanisms by hormones.

UNIT I

INTRODUCTION 6

History, Definition and scope of pharmacognosy; Systems of Indian Medicines – Siddha, Unani, Ayurveda, Homeopathy; Terminologies.

UNIT II

CLASSIFICATION OF CRUDE DRUGS 6

Taxonomical, Morphological, Pharmacological and chemical classifications; Chemistry of drugs and its evaluation.

UNIT III

PREPARATION OF CRUDE AND COMMERCIAL DRUGS 6

Making infusion, decoction, lotion, washers, insect repellents, suppositories, tincture, making herbal syrups, compresses, poultice, plasters, oinments, herbal oils and herbal salves. Surgical fibres, sutures and dressing.

UNIT IV

ORGANOLEPTIC STUDY **6**

Fruit – Amla, Bulb – Garlic, Rhizome – Ginger, seed – castor, Bark – Cinchona, Leaves – Neem, Flower – Clove.

UNIT V

ANALYTICAL PHARMACOGNOSY **6**

Drug adultration and detection. Biological testing of herbal drug. Phytochemical investigations with reference to secondary metabolites of locally available medicinal plants.

REFERENCES

1. S.B.Gokhale, Dr.C.K. Kokate, A.P. Purohit (2002) Pharmacognosy, Publisher: Nirali Prakasham, Pune.
2. N.C. Kumar (2004) An Introduction to Medicinal Botany and Pharmacognosy –, Emkay Publications, New Delhi.

B. PLANT HORMONES AND SIGNAL TRANSDUCTION

Semester: V | Max mark:100(Int:25,Ext:75)
Course code: 18UBT5S2B | Credit: 2
Total Hours: 30 | Exam hrs : 3

OBJECTIVES

To introduce basic concepts related to discovery and physiological effects of plant growth regulators. To impart an understanding of control of various physiological and developmental mechanisms by hormones. To give an insight into the cellular and molecular modes of action of phytohormones.

UNIT I

AUXINS **6**

Introduction – The emergence of the auxin concept, biosynthesis and metabolism of auxin, auxin transport, physiological effects of auxin, developmental effects of auxin – auxin receptors and signal transduction pathways of auxin.

UNIT II

GIBBERELLINS **6**

The discovery of the gibberellins, effects of gibberellin on growth and development, Biosynthesis and metabolism of gibberellin, physiological mechanisms of gibberellin-induced growth, signal transduction -cereal aleuronic layers.

UNIT III

CYTOKININS **6**

The discovery, identification and properties, Biosynthesis, metabolism and transport of cytokinins, biological roles of cytokinins, cellular and molecular modes of cytokinin action

UNIT IV

ETHYLENE **6**

Structure, biosynthesis and measurement of ethylene, developmental and physiological effects, cellular and molecular modes of ethylene action- Ethylene receptors

UNIT V - ABSCISIC ACID **6**

Occurrence, chemical structure and measurement of ABA, developmental and physiological effects of ABA, ABA Receptors - cellular and molecular modes of ABA action

REFERENCES

1. Lincoln Taiz and Eduardo Zeiger (2003) Plant Physiology. Third edition. Panima Publishing corporation.
2. Davies, P. J (2010) Plant Hormones - Biosynthesis, Signal Transduction, Action", Springer.
3. Perrot-Rechenmann, C. and Hagen, G (2002) Auxin Molecular Biology. Springer.

C. BIOBUSINESS

Semester: V | Max mark:100(Int:25,Ext:75)
Course code: 18UBT5S2C | Credit: 2
Total Hours: 30 | Exam hrs : 3

OBJECTIVES

The course is designed to develop knowledge and skills to master the future challenges of the biotechnology industries. It is designed to understand the Life Cycle Process of Biotech R&D and Marketing.

UNIT I

BIOTECHNOLOGY BUSINESS MANAGEMENT 6

Principles & Practices of Management & Communication Skills.Basics of Biotechnology and Bioinformatics – Business, Marketing, Materials, & Logistics Management.Biotechnology plant, Project & Production management. Intellectual property rights & technology transfer Innovation & knowledge management.

UNIT II

BIOTECHNOLOGY INDUSTRY & BUSINESS MANAGEMENT 6

Antibody Technologies; Antisense & RNAi Technology ; Biologics ; Biomarkers ; Biomaterials; Cell Culture ; DNA Sequencing ; Drug Development ; Emerging Technology ; Enzymes ; Gene Therapy ; Genetic Engineering ; Genomics ; Informatics ; Instrumentation & Equipment Microarray ; Molecular Biology ; Nanomedicine ; Personalized Medicine ; Proteomics ; Regenerative Medicine ; Stem Cell ; Tissue Engineering.

UNIT III

PHARMACEUTICAL BUSINESS INDUSTRY & MANAGEMENT 6

Pharmaceutical Industry: Issues, Structure & Dynamics; Legal, Regulatory, and Ethical Issues in the Pharmaceutical Industry; U.S Healthcare System & Pharmaceutical Managed Markets. Pharmaceutical Marketing: Pharmaceutical Marketing Research; Pharmaceutical Product Management; Managing the Pharmaceutical Sales Organization

UNIT IV 6

AGRICULTURE BUSINESS MANAGEMENT

Management of Agricultural Input Marketing; Fertilizer Technology & Management; Management of Agro Chemical Industry; Management of Agro Chemical Industry; Seed Production Technology & Management; Case studies : Banana; sugarcane, wheat, rice etc., Transgenic Seeds/Crops (Soybean, Corn, Cotton, & Others (Includes Canola, Wheat, Rice, and Potato among Others), and Biopesticides.

UNIT V

HEALTH CARE BUSINESS MANAGEMENT 6

Economics of Health Care and Policy, Managed Care and Market Structure, Financial Management of Health Institutions, Health Policy, Health Services Delivery: A Managerial Economic Approach, Legal Aspects of Health Care, Management of Care for the Elderly, Health Care Marketing, Comparative Health Care Systems, E-Health: Business Models and Impact, Health Care Entrepreneurship.

REFERENCES

1. Mark J. Ahn, Michael A. Alvarez, Arlen D. Meyers, Anne S York (2011) Building the Case for Biotechnology.
2. Peter Kolchensky (2011) The Entrepreneurship Guide to a Biotech startup", Evelexa,
3. Maureen D. MacKelvey, Luigi Orsenigo (2001) The Economics of Biotechnology" Edward Elgar Pub.
4. Steven B. Kayne (2005) Pharmacy Business Management" ,Pharmaceutical Press.
5. Damian Hine, John Kapeleris (2008) Innovation and Entrepreneurship in Biotechnology", Concepts, Theories and Case", Edward Elgar Publishing..
6. Yali Friedman (2008) Best practices in biotechnology business Development",Logos Press.