SRI KALISWARI COLLEGE, SIVAKASI

(An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai and Re- accredited with 'A' Grade (CGPA 3.30) by NAAC)

Programme Scheme, Scheme of Examinations and Syllabi

(with effect from June 2015)

Department of Biotechnology

(UG, PG and M.Phil Programmes)

Programme Outcome (PO) for Undergraduate Programme

Knowledge

PO 1: Well grounded knowledge in chosen subjects.

PO 2: Updated knowledge related to the subjects.

Skills

PO 1: Acquisition of cognitive skills

PO 2: Acquisition of Life Skills for Employment.

Attitude

PO 1: Holistic Personality Development through Self-directed and lifelong learning.

PO 2: Eco Sensitivity, inclusive culture, moral uprightless and social commitment.

Programme Specific Outcome (PSO) for Undergraduate Programme

Knowledge: Core course of Biotechnology to improve their knowledge and understating of the subject.

Skill Development: Practical training in all aspects of biotechnology.

Higher level ability: Technical skills like Plasmid DNA isolation, Isolation of bacteriophage&Phage titration, Preparation of serum, ELISA, Western blotting, Agarose Gel Electrophoresis, PCR develop higher level ability.

Progression to higher studies: Indepth knowledge on Cell biology, Genetics, Biochemistry, Microbiology, Molecular biology, Immunology, Animal Biotechnology, rDNA technology, Plant biotechnology learned three years equip students to go for higher studies.

Entrepreneurship and Employment: Knowledge on Isolation of microorganisms, Staining techniques, Biochemical tests, Analysis of food samples, Isolation of microorganism, Detection of Coliform bacteria, Preparation of plant tissue culture media, Micropropagation helps to develop in to Entrepreuner & get gainful employment.

SRI KALISWARI COLLEGE (AUTONOMOUS) – SIVAKASI
DEPARTMENT OF BIOTECHNOLOGY
Choice Based Credit System-Curriculum Pattern
UG Programme-B.Sc., Biotechnology-2015-2018

Part	Course code	Course Name	Hours	Credits
Semester I				
I	15UTAL11	Tamil/Hindi/French -I	6	3
II	15UENL11	General English-I	6	3
III	15UBTC11	**Core I:** Cell Biology	4	4
	15UBTC1P	**Core II:** Lab in Cell Biology & Genetics	4	3
	15UBTA11	**Allied Course-I:** Chemistry-I	4	3
		Allied Course-I: Lab in Anc.Chemistry-I	2	-
IV	15UBTN11	**Non Major Elective course-I**: Human Diseases - Communicable Diseases	2	1
	15UBTE11	**Enrichment course -I:** Fundamentals of Genetics	2	1
		Total	**30**	**18**
Semester II				
I	15UTAL21	Tamil/Hindi/French-II	6	3
II	15UENL21	General English-II	6	3
III	15UBTC21	**Core III :** Biochemistry	4	4
	15UBTC2P	**Core IV :** Lab in Biochemistry	4	3
	15UBTA21	**Allied Course-II:** Chemistry-II	4	3
	15UBTA2P	**Allied Course-II:** Lab in Anc.Chemistry	2	2+2
IV	15UBTN21	**Non Major Elective course-II:** Human Diseases – Non Communicable Diseases	2	1
	15UBTE21	**Enrichment course-II:** Basic concepts of Biotechnology	2	1
		Total	**30**	**22**
Semester III				
I	15UTAL31	Tamil/Hindi/French-III	6	3
II	15UENL31	General English-III	6	3
III	15UBTC31	**Core V:** Microbiology	4	4
	15UBTC3P	**Core VI:** Lab in Microbiology	4	3
	15UBTA31	**Allied Course-III** : Biological Sciences	4	3
	15UBTA3P	**Allied Course-III:** Lab in Biological Sciences	2	2
IV	15UBTS31	**Skill Based Course-I:** Human Physiology	2	2
	15UBTV31	**Value Based course- I:** Medicinal Plants	2	2

		Total	**30**	**22**
Semester IV				
I	15UTAL41	Tamil/Hindi/French-IV	6	3
II	15UENL41	General English-IV	6	3
III	15UBTC41	**Core VII:** Molecular Biology &Molecular Genetics	4	4
	15UBTC4P	**Core VIII :** Lab in Molecular Biology &Molecular Genetics	4	3
	15UBTA41	**Allied Course-IV:** Food Biotechnology	4	3
	15UBTA4P	**Allied Course-IV:** Lab in Food Biotechnology	2	2
		Optional/Elective		
	15UBTO41	**Course-I:** 1.Biostatistics	4	3
	15UBTO42	2. Fundamentals of Drug Designing		
		Extension		1
		Total	**30**	**22**
Semester V				
III	15UBTC51	**Core IX**: Immunology &Immunotechnology	5	5
	15UBTC52	**Core X:** Industrial Biotechnology	5	5
	15UBTC53	**Core XI:** Animal Biotechnology	5	5
	15UBTC5P	**Core XII:** Lab in Immunology &Immunotechnology	5	5
	15UBTO51	**Optional/Elective**		
	15UBTO52	**Course-II: 1.** Bioinformatics 2. Marine Biotechnology	4	3
IV	15UBTS51	**Skill Based course- II:** IPR, Bioethics& Biosafety.	2	2
	15UBTS52	**Skill Based course- III:** Cancer Biology	2	2
	15UVED51	**Value Education**	1	1
		Total	**30**	**28**
Semester VI				
III	15UBTC61	**Core XIII :** Recombinant DNA Technology	5	5
	15UBTC62	**Core XIV:** Plant Biotechnology	5	5
	15UBTC6P	**Core XV:** Lab in Recombinant DNA Technology	5	5
	15UBTC6Q	**Core XVI:** Lab in Plant Tissue Culture.	5	5
		Optional/Elective		
		Course-III:		
	15UBTO61	1. Stem cell Biology		
	15UBTO62	2. Biochemical techniques	4	3
IV	15UBTS61	**Skill Based course-IV:** Functional Genomics	2	2
	15UBTV61	**Value Based course-II**: Nano Biotechnology	2	2
	15UESR61	Environmental studies	2	1
		Total	**30**	**28**

Semester	I	II	III	IV	V	VI	Total
Credits	18	22	22	22	28	28	140

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
Choice Based Credit System
UG Programme - B.Sc., Biotechnology (2015-2018)
SEMESTER - I

CORE – I: CELL BIOLOGY- 15UBTC11 **Duration: 60 Hours**
Credits: 4

Objectives:

- To provide a thorough knowledge about structure and function of Cells, bio molecules and cellular development.
- This paper will help the student get a grasp of the latest advances in cell biology.

Course Outcome:

- Thorough knowledge about structure and function of Cells, bio molecules and cellular development.
- Knowledge about the role of the major cell organelles.
- Fundamental features of prokaryotic and eukaryotic cells and methods used to examine them.
- Knowledge on the specific processes and proteins involved in membrane transport.
- Understand the major stages of the cell cycle.
- Awareness on the latest advances in cell biology.

Unit: I (12 Hours)

Cell structure- Prokaryotic and Eukaryotic - Plant and Animal cells - structural features- a brief comparative account. Cell theory. Plasma membrane- chemistry and ultra structure- Fluid mosaic model-permeability and other functions.

Unit: II (12 Hours)

Endoplasmic reticulum and Golgi complex- morphology, structure and functions. Nucleus- ultra structure and organization- Chromosomes: morphology, structure- types: Giant chromosomes- polytene and lamp- brush chromosomes.

Unit: III (12 Hours)

Mitochondria and chloroplasts, morphology, Ultra structure and functions. Lysosomes- Ultra structure and functions -brief account. Ribosomes- Ultra structure and functions.

Unit: IV (12 Hours)

Cell cycle- mitosis and meiosis, Dynamics of cell division. Significance of mitosis and meiosis. Cell growth- normal and abnormal cell growth (cancer).

Unit: V (12 Hours)

Light, compound, Electron microscope a brief account. Sub cellular fractionation: Ultra centrifugation, Differential and density gradient centrifugation. Peroxisomes – formation, enzyme content and their role.

Text Books:

1. Verma, P.S and V.K. Agarwal, (2008), Text book of cytology, S. Chand & Co. New Delhi.
2. Ajay paul, M., (2007), Text book of cell and molecular biology, Books and Allied (P) Ltd. Kolkata.

3. De Robertis, E.D.P. and E.M.F. De Robertis, (1988), Cell and molecular biology, 8th International edition ISBN.

References:

1. James Darnet, Harvey Lodish, David Baltimore, (2005), Molecular Cell biology, Scientific American Books Ins.
2. Gupta, P.K. (2007), Cell and Molecular biology 2nd edition. Rastogi publication, India.
3. Wilson and Marrison, (2006), Cytology, Reniform publications, New York.

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
Choice Based Credit System
UG Programme - B.Sc., Biotechnology (2015-2018)
SEMESTER – I

CORE – II: LAB IN CELL BIOLOGY & GENETICS-15UBTC1P **Duration: 60Hours**
Credits : 3

Objectives:

- To impart the practical knowledge on Cell Biology.
- To learn the basic techniques of cell biology.

Course Outcome:

- Practical skills on Cell Biology.
- Basic techniques of cell biology.
- Knowlege about the organelles of cells and function.
- Different stages in mitosis and meiosis cell division.
- Understand the difference between monohybrids and dihybrids of plants.
- Knowledge on starch utilization in plants.

Cell Biology:

1. Parts and functioning of compound microscope.
2. Study of cell organelles by photo micrographs.
3. Study the different living and non-living cell inclusions-Starch grains, Raphides, and Cystolith.
4. Study of mitosis by smear technique using onion root tip.
5. Study of different stages of meiosis from permanent slides.
6. Study of different types of giant chromosome – Polytene and Lampbrush chromosomes from permanent slides.

Genetics:

1. Mendel Monohybrid, Dihybrid Experiment.
2. Incomplete dominance and Test cross ratio.

Reference Books:

1. Ashok Bendre, M. and Ashok kumar, (2009), A Text Book of Practical botany, Volume I and II, Rastogi Publications, India.
2. Pandey, B.P., (1999), Modern Practical Botany Volume I and II, S. Chand & Co., New Delhi.
3. Mitra S 1994, Genetics, A Blue Print of Life Tata McGraw Hill, New Delhi.
4. Strickberger M.W 1990, Genetics III Education Mcmillan Publishing Ltd, Singapore.

Choice Based Credit System
UG Programme - B.Sc., Biotechnology (2015-2018)
SEMESTER - I

NON MAJOR ELECTIVE COURSE-I **Duration: 30 Hours**
HUMAN DISEASES-COMMUNICABLE DISEASES-15UBTN11 **Credit : 1**

Objectives:

- To enable the student to know about the ubiquitous nature of pathogens and host - pathogen relationships
- To create awareness on diseases caused by the microorganisms
- To understand about the diagnosis and treatment of various diseases.

Course Outcome:

- Understand the ubiquitous nature of pathogens and host - pathogen relationships
- Awareness on diseases caused by the microorganisms and the prevention methods and vaccination
- Understand about the diagnosis and treatment of various diseases.
- Awareness on diseases and ensure the sanitation and hygiene

Unit: I (6 Hours)

Introduction to infectious diseases-terminologies, frequency of disease, characteristics of infectious diseases, disease cycle and transmission of pathogen.

Unit: II (6 Hours)

Pathogenesis, occurrence, epidemiology, diagnosis and treatment of *Streptococcus*, Mycobacterial Diseases, *Salmonella* infections *and Leptospirosis*.

Unit: III (6 Hours)

Pathogenesis, occurrence, epidemiology, diagnosis and treatment of Histoplasmosis, Aspergillosis and Candidiasis.

Unit: IV (6 Hours)

Pathogenesis, occurrence, epidemiology, diagnosis and treatment of malaria, amoebiasis and ascariasis.

Unit: V (6 Hours)

Pathogenesis, occurrence, epidemiology, diagnosis and management of AIDS, Hepatitis B and Influenza virus infections (H1N1, Chikunguinea, Dengue).

Text books:

1. M.J. Pelzer Jr., E.C.S. Chan and N.R. Kreig, (1993), Microbiology McGraw Hill Inc.,New York.

References:

1. R.C.Dubey and D.K.Maheshwari, (2005), A text book of Microbiology, S.Chand &Company, New Delhi.
2. Rajesh Bhatia and Rattan Lal,(1995), Essentials of Medical Microbiology, Jaypee Brothers,New Delhi.
3. Roger Webber, (1998), Communicable Diseases Epidemiology and control, Cab International publishers.

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Choice Based Credit System
UG Programme - B.Sc., Biotechnology (2015-2018)
SEMESTER - I

ENRICHMENT COURSE- I: **Duration: 30Hours**
FUNDAMENDALS OF GENETICS- 15UBTE11 **Credits: 1**

Objectives:

- To Study the principle of Mendelian Genetics.
- To analyse the characteristics of lethal disorders.
- To gain knowledge about the mutation and population Genetics

Course Outcome:

- Knowledge in genetics and science
- Understand about monohybrid and dihybrid plants
- Structure and function of genes, chromosomes and genomes
- Understand how traits get passed down through generations
- Fundamentals of molecular biology

Unit: I (6 Hours)

Mendelian Genetics- Mendel's work – Mendel's method, experiments, observations, and results. Rediscovery of Mendel's work- Mendel's law- Terminology- Back/test cross.Complete and Incomplete Dominance.

Unit: II (6 Hours)

Lethal factor- non allelic gene interactions- complementary gene-epistasis-duplicating genes-pleotropism. Allelic gene interaction- Multiple alleles-Blood group inheritance-Rh factor.

Unit: III (6 Hours)

Genes and chromosomes, linkage and crossing over-theories of crossing over- cytological basis- mapping of chromosomes. Sex determination and sex linked inheritance (colour blindness only)

Unit: IV (6 Hours)

Mutation- Gene mutation- molecular basis of gene mutation-base substitution, tatumerism- Mutagens, chromosomal aberrations- deletion, duplication, translocation, inversion-ploidy.

Unit: V (6 Hours)

Population Genetics-Gene Pool Concept- Hardy Weinberg law- gene frequencies calculations and factors affecting Hardy- Weinberg law.

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Text Books:

1. Gardener, A.J., Simmons M.J. and Snusted D.P, (2008), Principles of Genetics, John Willey and sons, NewYork.
2. P.S. Verma and V.K. Agarwal, (2008), Genetics, S. Chand & Co. New Delhi.

References:

1. Strickberger, M.W, (1996), Genetics, Macmillan Publishing Co, New York.
2. Maloy, S.R. and J. E. Cronan Jr., (2006), Microbial Genetics, D. Freifelder, Jones and Bartlett Publishers, Sudbury, Massachusetts
3. Sinnott E.W., I.C. Dunn, (2001), Principles of Genetics, Tata Mc Graw – Hill Publishing Company Ltd, New Delhi,
4. David Freifelder, (2005), Essentials of molecular Biology, Narosa Publishing House, New Delhi.

SRI KALISWARI COLLEGE (AUTONOMOUS), SIVAKASI
Choice Based Credit System
UG Programme – B.Sc., Biotechnology (2015-2018)
SEMESTER – II

Core – II: BIOCHEMISTRY- 15UBTC21 **Duration: 60 Hours**
Credits: 3

Objectives:

- To provide a thorough knowledge about structure and function of Cells, bio molecules and cellular development.
- This paper will help the student get a grasp of the latest advances in cell biology.

Course Outcome:

- Knowledge about structure and function of Cells, bio molecules and cellular development.
- Awareness on the latest advances in cell biology.
- Concepts of molecular and functional organization of a cell and its sub cellular components.
- Understand structure and interrelationship of various biomolecules and consequences of deviation from normal.
- Awareness about digestion and assilimation of nutrients and consequences of malnutrition.
- Understand the various aspects of metabolism and their regulatory pathways.

Unit: I (12 Hours)

Structure, functions and Classification of Carbohydrates with example. Glycolysis, Pentose Phosphate Pathway, TCA Cycle & its energitics.

Unit: II (12 Hours)

Structure, Classification and properties of aminoacids. Deamination, Transamination and Decarboxylation reactions of aminoacids. Structural Organization of Proteins (Primary, Secondary, Teritary and Quaternary) Metabolism of Aromatic Aminoacids and Urea Cycle.

Unit: III (12 Hours)

Structure, functions and classification of Lipids and fattyacids. Biosynthesis and beta oxidation of fatty acids. Structure and biological properties of Cholesterol.

Unit: IV (12 Hours)

Structure of DNA(A,B,Z DNA), RNA (mRNA,t RNA, r RNA). Structure of nucleosides and nucleotides. Salvage pathway of Purines and Pyrimidines.

Unit: V (12 Hours)

Classification and Nomenclature of Enzymes. Coenzymes, Cofactors. Water Soluble and fat soluble Vitamins-dietary sources and functions. Biologically valuable minerals (Copper, Iron and Zinc)

Text books:

1. Murray R.K.,D.K.Granner,P.A.Mayes & V.W.Rodwell.(2012) Harper's Biochemistry,twenty 29th edition,Mc Graw Hill Publications.
2. Jain J.L., Sunjay Jain, Nitin Jain, (2007) Fundamentals of Biochemistry , sixth edition, S.Chand and company Ltd.
3. Sathyanarayana , (2006) Text book of Biochemistry,third edition ,Uppala author publisher interlinks.
4. Eric E.Conn &Paul K Stumpf,George Bruening,Roy H.Doi. (2005),Outlines of biochemistry John wiley &sons.

References:

1. Lehninger.A.L.,Nelson.D.L.,Cox,.M.M (2004), Principles of Biochemistry sixth edition W.H.Freeman and company ,Newyork.
2. Voet .D.,Voet J.G.,and Pratt,C.W(1999)Fundamentals of Biochemistry John wiley and sons,Newyork.
3. Berg j.m.,Tymouzko,J.L. and Stryer .L, (2007), Biochemistry sixth edition. W.H.Freeman company,Newyork.

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Choice Based Credit System
UG Programme – B.Sc., Biotechnology (2015-2018)
SEMESTER – II

CORE –IV: LAB IN BIOCHEMISTRY-15UBTC2P **Duration: 60Hours**
Credits: 3

Objectives:

- To provide familiarity with basic biochemistry laboratory techniques.
- To enable the students to learn basic Biochemical estimations.
- To expose the students familiar with the equipments available in our laboratory.

Course Outcome:

- Familiar in basic biochemistry laboratory techniques.
- Understand the basic Biochemical estimations.
- Analyze the methods including graphing and statistical analysis.
- Problem solving skills and analytical thinking skills
- Familiar with laboratory skills.

1. Colorimeter and spectrophotometer(Principle and application)
2. pHmeter and preparation of buffers
3. Estimation of Proteins (Lowry's)
4. Estimation of Glucose (Dinitro salicylic acid)
5. Estimation of Ascorbic acid
6. Optimum pH, Optimum temperature of Salivary amylase.
7. Paper Chromatography for amino acid separation
8.

References:

1. Douglas A Skoog, F.James Holler, Timothy A.Nieman, (1997) Principles of Instrumental Analysis, 5th edition,Brooks Cole publishers.
2. Jayaraman J, (1999), Laboratory manual of Biochemistry, Sixth edition, New age international publishers

3. Keith Wilson,John Walker, (2000), Principles and Techniques of Practical Biochemistry, 5TH Edition, Cambridge University Press.
4. Dr.P.Palani velu, Analytical biochemistry and separation techniques, MKU, Madurai.

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Choice Based Credit System

UG Programme - B.Sc., Biotechnology (2015-2018)
SEMESTER - II

NON MAJOR ELECTIVE COURSE-II **Duration: 30 hours**
HUMAN DISEASES - **Credits: 1**
NON COMMUNICABLE DISEASES -15UBTN21

Objectives:

- To enable the students to know about the Health and Diseases
- To impart knowledge about various metabolic related disorders
- To create awareness on in borne metabolic disorders

Course Outcome:

- Knowledge about the Health and Diseases
- Understand about various metabolic related disorders
- Awareness on in borne metabolic disorders
- Understand about diagnosis, treatment and prevention method.

Unit: I (6 Hours)

Introduction to Human health-Definition-Physical health-Mental health and Social health Macronutrients & Micronutrients – physiological functions, dietary sources, requirements, deficiency conditions.

Unit :II (6 Hours)

Differences between communicable and non-communicable diseases. Coronary heart disease, Hypertension, Rheumatic heart diseases, stroke, and Cancer.

Unit: III (6 Hours)

Diabetes mellitus, glucose tolerance tests, sugar levels in blood.
Disorder of Lipids: Artherosclerosis, Obesity.

Unit: IV (6 Hours)

Disorders of liver and kidney: Jaundice, liver cirrhosis, Kidney failure, Normal Functions of liver and kidney.

Unit: V (6 Hours)

Inborn Errors of Metabolism: Phenylketonuria, alkaptonuria, albinism, Sickle cell anaemia

Text Books:

1. Ambika Shanmugam,2005,Fundamentals of Biochemistry for Medical students.
2. Cart A. Burdis and Edward R.Ashwood, Text Book of clinical Biochemistry

References:

1. Kaplan L.A. and Pesce A. J. C. V. Mosby, 1989, Clinical Chemistry.
2. W. J. Marshall and S. K. Bangert, Clinical Biochemistry,Churchill Livinston

3. Gowenlock, Practical Clinical Biochemistry (Varley).
4. M.N. Chatterjee and Rane shinde Text Book of Medical Biochemistry

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Choice Based Credit System
UG Programme - 2015-2018
SEMESTER - II

ENRICHMENT COURSE- II **Duration: 30Hours**
BASIC CONCEPTS OF BIOTECHNOLOGY– 15UBTE21 **Credits: 1**

Objective:

- To enable the students to understand about the basic concepts of Modern Biotechnology
- To impart knowledge to the students about the application of biotechnology in the enviroment.
- To explain the students about the basic techniques used in biotechnology.

Course Outcome:

- Understand the structure, composition and function of various biomolecules.
- Understand the fundamentals of biotechnology.
- Role of biotechnology in Spirullina cultivation and its applications
- Novel methods for production of antibiotic.
- Importance of mushroom and its cultivation technique.
- Application of biotechnology in pollution control.

Unit :I (18 hours)

Introduction, Definitions, scope and branches of Biotechnology. Applications and recent developments in Biotechnology. Biotechnology in India.

Unit:II (18 hours)

Basic concepts: Nucleic acids, Definition, Deoxyribonucleic acid, Ribonucleic Acids, messenger RNA, Tranfer RNA. Central Dogma, Protein Synthesis.

Unit:III (18 hours)

Genetic engineering: Definition, Concepts of Gentetic Engineering, Methodology of Genetic Engineering. Biomolecular methods: Gel Electrophoresis, SDS PAGE and Pulse field Gel Electrophoresis.

Unit:IV (18 hours)

Production of microbial biomass (Spirulina, Yeast), SCP, Primary and Secondary metabolites including Vitamins(Riboflavin,Cyanocobalamine), Amino acids (Glutamic acid,Cysteine), Antibiotic (Penicillin).Mushroom Cultivation.

Unit:V (18 hours)

Biotechnology in Pollution Control: Definition, Role of Biotechnology in Pollution control. Biological waster water treatment: Sewage treatment, Primary,Secondary, Teritary treatment.Degradation of Xenobiotics. Biomining and Bioleaching.

Text Books:

1. Biotechnology by V.Kumaresan, (2013) Saras Publication.

2. Biotechnology by Sathyanarayana.
3. A text book of Biotechnology by R.C. Dubey,(1993), S. Chand&Company LTD.

Reference Books:

1. Principles of Gene Manipulation by Sandy B. Primrose Richard Twyman, R.W. Old. Black Well Scence. Inc, UK.
2. Microbial biotechnology by Glazer and Nikaids (1995) Freeman Press.
3. Fundamentals of Biotechnology by Paul prave, Uwe Faust, Wolfgang Sitting (1987) WCH Weinhein.

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Choice Based Credit System
UG Programme - B.Sc., Biotechnology (2015-2018)
SEMESTER - III

CORE-V: MICROBIOLOGY -15UBTC31 **Duration: 60 hours**
Credits: 4

Objectives:

- To enable students to understand the diversity of microbes and importance of classification of microorganisms
- To help the students to understand the influence of microorganisms and microbiological applications on everyday life.

Course Outcome:

- Apply appropriate terminology relating to the structure, metabolism, genetics, and ecology of prokaryotic microorganisms, eukaryotic microorganisms, and viruses.
- Understand the nutritional requirement of microorganisms**.**
- Knowledge about the interactions between pathogenic microorganisms and susceptible hosts that results in infection and disease.
- Knowedge on methods of sterilization used in the control of microorganisms and apply this understanding to the prevention and control of infectious diseases.
- Understand the life cycle of algae bacteria and fungi and viruses.
- Understand the interaction between the microorganisms and plants, animals.

Unit: I (12 Hours)

History and scope of Microbiology. Progressive development of Microscope: Principles and applications of Light microscope-Simple, compound, dark field, phase contrast microscopes, Fluorescent microscopes, Confocal microscopes and Electron microscopes-TEM, SEM.

Unit: II (12 Hours)

Classification of microbes-Bacteria, *(upto* the order level with one example), Fungi, Algae-classification up to division. Viruses (up to family with one example).

Unit: III (12 Hours)

General structure of Bacteria, Fungi and Algae. Nutritional Requirement,Nutritional types of Microorganisms,Bacterial growth curve. Sterilization methods .

Unit: IV (12 Hours)

Cultural characteristics, Morphology and Pathogenesis of Bacteria- *Escherichia Coli, Salmonella, Mycobacterium*, Fungi- *Aspergillus,Candida albicans* ,Viruses- HIV,HBV,Virions and prions

Unit: V (12 Hours)

Life cycle of bacteria, fungi-rhizopus and yeast, Algae-Chlamydomonas. Life cycle of viruses-plant, animal and bacterial viruses. Interactions between microorganisms-Mutualism, Commensalism, Antagonism, exploitation etc.Plant microbe Interaction-Symbiosis,Mycorrhizae.

Text books:

1. Prescott L.M., J.P. Harley and D.A. Klein, (2005) Microbiology, Sixth edition McGraw Hill, Boston.

2. Pelzer M.J., E.C.S. Chan and N.R. Kreig, (1993) Microbiology, McGraw Hill Inc., New York.

3. Ananthanarayanan and J.Panicker. (2005) Text book of Microbiology, Eighth edition,Orient Long Publishers.

References:

1. Michael T. Madigan John M. Martin & Jack Parker. (1984) Biology of Microorganisms, Prentice Hall International, Inc., London.

2. Gerard J. Tortora, Berdell R. Funke, Christine & L. Case. (2001) Microbiology - An Introduction, Benjamin Cummings, U.S.A.

3. Danial Lim. (1998) Microbiology, McGraw-Hill Companies , New York.

4. Greenwood D., R. Slack and J. Peutherer. (1997) Medical Microbiology , ELST with Churchill Livingstone, Hong Kong.

SRI KALISWARI COLLEGE, (AUTONOMOUS), SIVAKASI.

Choice Based Credit System

UG Programme-B.Sc Biotechnology 2015-2018.

Semester-III

Core-VI: LAB IN MICROBIOLOGY -15UBTC3P **Duration: 60 Hours**

Credits: 3

Objectives:

- To enable the students acquire the knowledge about basic technical skills in microbiology lab.
- To enable the students in the culturing, identification and maintenance of microbes.

Course Outcome:

- Perform safe practices in a microbiology laboratory.
- Understand the use of culture media.
- Identify unknown bacteria using biochemical testing.
- Perform proper streaking for isolation using the quadrant method
- Perform appropriate staining technique.
- Interpret biochemical test results properly to determine species identification

1. Microbiological Techniques-Media preparation, sterilization techniques, streaking techniques.
2. Isolation of Microorganisms from soil, water, air by spread plate and pour plate methods.

3. Staining Techniques - Gram staining
Flagella staining
Endospore staining

4. Biochemical tests- IMVIC tests
Starch hydrolysis
Catalase test
Oxidase test
Acid and gas production test

5. Test of microorganisms for enzymes –protease and amylase.

References:

1. Ronald M.Atlas *et al*., (1997),Experimental Microbiology,Benjamin and Cummings Publication.
2. J.G. Cappuccino and N. Sherman, (2002),Microbiology: A Laboratory Manual Addison-Wesley.
3. Kannan.N., (1995), Lab manual in Microbiology Panima publishers,New Delhi..
4. J.G.Holt,N.R.Krieg, (2000), Ninth edition,Bergey's Manual of Determinative Bacteriology,

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Choice Based Credit System
UG Programme - B.Sc., Biotechnology (2015-2018)
SEMESTER - III

ALLIED COURSE –III: BIOLOGICAL SCIENCES- 15UBTA31 Duration: 60 Hours
Credits: 3

Objectives:

- To provide familiarity with basic topics about classification, nomenclature and herbarium preparation.
- To provide the knowledge about the general aspects of algae, fungi and bryophyte.
- To help the students acquaint with details of pteridophytes, gymnosperms and angiosperms.

Course Outcome:

- Knowledge about the modern system of classification of plants.
- Analyze the Economic importance and Life history of Algae, Fungi and Bryophytes.
- Understand the Classification and Life history of Pteridophytes, Gymnosperms.
- Salient features of Monocot and Dicot plants.
- Characteristic features of invertebrates and their suitable examples.

Unit: I (12 Hours)

Basics of classification-Units of classification. Nomenclature-Binomial system. Systems of classification- artificial, natural and phylogenetic. Natural system of classification-Bentham and Hooker system of classification of plants- Herbarium and their importance.

Unit: II (12 Hours)

Economic importance of algae- Life history of algae- *Sargassum*.Economic importance of fungi- Life history of fungi-Yeast. Bryophytes- General characters, classification up to class level- Life history of Bryophytes-*Marchantia.*

Unit: III (12 Hours)

Pteridophytes- General characters, classification up to class level- Life history of Pteridophytes- *Selaginella.* Gymnosperms- General characters, classification up to class level-

Life history of Gymnosperms-*Pinus.* Economic importance of Gymnosperms. Angiosperms-Dicot family-Malvaceae- *Hibiscus rosa sinensis*, Monocot family- Musaceae- *Musa paradisiaca*.

Unit: IV (12 Hours)

General classification, characteristic features of invertebrate from Protozoa to Mollusca.

Unit: V (12 Hours)

General classification, characteristic features of vertebrates from Prochordata to Chordata. .

Text Books:

1. Jordon, E.L.and P.S. Verma, (2006), Invertebrate Zoology, S. Chand & Co., New Delhi.
2. Singh, V., P.C. Pande and D.K. Jain, (2002), Text Book of Botany, Rastogi Publication, New Delhi.
3. Jordon, E.L. and P.S. Verma, (2008), Chordate Zoology, S. Chand & Co., New Delhi.

References:

1. Dutta, A.C., (2004), Botany for Degree students, Oxford University press.
2. Smith, G.M., (2009), Cryptogamic botany, Volume I and II, Tata Mc Graw Hill, India.
3. Subramanyam, N.S., (2003), Modern plant Taxonomy, Vikas Publishing House. New Delhi.

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SEMESTER – III

ALLIED COURSE -IV **Duration: 30 Hours**
LAB IN BIOLOGICAL SCIENCES- 15UBTA3P **Credit: 2**

Objectives:

- To practice the students in handling of plants, animals and lower plants and their identification.
- To impart the practical knowledge on Plant Diversity.

Course Outcome:

- Handling and identifation of plants, animals and lower plants.
- Practical knowledge on ecological techniques.
- Basic techniques of cell biology.

Botany:

1) Vegetative structure and reproductive structure in *Sargassum, Yeast, Marchantia.*

2) Vegetative structure and reproductive structure in *Selaginella, Pinus*.

3) Dissection and study of any available Dicot flower.

Zoology:

4) Cockroach- external, digestive and reproductive system.

5) Pigeon- external, digestive and reproductive system.

6) Morphology of following spotters only: Amoeba, Euglena, Hydra, Liver fluke, *Taenia*, Ascaris, Earth worm, Prawn, Pila, Star fish, Calotes, Pigeon and Rat.

Reference Books:

4. Ashok Bendre, M. and Ashok kumar, (2009), A Text Book of Practical botany, Volume I and II, Rastogi Publications, India.
5. Verma, P.S. and V.K. Agarwal, (2009), A manual of Practical Zoology; Invertebrates and Vertebrates, S. Chand & Co., New Delhi.
6. Pandey, B.P., (1999), Modern Practical Botany Volume I and II, S. Chand & Co., New Delhi.
7. Lal, S.S, (2008), A text book of vertebrate zoology, Raj pal Publishers, New Delhi, India.

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Choice Based Credit System
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SEMESTER – III

SKILL BASED COURSE-I: HUMAN PHYSIOLOGY-15UBTS31 **Duration: 30 Hours**
Credits: 2

Objectives:

- To understand the nutritional requirements and Basal Metabolic Rate.
- To make the students familiar with the process of respiration
- To make the students understand the role of Haemoglobin.
- To help the students in understanding the mechanism of hormones in our body.

Course Outcome:

- Understand about nutrition and their values
- In depth analysis of the internal organs and their working mechanisms.
- Understand about important of hormones and their role in health
- Importance of health and exercise.
- Knowledge about physiology of digestion and absorption of nutrition.
- Awareness on the ultra structure and activities of bones and muscles

Unit: I (6 Hours)

Nutritive Requirements – Carbohydrates, proteins, lipids, Vitamins and minerals. Physiology of Digestion, Absorption and Assimilation- hormonal control of digestion. Basal Metabolic Rate (BMR).

Unit: II (6 Hours)

Structure of Human Respiratory system. Respiratory pigments. Mechanism of Breathing: external respiration and internal respiration. Structure of mammalian heart. Heart beat-mechanism of circulation –origin and conduction of heart beat – Blood coagulation. Haemoglobin: Structure and function.

Unit: III (6 Hours)

Structure of mammalian kidney – Urine formation: Glomerular filtration – Tubular reabsorption and secretion – Counter current mechanism – Hormonal regulation. Thermoregulations.

Unit: IV (6 Hours)

Ultra Structure of skeletal muscle. Mechanism of muscle contraction- theories. Structure of neuron – Origin and conduction of nerve impulse. Synaptic transmission –neuromuscular junction. Biological Clocks.

Unit: V (6 Hours)

Endocrine and exocrine glands-Pituitary, Thyroid, Adrenal, Ovary, Testis-Hormones and its functions.

Reference Books:

1. W.B. Saunders, Guyton and Hall (2007), Text Book of Medical Physiology.
2. Murray (2010), Harper's Illustrated Biochemistry, Appleton & Lange.
3. Ganong (2003), Review of Medical Physiology, Lang Medical Publications.
4. Brown (1957), M.E. Physiology of fishes, Academic press.

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SEMESTER – III

VALUE BASED COURSE –I: MEDICINAL PLANTS- 15UBTV31 **Duration: 30 Hours**
Credits: 2

Objectives:

- To provide information about medicinal plants and their importance.
- To provide the knowledge about the general aspects of nursery techniques and organic farming.
- To acquaint the students with details of active constituents of medicinal plants.

Course Outcome:

- Identify medicinal plant taxa and habitats threatened by non-sustainable harvest.
- Understand the present and future prospectus of the medicinal plants.
- High levels of trade, environmental degradation, and other factors contributing to loss of species and genetic diversity.
- Work with local, regional, national, and global partners to design and implement conservation action plans for priority medicinal plant taxa and habitats.
- Opportunities for consumers, industry, and other beneficiaries to understand and participate more directly in conservation.
- Marketing of Medicinal plants in India and World level.

Unit: I (6 Hours)

Introduction – History- Importance of Medicinal plants-present status and future prospectus of medicinal crops-opportunities.

Unit: II (6 Hours)

Nursery Technology- Time of planting – preparation of bed- seeds sowing –Crop establishment technique-planting technique for field crop- Nursery hygiene and Disease Control-Post planting measures.

Unit: III (6 Hours)

Organic Farming-Concepts of organic farming- Biofertilizers and biological pest control-manure- Biopesticides- Integrated pest management-Basic Standards and general principles for organic Farming. Economic importance of cultivation of medicinal plants.

Unit: IV (6 Hours)

Processing of medicinal plants- Decoction –Extraction, infusion, Maceration. Parts of medicinal plant to be used –Active Constituents of medicinal plants- preparation of herbal remedies.

Unit: V (6 Hours)

Cultivation of medicinal plant- *Aloe vera*; Processing and products recovery from *Aloe vera* and its applications.

Text and Reference Books:

1. Sharma, R., (2004), Agro-techniques of medicinal plants, Daya Publishing House, New Delhi.
2. Azhar Ali Farooqi and B.S. Sreeramu, (2001), Cultivation of medicinal and Aromatic Crops, University press, India.
3. Purohit, S.S. and S.P. Vyas, (2006), Medicinal Plant Cultivation-Scientific Approach, Agrobios, India

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SEMESTER – IV

CORE-VII **Duration: 60 Hours**
MOLECULAR BIOLOGY& MOLECULAR GENETICS-15UBTC41 Credits: 4
Objectives:

- To enable the students to understand about the basics of Molecular biology
- To impart knowledge to the students about the concepts of Molecular Genetics.
- To explain the concept of gene regulation and gene transfer methods.

Course Outcome:

- Knowledge about the bacterial and eukaryotic DNA replication, transcription, translation and post translational modification,
- Regulation of gene expression in prokaryotes.
- Knowledge about genetic diseases and causes of genetic diseases.
- Knowledge on mutation and various aspects of DNA repair mechanism.
- Knowledge about the types of mutation and it's causing agents.
- To ensure the students understand about transposable elements and transposition mechanism

Unit: I (12 Hours)

Structure of NucleicAcid, DNA Replication: Prokaryotic and eukaryotic DNA replication. Mechanism of DNA replication. Transcription-Post Transcriptional Modification

Unit: II (12 Hours)

Translation-Post translational Modification- Gene regulation in prokaryotes,*lac* operon,*ara* operon and *trp* operon.Models of recombination.Genetic diseases-chromosomal,molecular basis of genetic diseases.

Unit: III (12 Hours)

Plasmids-Plasmid types-Conjugation:Principle,types-F-mediated and Hfr mediated mechanism.Transformation:Definition,process and mechanism.Transduction-Generalised and specialized transduction.Transfection of phage DNA.

Unit: IV (12 Hours)

Mutation-Definition,types-insertion,deletion,addition,rearrangement.Mutagenesis-types-site directed mutagenesis,base analogue mutants,tautomerisation.DNA damage and repair mechanism-photo reactivation,direct repair of nicks, excision repair,mismatch repair,recombination repair,SOS repair mechanisms.

Unit: V (12 Hours)

Transposable genetic elements-Identification of Transposition-IS elements, Composite transposons,Tn3, Tn5, Tn9, Tn10 and Mu phage. Transposition mechanism.

Text books:

1. S.R. Maloy, J. E. Cronan Jr., and D. Freifelder.(2006), Microbial Genetics Jones and Bartlett Publishers, Sudbury, Massachusetts.
2. Brown T. A, (2007)Genomes 3 Garland Science Publishing.

References:

1. James D Watson, Tania A. Baker,Stephen P. Bell, Alexander Gann, Michael Levine and Richard Losick, Benjamin Cummings , (2004).Molecular Biology of the Gene., Fifth Edition.
2. G. M. Malacinski, (2002)Essentials of Molecular Biology, Fourth Edition Jones & Bartlett Publishers.
3. Peter J. Russel. (2006) Genetics – A Molecular Approach, 2nd Edition.
4. T.Cullis,Burton,S.Guhman,Antony Griffiths,David Suzuk.,(2003), Genetics:A Beginner's guide, One world publication limited.

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Semester-IV

Core-VIII **Duration: 60 Hours**
LAB IN MOLECULAR BIOLOGY **Credits: 3**
MOLECULAR GENETICS -15UBTC4P

Objectives:

- To enable the students acquire the knowledge about basic technical skills in Molecular Biology.
- To enable the students for the better understanding of Molecular Genetics.

Course Outcome:

- Understand the principle of bacterial conjugation.
- Isolation of bacteriophage and their titration.
- Understanding the mechanism of mutation.

- Knowledge about the differenciation auxotrophic and prototrophic mutants.
- Isolate the DNA from plants, animals,plasmids.

1. Bacterial Conjugation
2. Isolation of bacteriophage and phage titration
3. Growth curve of bacteria
4. Isolation of Auxotrophic mutants.
5. One step growth curve of bacteriophage.
6. Plasmid DNA Isolation.
7. Mutation analysis of Bacteria using Physical agent(UV)

References:

1. Miller, J.H. (1992),A Short Course in Bacterial Genetics,
2. Ronald M.Atlas *et al*., (1997),Experimental Microbiology,Benjamin and Cummings Publication.
3. J.G. Cappuccino and N. Sherman, (2002),Microbiology: A Laboratory Manual Addison-Wesley.
4. Kannan.N., (1995), Lab manual in Microbiology Panima publishers,New Delhi..
5. J.G.Holt,N.R.Krieg, (2000), Ninth edition,Bergey's Manual of Determinative Bacteriology.

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DEPARTMENT OF BIOTECHNOLOGY
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SEMESTER – IV

ALLIED COURSE-IV: FOOD BIOTECHNOLOGY -15UBTA41 **Duration: 60 Hours**
Credits: 3

Objectives

- To enable the students understand importance of food Biotechnology
- It creates awareness on Microorganisms involved in food Contamination
- It creates awareness on hazard analysis of food and quality of the food substances.

Course Outcome:

- Awareness about the food contamination by microorganisms.
- Understand the production of cheese, bread, wine.
- Production of single cell protein and their economic importance.
- Understanding of food preservation techniques.
- Awareness on food hazardous and food analysis.
- Importance of Dairy products and its types.

UNIT – I (12Hours)

Introduction: Importance of food Biotechnology, Scope of food Biotechnology –Biotechnology and Dairy industry, biotechnology and baking industries, application of biotechnology on plant tissue culture.Future prospects of Biotechnology and Food industry.

UNIT – II (12Hours)

Preparation of Cheese, bread, wine, fermented vegetables – methods and organisms used. Food and enzymes from microorganisms – single cell protein, production of enzymes.

UNIT – III (12Hours)

General principles underlying spoilage.Contamination, spoilage and preservation of different kinds of foods, Vegetable and fruits – meat and meat products – fish and other sea foods – eggs and poultry –Milk and milk products .

UNIT – IV (12Hours)

Food Poisoning: food borne infections (a) Bacterial: Staphylococcal, Brucella, Bacillus, Clostridium, Escherichia, Salmonella (b) Fungal : Mycotoxins including aflatoxins, (c) Viral: Hepatitis, (d) Protozoa – Amoebiasis.

UNIT – V (12Hours)

Principles of food preservation – methods of preservation. a. Physical (irradiation, drying, heat processing, chilling and freezing, high pressure and modification of atmosphere) b. Chemical (Sodium benzoate Class I & II) . Food Sanitation: Good manufacturing practices – Hazard analysis, Critical control points, Personnel hygiene, The food safety and standards authority of India (FSSAI).

Text Books:

1. Adams, M.R. and Moss, M.O.1995. Food Microbiology, The Royal Society of Chemistry, Cambridge.
2. Tripathy SN, 2006. Food Biotechnology, Dominant Publishers and Distributors, Delhi

References:

1. Jay, J.M.1987. Modern Food Microbiology. CBS Publishers and distributors, New Delhi.
3. Atlas, R.M. 1989. Microbiology, A Fundamentals and Applications, Macmillian Publishing company. .
4. Frazier, W.C. and Westhoff, D.C.1988. Food Microbiology, TATA McGraw Hill Publishing company ltd., New Delhi.

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Semester-IV

ALLIED COURSE - IV **Duration: 30 Hours**

LAB IN FOOD BIOTECHNOLOGY -15UBTA4P **Credits: 2**

Objectives

- To enable the students acquire the knowledge about basic technical skills in food Biotechnology
- To enable the students in the isolation and identification of microbes in food samples.
- To create awareness on hazard analysis of food and quality of the food substances

Course Outcome:

- Knowledge about the basic food biotechnology techniques.
- Knowledge about the isolation and identification of food contaminants.
- Identify the quality of milk.
- Identify the water quality analysis.
- Awareness on microbiological examination of soft drinks.

1.Analysis of bacterial counts in food samples.
2.Isolation of lipolytic organisms from butter
3.Methylene blue reductase test
4.Turbidity test for testing sterilized milk.
5.Microbiological examination of soft drinks

6.Detection of coliform bacteria in water-Presumptive test
Confirmed test
Completed test

References:

1. Kannan N, 1996. Laboratory manual in General Microbiology. Palani Paramount Publications, Palani.
2. Collins, C. H, Lyne, P. M, Grange, J. M, 2001. Collin's and Lyne's Microbiological methods. Oxford University Press, INC., Newyork.

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SEMESTER – IV
OPTIONAL/ELECTIVE COURSE – I: BIOSTATISTICS-15UBTO41 Duration: 60 Hours
Credits : 3

Objectives:

- To make the students to understand the basic concept of biostatistics.
- To provide the knowledge about the general aspects of collection of data, classification of data and tabulation of data.
- To acquaint the students with details of various statistical tools for the storage, retrieval and analysis of biological data.
- To expose students to various bio statistical tools used in biotechnology research.

Course Outcome:

- Understand about basic knowledge on biostatistics and their important in applied biology
- Understand about history of biostatistics and their role
- Knowledge in mean, median and mode and the difference in tabulation
- Understand about diagrams and tabulations and their role in experimental studies
- Knowledge about ANNOVA and their application in research studies.

Unit: I (12 hours)

Concepts of statistics-descriptive, inferential biostatistics, statistical methods, Biological measurement, Functions of statistics, Limitations of statistics.

Unit: II (12 hours)

Collection of Data, Sampling and Sampling design, classification & Tabulation, Diagrammatic representation & Graphic representation of data.

Unit: III (12 hours)

Mean-simple arithmetic mean, Median, Mode, Range , Standard deviation & Variance.

Unit: IV (12 hours)

Test of significance: Students t Test , Chi square test, Analysis of variance, Introduction to Non Parametric tests.

Unit: V (12 hours)

Types of correlation- positive, negative, simple, partial, and multiple, linear and non linear correlation, Regression analysis.

Text Books:

1. Zar J.H. (2003) Bio statistical analysis. Tan Prints (India) Pvt. Ltd. New Delhi.

2. Veer Bala Rastogi. (2004) Fundamentals of Biostatistics, Ane books New Delhi, India.
3. Pillai R.S.N. and Bagavathi V. (2003) Statistics – Theory and practice, S. Chand & Co Ltd, New Delhi

References:

4. Arora P.N and P. K. Malhan. (1985) Biostatistics. Himalaya publishing house, New Delhi.
5. Gurumani N. (1997) An Introduction to Biostatistics MJP publishers, Chennai.
6. Irfan Ali Khan and Atiya Khanum. (2003) Fundamentals of Biostatistics, Ukkaz Publications.

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Semester-IV

OPTIONAL/ELECTIVE COURSE-I **Duration: 60 Hours**

FUNDAMENTALS OF DRUG DESIGNING -15UBTO42 **Credits: 3**

Objectives

- To provide students with an understanding of the process of drug discovery.
- To make them to understand the development from the identification of novel drug targets to the introduction of new drugs into clinical practice.

Course Outcome:

- Understand the development and discovery of Drugs.
- Innovative approaches of drug discovery.
- Understand the role of enzymes and receptors during drug design.
- Role of Pro drug and their applications.

Unit:I (12 Hours)

Introduction to The Drug Discovery/Development: General principles of Drug Discovery and Drug Development, Source of Drugs: Microbial, plant and animal. Chemical synthesis of Penicillin and tetracycline. Patenting the drugs. Molecular dissection and Metabolic stabilization of drugs.

Unit:II (12 Hours)

Approaches to New Drug Discovery: Drugs Derived from Natural Products- Existing Drugs as a Source for New Drug Discovery-Using Disease Models as Screens for New Drug Leads (for cancer) -Physiological Mechanisms: the Modern "Rational Approach" to Drug Design.

Unit:III (12 Hours)

Enzymes as Targets of Drug Design: Enzyme kinetics - Enzyme inhibition and activation - Approaches to the Rational Design of Enzyme Inhibitors.

Receptors as Targets of Drug Design: Receptor Theory-Receptor Complexes and Allosteric Modulators-Molecular Biology of Receptors-Lead Compound Discovery of Receptor agonists and antagonists.

Unit:IV (12 Hours)

Prodrug Design and Applications: Definition – Applications - Prodrug Design Considerations.

Prodrug Forms of Various Functional Groups: Ester prodrugs of compounds containing –COOH or –OH-Prodrugs of compounds containing amides, imides, and other acidic NH-Prodrugs of Amines-Prodrugs for compounds containing carbonyl groups.

Unit:V (12 Hours)

Drug release and activation mechanisms - Prodrugs and intellectual property rights – two court cases - Docking and virtual screening - Molecular Dynamics and binding free energy methods - Combinatorial Chemistry and Microwave Chemistry : Solid-phase and Solution Phase Strategies. Role of Microwave Chemistry in drug designing.

References:

1. Kerns, E.H.; Di, L. ,(2008), Drug-Like Properties: Concepts, Structure Design and Methods from ADME to Toxicity Optimization, Academic Press, Oxford.
2. M. E. Wolff, (2005), Burger's Medicinal Chemistry and Drug Discovery, 5th Edition, Vol. 1. Principles and Practice, edited, John Wiley & Sons: New York.
3. A. W. Czarnik and S. H. DeWitt, A., (2007) Practical Guide to Combinatorial Chemistry, American Chemical Society: Washington DC.

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Semester-V

CORE-IX: IMMUNOLOGY &IMMUNOTECHNOLOGY-15UBTC51 Duration: 75 Hours
Credits: 5

Objectives:

- To explore the students in natural mechanism of body defense and scope of immunology.
- To impart the knowledge on immune response, cells and organs of the immune system.
- To learn the immunodiagnostic techniques of infectious diseases.

Course Outcome:

- Understand the cells and organs involved in the immune system of the body
- Familiar with the body's natural defense (immunity), its mechanism and active immunity by vaccination
- Understand the mechanisms of humoral and cell mediated immune response
- Handling skills of different immunotechniques for disease diagnosis and identification
- Theoretical understanding of transplantation immunology and immunosuppressive agents
- Understand how to combat the disease and immunotherapies available
- Highlight the current applications of immunological research in practice

Unit: I (15 Hours)

History and Scope of immunology. Overview of the immune system. Immunity and types of immunity, Immune cells, Memory Cells, Lymphoid organs- primary and secondary organs.

Unit: II (15 Hours)

Antigens – Types and characteristics. Structure, properties, types and functions of immunoglobulins. Immune response-Cell mediated immune response and humoral immune

response, Antigen-Antibody interactions-Precipitation, Agglutination. Complement systems-activation and biological role.

Unit: III (15 Hours)

Immunotechniques- Radial immunodiffusion, Double immunodiffusion, Immunoelectrophoresis, Radio immune assay, Immunoprecipitation, Immunofluroscence, ELISA, Western blotting. Principles and construction of monoclonal antibodies and their applications. Interleukins – Structure, properties, types and functions.

Unit: IV (15 Hours)

HLA tissue typing and transplantation, tumor immunology, Hypersensitivity: types, mechanism and disorders of hypersensitivity. Immunity to infectious agents – bacteria, virus and parasites, Allergy, Auto immunity.

Unit: V (15 Hours)

Structure and functions of class I and class II MHC, T cell receptor (TCR). Immunology of infectious diseases – tuberculosis, malaria, and AIDS.

Text books:

1. Kuby, Richard A. Goldsby, Thomas J.Kindt, Barbara A. Osborne, (2000), Immunology, IVth Edition, W.H. Freeman and Company.
2. C.V. Rao, (2002), An Introduction to Immunology, Narosa Publishing House, Chennai.
3. K.M.Pavri, (1996), Challenge of AIDS, National Book Trust, India.

References:

1. Ian Tizard, (1995), Immunology: An introduction, Thomson Learning.
2. Roitt, I, (2000), Essentials of Immunology, IV Edition, Blackwell Sci., New York.
3. Roitt.I, Brostoff.J, Male.D, (2001), Immunology, VI Edition, Harcourt publishers Ltd, New York.

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Semester-V

CORE- X: INDUSTRIAL BIOTECHNOLOGY-15UBTC52 **Duration: 75 Hours**
Credits : 5

Objectives:

- To make the students to understand the scope and applications of Industrial Biotechnology.
- To obtain knowledge about the basic fermentors and its types.
- To make the students to know about the innovative microbial food products.

Course Outcome:

- Understand the scope and applications of Industrial Biotechnology.
- Basic knowledge about fermentors and its types for the production of recombinant proteins.
- Knowledge about the innovative microbial food products.
- Explore the methods of potential improvement of efficient strains to increase the yield of microbial products

- Knowledge on immobilization of enzymes and cells and downstream processing of biologicals
- Understand the mechanism for the production of secondary metabolites.
- Understand the importance of single cell protein and single cell oils

Unit: I (15 Hours)

Scope and applications of Industrial Biotechnology- Commercially available Biotech products and their uses. Industrial wastes- Waste management using *Pseudomonas.* Microbial based environmental applications of biotechnology

Unit: II (15Hours)

Bioreactor design, parts, types & functions. Bioprocess control and monitoring variables such as temperature, agitation, pressure and pH. Introduction to large scale production of recombinant proteins (insulin, Biopolymer) using bioreactors.

Unit: III (15 Hours)

Isolation and screening of industrially important microbes, strain improvement, Fermentation and its types, Media formulation and sterilization

Unit: IV (15Hours)

Production of Primary and Secondary metabolites including vitamins (riboflavin production), amino acids (Glutamate production) commercial products (Citric acid, lactate, vinegar), antibiotic production (Penicillin & Bacterial Toxoids). Basic concepts of downstream processing

Unit: V (15 Hours)

Fermented foods-Yoghurt, Butter milk, Cheese. Microbial foods-Single cell protein (SCP), Single cell oils (SCO) -Biofuels

Textbook:

1.Wulf Crueger and Anneliese Crueger. (2000) A Textbook of Industrial Microbiology Punima Publishing Corporation, India.

References:

1. Stanbury P.F., Whittaker A and Hall S.J. (1995) Principles of Fermentation Technology
2. A. H Patel. (1995), Industrial Biotechnology MacMillan Education Limited
3. Paul Prave U., W.C Faust and Wolf Sitting. (1987) Fundamentals of Biotechnology VCH Publishers.

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Semester-V

CORE-XI: ANIMAL BIOTECHNOLOGY-15UBTC53 **Duration: 75 hours**
Credits: 5

Objectives:

- To help students to explore diagnostic method and therapy for mortal diseases
- To expose the students in animal genomics.

- To give knowledge to the students brain with innovative tools of animal transfer methods.

Course Outcome:

- Explore diagnostic method and therapy for mortal diseases.
- Expose to genetic engineering for the production of regulatory proteins, vaccines and hormones.
- Understand the basic principles of animal tissue culture and handling procedures
- Knowledge on the concept of transgenesis and methods of transferring genes using various vectors into the host.
- Understand the fundamentals of animal genomics.
- Basic understanding about genetically modified organisms.
- Understand the ethical issues related to animal biotechnology and to introduce the concepts and importance of intellectual property rights- patents, copyright, tradesecrets, trademark.
- Understand human genome project and gene therapy.

Unit:I (15 Hours)

Introduction about animal tissue culture-washing, sterilization of animal tissue culture glassware and media preparation-primary culture and subculture-Transformation of animal cells.

Unit:II (15 Hours)

Basic tools for animal tissue culture: Cultivation & Maintenance of Fibroblast cell lines, HeLa cell lines, A549, MCF 7, ZR751, Hep G2, -Significance of animal tissue culture.

Unit:III (15 Hours)

Biology of viral vectors.Eg.SV40, Adenovirus, Retrovirus, Vaccinia virus.Baculovirus vectors and its use for biocontrol.

Unit:IV (15 Hours)

Genetic Engineering as applied for the production of regulatory proteins, blood, products, vaccines and hormones.

Unit:V (15 Hours)

Production of transgenic animals.Transgenics in animal biotechnology research.Gene knockout and mice model for human genetic disorder. Gene therapy, Introduction to Human genome project.

Text books:

1. Varun Mehta, (2006), Animal Biotechnology, Campus Books International, New Delhi.
2. Sasidhara R. (2006), Animal Biotechnology, MJP publishers, Chennai.

References:

1. DonMurray C. and Walter, E.Wlest. (1991), Gene transfer and expression protocols, Methods in Molecular Biology, Humana Press.
2. James D.Watson,Michael Gilman,Jan Witkowski;Mark Zoller, Gilman Witkowski, (1993),Recombinant DNA , 2nd Edition.WH Freeman and Co.
3. Bernard R Glick and Jack.J.Pasternack. (2003), Molecular Biotechnology.,American Society for Microbiology.

CORE- XII **Duration: 75 Hours**
LAB IN IMMUNOLOGY& IMMUNOTECHNOLOGY -15UBTC5P **Credits: 5**

Objectives:

- To practice the students in handling of animals, antigen preparation and bleeding techniques.
- To impart the practical knowledge on antigen-antibody techniques.
- To learn the immunodiagnostic techniques of infectious diseases.

Course Outcome:

- Identify the blood groups using antibody specific to each blood group antigens and to study the principle of transfusion
- Knowledge on different types of antigen, hapten, adjuvants and immunization methods to elicit polyclonal antibody production in animals
- Expose to the different immunotechniques for disease diagnosis and identification
- Isolate and separate B and T lymphocytes from total human blood using nylon wool column
- Enumerate WBCs and RBCs from human blood using haemocytometer
- Detect the specific protein (antigen) present in the unknown protein sample using western blotting
- Detect the presence or absence of antigen/antibody present in the unknown sample using ELISA

1) Identification of blood cells and blood grouping
2) Antigen Preparation
3) Immunization and bleeding techniques
4) Preparation of serum and complement
5) Isolation and enumeration of lymphocytes and Rosette assay
6) Antigen- Antibody interactions:
    a. Agglutination
    b. Immunodiffusion- Single immunodiffusion, Double immunodiffusion, Radial imunodiffusion.
    c. Electrophoresis – Classical, Counter Current and Rocket immunoelectrophoresis.
7) Isolation of IgG
8) ELISA
9) Western Blotting

References:

1. Hay, F.C. and O.M.R. Westwood, (2000), Practical Immunology, IV Edition, Blackwell Publishers.
2. Thompson, R.A, (1977), Techniques in clinical Immunology, Blackwell Scientific Publishers.
3. Bhatia, A, (2000), Manual of Practical Immunology, I Edition, Palani Paramount Publication.
4. Talwar G.P, S.K. Gupta, 1992, A Handbook of Practical and Clinical Immunology CBS Publishers & Distributors.

OPTIONAL/ELECTIVE COURSE-II **Duration: 60 hours**
BIOINFORMATICS – 15UBTO51 **Credits: 3**

Objectives:

- To provide students with a practical and the theoretical knowledge of DNA sequences, genomes, protein sequences and protein structure information that will prepare them for careers in bioinformatics, academia, industry and research.
- To understand the vast quantities of data generated in the fields of Molecular and Biological Sciences.
- To help students to acquire problem-solving skills and gain experience in understanding, handling and developing important software used in pharmaceutical, chemical and biotechnology industries.

Course Outocome:

- Practical and the theoretical knowledge of DNA sequences, genomes, protein sequences and protein structure information that will prepare them for careers in bioinformatics, academia, industry and research.
- Understand the vast quantities of data generated in the fields of Molecular and Biological Sciences (databases available for different organisms).
- Problem-solving skills and gain experience in understanding, handling and developing important software used in pharmaceutical, chemical and biotechnology industries.
- Understand the basic algorithms of bioinformatics and to learn with the fundamentals of sequence retrieval and alignment and to study the phylogenetic relationship between the different organisms
- Understand with application of structural biology and molecular docking and to impart knowledge on drug designing.

UNIT: I (12 hours)

Introduction to Bioinformatics – Definitions, Basic concepts, Scope and Applications of Bioinformatics. Genome Project: Human genome project and its current status.

UNIT: II (12 hours)

Biological Databases: Nucleic acid sequence databases – EMBL, GenBank, and DDBJ. Protein Sequence Databases – PIR, Swiss-PROT. Structural Databases – PDB, PubChem. File formats – GenBank, FASTA file formats.

UNIT: III (12 hours)

Sequence Alignment: Pair wise Alignment: Local alignment – BLAST; global alignment - FASTA. Multiple sequence alignment: ClustalW.

UNIT: IV (12 hours)

Phylogenic tree: PHYLIP, Tree constructing Methods: Distance Based Method- the Neighbour joining method. Structure based drug designing. Molecular docking.

UNIT: V (12 hours)

Protein primary structure Analysis (using EXPASY tools): Amino acid composition analysis, Molecular weight, Hydrophobicity and Hydropathy profiles, helical wheel. Protein secondary structure Prediction - GOR method.

Text Books:

1. Bioinformatics sequence and genome analysis, David M. Mount (2009), Gold Spring Harbor Press Publishers, England.
2. Introduction to Bioinformatics, Parry Smith and TK Attwood (2001), 8th edition, Pearson education. UK

Reference:

3. Instant notes on Bioinformatics, T.K.Westhead, VIVA Publishers. New Delhi.
4. Molecular Modeling, Andrew Leach (2003), 2nd Edition. USA.

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Semester-V

OPTIONAL/ELECTIVE COURSE -II **Duration: 60 Hours**
MARINE BIOTECHNOLOGY-15UBTO52 **Credits: 3**

Objectives:

- To make the student understand the major components of sea.
- To enable the students with bioactive compounds from marine environment.
- To enrich the students in areas of Probiotics and transgenic fish.

Course Outcome:

- Awareness on the physical and chemical elements present in Sea.
- Understand the bioactive compounds of the sea.
- Knowledge on the biodiversity of different organisms in marine environment.
- Application of marine organisms for production of antibiotics.

Unit: I (12 Hours)

Introduction to elements of the ocean. The major and minor elements in sea. Dissolved Gases in sea water. Factors affecting dissolved gases in sea. Physical & Chemical characteristic of ocean: Temperature, Depth, Stratification, Salinity, Dissolved Oxygen, Carbondioxide.

Unit: II (12 Hours)

Marine Environment- Buoyancy and Flotation.Barriers and Boundaries. The Planktons-Phtoplankton and Zooplanktons. Mammals in marine environment, The Nekton, Shark and Bony fish. Marine Birds.

Unit: III (12 Hours)

Bioactive compounds from marine organisms-Coral reef, Tunicates, Sponges, Cnidarians, Bryozoans, mollucs.Microbes causing diseases in marine-Aspergillosis,Bacterial Bleaching, Black band disease,White band disease. Commercially important enzymes from marine organisms-Proteases and Chitinases.

Unit: IV (12 Hours)

Introduction to Noncultivable bacterial diversity. Extremophilic microbes: Diverstiy and perspectives. Transgenic Fish. Commercial Fish vaccines and vaccination. Introduction to Bioluminescence.

Unit: V (12Hours)

Molecular Pathology: Development of Antibody and Diagnostic tools to identify different bacterial and viral diseases of Marine organisms.

Textbooks:

1. K.Ramasamy, (2000), Fish Pathology.

References:

1. Fingerman, M.Nagashanam, R. Thompson,(1998),Recent advances in Marine Biotechnology M. Oxford& IBH Publishers.

2. Omum. (1992), The search for bioactive compounds from Microorganisms
3. Kamely, D Chakrabarty,A&Omum, G.S. (1990), Biotechnology and Biodegradation
4. Karl D M. (1995),Microbiology of deep sea hydrothermal vents

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Semester-V

SKILL BASED COURSE-II: **Duration: 30 Hours**
IPR, BIOETHICS & BIOSAFETY -15UBTS51 **Credits: 2**

Objectives:

- To learn Intellectual property rights and productions.
- To learn about patenting, Bioethics, Biopiracy and its importance.
- To learn the application Biosafety and hazards of environmental management.

Course Outcome:

- Importance of Intellectual property rights and productions
- Awareness on patenting, Bioethics, Biopiracy and its importance
- Operation of Biosafety and hazards of environmental management
- Understand about the ethics of cloning and stem cell research
- Knowledge on guidelines of ICMR and DBT

Unit: I (6 Hours)

Introduction to Intellectual Property Rights, Definitions, Intellectual Property Rights and Intellectual Property Productions. WIPO

Unit: II (6 Hours)

Patent: Description claims, patenting strategies, copy rights, Trade secrets, Trade Markets, Plant Variety production.

Unit: III (6 Hours)

Patenting of Biological Materialas: Product patents, importance to inventors, conditions for patenting, patentiong of live forms, and significance of patenting in India.

Unit: IV (6Hours)

Introduction to ethics: Definitions, the scope of Bioethics, ethics of cloning and ethics of stem cell research, Biopiracy, Ethical guidelines of ICMR&DBT.

Unit: V (6 Hours)

Bio safety: Introduction Hazards of environmental engineering, Biosafety guideline of regulations. Operation of Biosafety guideline and regulations.

Text books:

1. Sing K,(2010) IPR on Biotech BCIL, New Delhi.

References:

1. Beier F.K, Crespi R.S and Straus. (1985),Biotechnology & Patent protection Oxford & IBH Publishing Co, New Delhi.
2. WWW.Sjcancer.org/library/userfiles/pdf bioethics

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Semester-V

SKILL BASED COURSE- III: CANCER BIOLOGY -15UBTS52 **Duration: 30 Hours**
Credits: 2

Objectives:

- To make the students understand the basic properties of Cancer
- To give idea about Cancer diagnosis and treatment.
- To understand the basic characteristic features of Stem cells

Course Outcome:

- Mechanisms of transformation of normal cell into cancerous cell
- Understand the physical, chemical and biological agents that causes cancer
- Understand the genes (oncogenes and tumor suppressor genes) involved in cancer progression and termination
- Knowledge on the classical and advance methods of diagnosis of cancer
- Explore the current trends of cancer research such as nanomedicine and therapies available
- Understand the gene silencing process using RNAi technology of cancerous cells

Unit: I (6 Hours)

Introduction: Cancer cells and its properties. Classification of Cancer:Carcinoma-Sarcoma-Leukemia- Lymphoma.Cell cycle-Phases of cell cycle. Carcinogenic agents-Physical, Chemical agents.

Unit: II (6 Hours)

Mechanisms: Chemical carcinogenesis:Initiation, Promotion, Progression. Radiation-Genetic effects of ionizing radiation. Oncogenes and Antioncogenes.Risk factors.

Unit: III (6 Hours)

Cancer epidemiology, inherited susceptibility to cancer. Tumor suppressors-P53 and Retinoblastoma. Genetic instability: Aneuploidy, Tolomere attrition. Tumor metastasis.

Unit: IV (6 Hours)

Diagnosis and Treatment of cancer. Chemotherapy-Classification OF Cytotoxic drugs, Alkylating agents, Platinum drugs. Radiotherapy.

Unit: V (6 Hours)

Current Scenario of Cancer treatment: Nanomedicine-Ormosil, Gold, Silver&Palladium Nanoparticle. Induction of Gene Silencing in Cancer Cells-RNAi Technology.

Text Books:

1. G.P. Jeyanthi (2009), Molecular Biology, MJP Publishers.

References:

1. Ruddon R.W. (1987), Cancer biology 2 nd Edition.OXFORD University press

2. Stella, Pelengaries and Michael khan.(2006) The molecular biology of cancer Blackwell publishers.
3. Old and Primrose, (2000),Principles of Gene Manipulations 6TH Edition, Blackwell Science Publication.

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Semester-VI

CORE- X: RECOMBINANT DNA TECHNOLOGY-15UBTC52 **Duration: 75 Hours**
Credits: 5

Objectives:

- To provide knowledge on the construction of recombinant molecule.
- To help students understand how to transform the recombinant molecule into the desire host.
- To learn the application Such as PCR, Genomic library, DNA Fingerprinting.

Course Outcome:

- Basic principles of recombinant DNA technology and its pros and cons
- Knowledge on the bacterial vectors, viral vectors for the construction of recombinant molecule
- Knowledge on the construction of recombinant molecule and how to transform the recombinant molecule into the desire host
- Knowledge on methods of gene transfer into bacteria, plant, animal
- Knowledge on molecular techniques such as PCR, RFLP, genomic library, DNA fingerprinting and RAPD and to highlight the methods of gene sequencing
- Detect DNA, RNA, Protein by blotting techniques
- Understand the application of rDNA in industrial enzyme production

Unit: I (15 Hours)

Introduction to rDNA technology: Restriction enzymes-Discovery-Types and uses-DNA modifying enzymes-Methylase-Alkaline phosphatase- Topoisomerase. Ligases and Polymerases.

Unit: II (15 Hours)

Cloning vectors and their applications-Plasmid-High and low copy number plasmids-plasmid regulation- Cloning Vector-pBR322, pUC18, M13 phages-Expression vectors-Shuttle vectors- Cosmids-Ti plasmid -Artificial chromosomes-BAC and YAC.

Unit: III (15 Hours)

Gene Cloning-Sticky and Blunt ends-Ligation-Adapators-Linkers-Homopolymer tailing-Cloning host-*E.coli* and Yeast. Genomic and cDNA libraries-construction and applications.

Unit: IV (15 Hours)

Methods of gene transfer into: Bacteria, Plant and Animal-physical and chemical methods. Screening-Alpha complementation-Blue white Selection. Affinity tags and their uses.

Unit: V (15 Hours)

Polymerase chain reaction-types –mechanism and applications. Probes- Radiolabelled and non-Radiolabelled probes. Blotting techniques, DNA sequencing-Sanger-Maxam and Gilbert-Automated sequencing-DNA finger printing and their applications.

Text books:

1. T. A. Brown, (2006), Gene Cloning and DNA Analysis. An Introduction, Blackwell Scientific Publications.
2. Glick, B.R., and Pasternack, J.J., (1998), Molecular Biotechnology, Second Edition ASM Press, Washington, DC.

References:

1. S. B. Primrose and R. M. Twyman, (2006), Principles of Gene Manipulation and Genomics Blackwell Scientific Publications.
2. U.Sathyanarayana, (2005), Text of Biotechnology, Books and Allied (P) ltd.

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Semester-VI

CORE- XI: PLANT BIOTECHNOLOGY-12UBTC53 **Duration: 75 Hours**
Credits :5

Objectives:

- To gain knowledge of Plant Genome Organization organelles organization.
- To study the perception of Plant Tissue Culture and the techniques involved.
- To learn Plant Genetic engineering and their application Such as Plantibodies, Improved Nutritional Content.

Course Outcome:

- Knowledge of Plant Genome Organization organelles organization.
- Perception of Plant Tissue Culture and the techniques involved.
- Knowledge on the regulation of gene expression in plant development
- Basic concepts of plant genetic engineering and its application such as edible vaccines, plantibodies, improved nutritional content resistance to bacterial, fungal and viral infections
- Influence of plant hormones in plant tissue culture
- Understand the molecular mechanism of agrobacterium mediated gene transfer and to study the plant-pathogen interaction
- Basic knowledge on gene silencing using RNAi technology

Unit:I (15 Hours)

Structural features of a higher plant gene-Gene families-Chloroplast organization-Photosystem I & Photosystem II -Mitochondrial genome organization-Cytoplasmic male sterility

Unit:II (15 Hours)

Planthormones-CultureMedia-Sterilization-Totipotency-Dedifferentiation-rediferrentiation-Micropropagation-Somatic embryogenesis-Somoclonal variation-Somatic hybridization-Types of culture-Callus, Suspension, Protoplast and anther culture.

Unit:III (15 Hours)

Natural genetic Engineers and their use in the development of transgenic plants (*Agrobacterium tumefaciens*) -Ti plasmid vector- plant viral vector- Direct transformation by physical methods -Symbiotic nitrogen fixation in legumes by Rhizobia.

Unit:IV (15 Hours)

Selectable markers-reporter genes-promoters. Transgenic plants engineering for resistance to Bacteria, fungi, pest, Herbicide. Delay of fruit ripening. Golden rice.

Unit:V (15 Hours)

Gene silencing -Terminator gene technology -Plantibodies-edible vaccines-Plant as a bioreactor- -Modification of improved nutritional content.

Text Books:

1. Greison and S.Covey, (2001),Plant Molecular Biology, Blackie
2. Purohit, S.S., (2003) ,Agricultural Biotechnology Agrobios India.

References:

1. A.Slater., N.Scott and M.Flower (2003),Plant Molecular Biology and Biotechnology Oxford university press. Oxford.
2. P.J. Lea and R.C..Leegood (1993), Plant Biochemistry and Molecular biology John Wiley &Sons.
3. Ignacimuthu, S. (1996),Applied Plant Biotechnology, Tata McGrawhill

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Semester-VI

CORE- XV: **Duration: 75Hours**
LAB IN RECOMBINANT DNA TECHNOLOGY-15UBTC6P **Credits: 5**

Objectives:

- Perform DNA Isolation at different levels of organisms.
- Hands on experience at PCR, plasmid isolation techniques
- Handling techniques in Recombinant DNA technology

Course Outcome:

- To perform DNA isolation from different organisms such as plant, bacteria and human blood.
- To study the transformation of recombinant DNA into bacteria
- To amplify the gene of interest by polymerase chain reaction (PCR)
- To perform the cloning of the gene of interest in vector and screening of the recombinants and non recombinants
- To identify the gene of interest by southern hybridization
- To identify the protein of interest by western blotting
- To provide hands on experience on molecular techniques to every students.

1. Isolation of DNA from Bacteria, Plant and blood.
2. Agarose Gel Electrophoresis
3. Isolation of Plasmid DNA.
4. Restriction Digestion and ligation
5. Transformation and Blue-white screening using IPTG and X –Gal in E.coli.
6. Polymerase Chain Reaction.

References:

1. Joseph Sambrook, David N Rusell, Joe Sambrook, (2001)Molecular Cloning : A Laboratory Manual (3-Volume set) Cool Spring Harbor press.
2. Bernard Perbal, (1988), A Practical guide to Molecular Cloning, Wiley-Interscience.
3. Fred M.Ausbel, Rogerbrent, Robert E.Kingston, David D. Moore.J.G.Seidman, John A.Smith Kevinsgruhl, (2002) Current Protocolos in Molecular Biology, John Wiley and Sons. Inc.

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Semester-VI

CORE- XVI : LAB IN PLANT TISSUE CULTURE-15UBTC6Q **Duration:75 hours**
Credits : 5

Objectives:

- To give practical knowledge of plant tissue culture
- To provide the students knowledge on the techniques involved in plant tissue culture.
- To give training on generation of *in vitro* propagated plants

Course Outcome:

- Basic knowledge of plant tissue culture such as surface sterilization, media preparation, contamination and other handling procedures
- Understand the techniques involved in plant tissue culture & to generate *in vitro* propagated plants
- Knowledge on hardening techniques
- Handling skills for agrobacterium mediated gene transfer and host–plant pathogen interactions
- Isolation and purification of protoplasts
- Hands on experience to all students
- Importance of marketing the plants from plant tissue culture

1. Preparation of plant tissue culture media(MS,B5 and Nitch and Nitch medium) Stock and Hormone preparation (2,4-D,NAA,BAP)
2. Surface Sterilization.
3. Micropropagtation
4. Callus induction
5. Anther Culture
6. Regeneration of Shoots and roots.
7. Hardening
8. Isolation and purification of protoplasts.
9. Immobilisation of callus/ plant tissues.

References:

1. Plant tissue culture, Techniques and Experiments. Robert H.Smith (2000) Elsevier Science and technology Books.
2. Pal Maliga,Daniel F K Lessug Anthony R, Loil helm Gruissm and Joseph E varner Cold (1994.)Methods in plant Molecular Biology. A Laboratory Course Manual, Spring Harbour Laboratory press.

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Semester-VI

OPTIONAL/ELECTIVECOURSE-III **Duration: 60 Hours**
STEM CELL BIOLOGY-15UBTO61 **Credits: 3**

Objectives:

- To make the students understand the basic properties of Stem Cells.
- To enrich the students in characterization and Differenciation of Stem cells.

Course Outcome:

- Understand the properties and types of stem cell.
- Knowledge about the techniques used for studying stem cell.
- Application of stem cell biology in medicine.
- Justify the ethical consideration of stem cell research.

Unit: I (12 Hours)

Stem cell concept – Properties of stem cell – Types of stem cell embryonic stem cell – Adult stem cells – Problem of differentiation.

Unit: II (12 Hours)

Differentiation status of cells – Primordial germ cell -Skin cell - Gastrointestinal cells – Embryonic stem cell differentiation as a model to study haematopoetic and endothelial cell development.

Unit: III (12 Hours)

Stem cell location and Classification – Neural stem cells – Stem cell niches – Germ line Epithelial and Epidermal and neural niches.

Unit: IV (12 Hours)

Uses of Stem cells - Human stem cells – Renewal of stem cells- Stem cells and Tissue engineering –Embryonic stem cells and Gene therapy - Therapeutic cloning.

Unit: V (12 Hours)

Single-Cell PCR methods for studying stem cells – Ethical and Social consideration of Stem cell Research

References:

1. Kursad Turksen,(2012), Embryonic Stem Cells Method and Protocols,Humana press,.
2. Russell Korobkin and Stephen R. Munzer,(2007), Stem Cell Century, Law and Policy for a Breakthrough Technology,Yale University Press.
3. Robert Lanza, (2005), Essential of Stem cell Biology, Elsevier press.
4. Robert Lanza, (2007), Hand Book of Stem Cells Volume 1&2, , Elsevier press.

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Semester-VI

OPTIONAL /ELECTIVE COURSE - III: **Duration: 60 Hours**
BIOCHEMICAL TECHNIQUES-15UBTO62 **Credits: 3**

Objectives:

- To understand principles of instruments.
- To learn the techniques of collecting biological signals using basic sensors.
- To provide complete information on instruments of biological research.

Course Outcome:

- Basic principles of biological instruments such as microscopy, flow cytometry
- Knowledge on chromatographic, electrophoretic, spectroscopic and radioisotopic techniques for analysis of biological compounds
- Application of instruments for the biological research
- Techniques of two dimensional gel electrophoresis and MALDI-TOF.
- Information on immunotechniques for disease diagnosis and identification.

Unit:I (12 Hours)

Microscopic Techniques: Principles and Applications of Light, Phase Contrast, Fluorescence Microscopy, Scanning and Transmission Electron Microscopy, Confocal Microscopy, Cytophotometry and Flow Cytometry, patch clamping, advances of microscopy. Centrifugation: Preparative and Analytical Centrifuges, Sedimentation analysis RCF, Density Gradient Centrifugation.

Unit:II (12 Hours)

Chromatography Techniques: Principles sand Application of Paper Chromatography, TLC, GelFiltration Chromatography, Ion Exchange Chromatography, Affinity Chromatography, GLC and HPLC.

Unit:III (12 Hours)

Electrophoretic Techniques: Principles and Application of Gel Electrophoresis, 2DE: Iso-electric Focusing & PAGE, Immuno diffusion, Immuno Electrophoresis, ELISA , Southern , Northern and Western Blotting .

Unit:IV (12 Hours)

Spectroscopic Techniques :Principles and Application of UV and Visible Spectroscopy, Fluorescence Spectroscopy, MS, NMR, ESR, Atomic Absorption Spectroscopy, X- ray Spectroscopy, Raman Spectroscopy , MALDI TOF

Unit :V (12 Hours)

Radio-isotopic Techniques: Introduction to Radioisotopes and their Biological Applications ,Radioactive Decay – Types and Measurement, Principles and Applications of GM Counter , Solid and Liquid Scintillation Counter, Autoradiography, RIA .

Text books

1. Wilson K.,and amp, J. Walker, Eds (2005), Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press
2. Kensal E Van Hold, Curtis Johnson, Publishing Ho (2005) Principles of Physical Biochemistry, Second Edition Prentice hall

References:

1. Avinash Upadhyay, Kakoli Upadhyay, Nirmalendu Nath, (2005) Biophysical Chemistry (Principles and techniques) Student Edition(8),Himalaya Publishers, India
2. John F. Robyt, Bernard J. White (1990) Biochemical techniques: Theory and practice First edition, Wave land press, Inc.
3. Dauglas A Skoog (1985) Principles of instrumental analysis, third edition , Saunders college publishers.

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Semester-VI

SKILL BASED COURSE-IV: FUNCTIONAL GENOMICS -15UBTS61 Duration: 30 hour
Credits: 3

Objectives:

- To provide students with a theoretical knowledge of Proteome and genomes.
- To help the students to understand the various proteomic and genomic analysis techniques.
- To enable students to acquire problem-solving skills and gainon techniques used in biotechnology, pharmaceutical, chemical and industries.

Course Outcome:

- Theoretical knowledge of Proteome and genomes
- Understand the various proteomic and genomic analysis techniques
- Understand the principle of DNA sequencing and mapping of the genome
- Acquire problem-solving skills and gain experience used in biotechnology, pharmaceutical, chemical and industries
- Applications of DNA array and protein array
- Basic concepts of pharmacogenomics in the identification of drug targets

Unit:I (6 Hours)

Definition Genomics. Construction of genetic maps; Physical maps, RFLP, FISH to identify chromosome landmarks. Human genome project.

Unit:II (6 Hours)

DNA sequencing: Chemical, enzymatic and automated DNA sequencing and sequence assembly, sequence annotation.

Unit:III (6 Hours)

DNA Micro array: Basic principles and design, Applications. cDNA oligonucleotide micro array. Genotyping/SNP detection; Detection technology; Computational analysis of micro array data.

Unit:IV (6 Hours)

Overview of protein structure-primary, secondary, tertiary and quarternary structure; Identification and analysis of proteins by 2D analysis; Yeast two hybrid system, Phage display; Protein interaction maps; Protein arrays-definition, applications- diagnostics, expression profiling.

Unit:V (6 Hours)

Proteomics and drug discovery; High throughput screening for drug discovery; Identification of drug targets; Phylogenetics, Metabolomics. Mass spectrometry and HPLC Principle, instrumentation and application.

References:

1. Genomes, Brown TA(Genomes) , 3rd Edition, Garland Science. UK
2. Principles of Gene Manipulation and Genomics, Primrose S & Twyman R (2006), 7th Edition, Blackwell publishers. UK
3. Molecular Biotechnology, Glick BR & Pasternak JJ, (1998)3rd Edition, ASM Press, Washington.

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Semester-VI
VALUE BASED COURSE-II: NANOBIOTECHNOLOGY -15UBTV61 Duration: 30 Hours
Credits: 1

Objectives:

- To understand the different approaches of nanoparticle synthesis.
- To make the students familiar with biological synthesis of nanoparticles.
- To make the students understand the methods of characterizing nanoparticles.

Course Outcome:

- Understand the basic concepts and historical aspects of nanotechnology
- Understand the different physical, chemical and biological methods of synthesis of nanoparticles
- Characteristic analysis of nanoparticles using UV spectrometry, microscopic techniques such as SEM, TEM and X-ray diffraction
- Applications of nanoparticles in anticancer, antiangiogenic, drug delivery and imaging
- Understand the scope of nanomedicine in near future

Unit: I (6 Hours)

History and Scope.Background and definition of Nanotechnology. Scientific revolutions. Properties of Nanoparticles. Nanosized particles, crystal structure. Nanoscalar- molecular and atomic size.

Unit: II (6 Hours)

Synthesis of Nanoparticles using Bottom up and Top Down approaches. Chemical Precipitation and reduction methods. Sol gel method, Sonochemical synthesis. Physical methods: Ball Mining, Physical Vapour deposition, Chemical Vapour deposition, Sputter deposition.

Unit: III(6 Hours)

Synthesis of Nanoparticles using Biological Sources- Plant, Microorganism, Bacteria,Mushrooms and Fungi.

Unit: IV (6 Hours)

Characterization Techniques: X-ray diffraction and Energy dispersive X ray analysis. Scanning Electron Microscopy and Transmission Electron Microscopy. Atomic force microscopy and Scanning tunneling microscopy.

Unit: V (6 Hours)

Applications of Nanoparticles: Anticancerous, antioxidant and antiangiogenic activities of Nanoparticles. Nanomaterials in drug delivery and therapy. Nanomedicine.

Text Books

1. Introduction to Nanotechnology, Chareles P.poole jr. and frank J. Owens, Wiley inter science.

2. Nanotechnology Principles and Practices by Sulabha K.Kulakarni.

3. Essentials of Nanotechnology 2009 by Jeremy ramsden, Jeremy ramsden and Ventus Publishing,

References

1. Nanoscience, Nanobiotechnology and Nanobiology, 2010. Patrick Boisseau,Marcel Lahamani, Springer Heldelberg Dordrecht London New York,

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Semester-VI

PART- IV: ENVIRONMENTAL STUDIES-12UESR61 **Duration: 30 Hours**
Credits: 1

Objectives:

- To understand that living and non living things are interlinked from Micro to macro level as an unbroken chain from sun to soil.
- To provide the knowledge about the general aspects of eco system and their structure.
- To acquaint the students with details of diversity of animals and plants and their conservation.

Course Outcome:

- Understand that living and non living things are interlinked from micro to macro level as an unbroken chain from sun to soil
- Knowledge about the general aspects of eco system and their structure
- Details of diversity of animals and plants and their conservation
- Core concepts and methods from ecological and physical sciences and their application in environmental problem solving.
- Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.
- Address the lethal impact of global warming and control measures.

Unit: I (6 Hours)

Structure of earth and its components: Atmosphere, Lithosphere, Hydrosphere and Biosphere. Renewable and nonrenewable resources- Forest, water, energy resources.

Unit: II (6Hours)

Concept of an ecosystem-Structure and function-Energy flow in the ecosystem-Food chain and food web, Ecological pyramids-types. Bio geo chemical cycle-carbon, water and nitrogen cycle.

Unit: III (6Hours)

Introduction, definition- genetic, species, and ecosystem diversity-Threats to bio diversity-Conservation of Bio diversity-Insitu, Exsitu conservation. India as mega diversity

nation- Hot spots of bio diversity-bio geo graphical distribution-Endangered and endemic species of India.

Unit: IV (6Hours)

Definition, causes, effects and control measures of Air, Water, Noise, soil, nuclear pollution. Global issues- Global warming, acid rain, Ozone layer depletion.

Unit: V (6Hours)

Sustainable development-sustainable agriculture, organic farming, water conservation-rain water harvesting and waste recycling-solid waste management. Population explosion- family welfare programme- Environment and human health-HIV/AIDS.

Text Books:

1. Dharmaraj, J. (1995), Text book of Environmental studies, S. Chand & Co. New Delhi.
2. Anubha Kaushik., (2007), Text book of Environmental studies, Books and Allied (P) Ltd. Kolkata.

References:

1. Agarwal, K.C. (2001), Environmental Biology, Nidi publication Ltd,Bikaner.
2. Odum, E.P. (1971), Fundamentals of ecology, W.B. Saunders Co. USA.
3. De, A.K. (2001), Environmental chemistry, Wiley Eastern Ltd, New York.
4. Miller, T.G. (2004), Environmental sciences, Wadsworth Publishing Co, New Delhi.