VIVEKANANDHA

COLLEGE OF ARTS AND SCIENCES FOR WOMEN

[AUTONOMOUS]

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Periyar University
(Approved by AICTE and Re-accredited with „A“ Grade by NAAC)Recognized Under 2(f)
and 12 (b) of UGC Act, 1956.
Elayampalayam, Tiruchengode-637 205, Namakkal Dt., Tamil Nadu, India

DEPARTMENT OF BIOTECHNOLOGY

SYLLABUS

SPONSORED BY ANGAMMAL EDUCATIONAL TUST
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VEERACHIPALAYAM – 637 303, SANKARI Tk., Salem Dt., Tamil Nadu

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M.Sc., BIOTECHNOLOGY

CHOICE BASED CREDIT SYSTEM

(For the students admitted from the year 2014-2015 onwards)

SEMESTER	PAPER CODE	COURSE	COURSE/ TITLE	Hrs	Credit	Marks		
						CIA	EA	TOTAL
I	14P1BT01	Core I	CELL & MOLECULAR BIOLOGY	5	5	25	75	100
	14P1BT02	Core II	BIOCHEMISTRY	5	5	25	75	100
	14P1BT03	Core III	MICROBIOLOGY	5	5	25	75	100
	14P1BTE01	Elective-I	BIOPROCESS AND MICROBIAL TECHNOLOGY	5	4	25	75	100
	14P1BTP01	Core Practical I	LAB IN CELL & MOLECULAR BIOLOGY AND BIOCHEMISTRY	5	3	40	60	100
	14P1BTP02	Core Practical II	LAB IN MICROBIOLOGY, BIOPROCESS AND MICROBIAL TECHNOLOGY	5	3	40	60	100
	TOTAL			30	25	180	420	600
II	14P2BT04	Core IV	IMMUNOLOGY & IMMUNOTECHNOLOGY	5	5	25	75	100
	14P2BT05	Core V	GENETIC ENGINEERING, IPR &BIOETHICS	5	5	25	75	100
	14P2BT06	Core VI	BIOSTATISTICS & BIOINFORMATICS	5	5	25	75	100
	14P2BTE02	Elective-II	BIOPHYSICS	5	4	25	75	100
	14P2BTP03	Core Practical III	LAB IN IMMUNOLOGY AND IMMUNOTECHNOLOGY	5	3	40	60	100
	14P2BTP04	Core Practical IV	LAB IN GENETIC ENGINEERING &BIOINFORMATICS	5	3	40	60	100
	TOTAL			30	25	180	420	600

SEMESTER	COURSE CODE	COURSE	COURSE TITLE	Hrs	CREDIT	Marks		
						CIA	EA	TOTAL
III	14P3BT07	Core VII	Plant Molecular Biology and Biotechnology	5	5	25	75	100
	14P3BT08	Core VIII	Animal cell culture Technology	5	5	25	75	100
	14P3BTE03	Elective III	Genomics and Proteomics	5	5	25	75	100
	14P3AMBED1	EDC	Medical Laboratory Technology	4	4	25	75	100
	14P3BTP05	Core Practical V	Lab in Plant Molecular Biology and Biotechnology	5	3	40	60	100
	14P3BTP06	Core Practical VI	Lab in Animal Cell Culture Technique	5	3	40	60	100
	14P3HR01	Value education	Human rights	1	1	25	75	100
	Total			30	26	205	495	700
IV	14P4BT09	Core IX	Nano Biotechnology	5	5	25	75	100
	14P4BTE04	Elective IV	Research Methodology And Environmental Biotechnology	5	5	25	75	100
	14P4BTPR01	Project	Project & Viva Voce	20	5	40	60	100
	TOTAL			30	15	90	210	300
GRAND TOTAL				120	91	655	1545	2200

CORE PAPER - I

CELL & MOLECULAR BIOLOGY

PAPER CODE: 14P1BT01 **Total Hours: 60**

hoursCREDIT : 5 Hrs/Week: 5 hours

Subject description

This paper provides a thorough knowledge about structure and function of cells, cellular energetic, protein trafficking, bio molecules and cellular development.

Goal

Students after completion of this paper will be exceptionally well prepared to pursue careersin cellular and sub cellular biological research, biomedical research, or medicine or allied health fields

Objective

Understanding the structural and functional aspects of the cell provides the student with a strong foundation in the molecular mechanisms underlying cellular function

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UNIT	CONTENT	HOURS
I	**Cell theory**; Types of cells; Ultra structure of prokaryotic and eukaryotic cells and its intracellular organelles – Nucleus & Chromosomes, Mitochondria, Chloroplast, Endoplasmic reticulum, Ribosomes, Golgi complex, Vacuoles, Peroxysomes, Lysosome and Microbodies. Fractionation & Purification of subcellular organelles	**12**
II	**Cytoskeleton**: Cell motility and Cellular movements, Microtubules, Microfilament. Structure and functions of plasma membrane: cell recognition and cell to cell signaling. Specialized cell structure and function (Muscle cell, nerve cell & motile cell).	**12**
III	**Cell cycle and molecular events in mitosis & meiosis.** Mitochondrial electron transport system, oxidative reactions in microbodies, pathways of photosynthesis – light & dark reactions.	**12**
IV	**Nucleic acids** (DNA and RNA). DNA replication. Central dogma of life. RNA transcription and processing, interaction of mRNA, rRNA and tRNA on proteinsynthesis. Post translational modification. Protein localization: Protein targeting to various organelles and secretion of proteins by exocytosis, receptor mediated endocytosis. Regulation of gene expression: Lac and Trp operon concept.	**12**
V	**Homologous recombination** - Holiday junction. Developmental pattern of Drosophila & Arabidopsis. Homeotic genes in development. Spatial and temporal regulation of gene expression. Cancer: characteristics & causes, oncogenes and tumour suppressor genes.	**12**

References

Text Books

1. Ajay, P. (2007). Text Book of Cell and Molecular Biology. 2nd edition. Books and Allied (P) Ltd.
2. Bruce, A. Alexander, J. Julian, L. Martin, R. Keith, R. and Peter, W. (2002). Molecular Biology of the Cell. 4th edition. New York: Garland Science.
3. Darnell, J. Lodish, H. and Baltimore, D. (1990). Molecular Cell Biology. 2nd edition, Scientific American Books Inc.
4. David, A. D. Harvey, A. M. and James, W. Plant Mitochondria.
5. Gardener, E.J. Simmons, M.J.and Snustad, D.P. (2006). Principles of Genetics. 8th edition, John Wiley and Sons Publications.
6. Hancock, J.T. (2008). Molecular Genetics. Viva Books Pvt. Ltd.
7. Karp, G. (2008).Cell and Molecular Biology. 5th edition, John Wiley and Sons Inc. Hardcover, ISBN: 978-0-470-04217-5.
8. Lodhish, H. (1995). Molecular cell Biology. WH Freeman and Co., New York.
9. Malacinski, G.M. and Freifelder, D. (1998). Essentials of Molecular Biology. 3rd edition, Jones and B. Artlet Publisher Inc., London.
10. Peter, J. R. (2006). Fundamentals of Genetics.
11. Pragya, K. Cell and Molecular Biology.
12. Roberties, E.D.P. and Roberties, E.M.F. (1998). Cell Biology and Molecular Biology. K. M. Verghese and Company.
13. Tamarin, R.H. (2004). Genome to function - Principles of Genetics. Tata McGraw-Hill Publishing Comp. Ltd.
14. Veer Bala, R. Fundamentals of Molecular Biology.
15. Veer Bala, R. Molecular Biology of gene.
16. Verma, P.S. and Agarwal, V.S. (1986). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand and Company, New Delhi.
17. Watson, J.D.T.A. Baker, S.P. Bell, A. Gann, M. and Levine, R.L. (2004). Molecular Biology of the Gene. 5th edition. Pearson Education Inc.

Publications

1. Gupta, P.K. (2004). Biotechnology and Genomics. Rastogi Publications.
2. Malacinski, G.M. (2002). Essentials of Molecular Biology. Jones and Barlett Publishers.

SEMESTER I
CORE PAPER – II-BIOCHEMISTRY

PAPER CODE : 14P1BT02 **Total Hours: 60 hours**

CREDIT : 5 **Hrs/Week : 5**

hours

Subject description

This paper presents the study of identification and quantitative determination of the substances, studies of their structure, determining how they are synthesized metabolized and degraded in organisms, and elucidating their rile in the operation of the organism.

Goal

This paper in biochemistry has been designed to provide the student with a firm foundationin the biochemical aspects of cellular functions which forms a base for their future research.

Objective

On the successful completion of the course the students will get an overall understanding of structure of atoms, molecules and chemical bonds, enzyme kinetics, bio polymers and metabolic reactions in a living system.

UNIT	CONTENT	HOURS
I	**Concepts of pH-** Acids, Bases and buffers of biological importance**.Thermodynamics** – Laws, Concept of free energy and standard free energy, energy rich bonds, Biological energy transducers, Energy metabolism – exergonic, endergonic and coupled reactions.	**12**
II	**Carbohydrtes -** Classification, structure, functions and reactions of carbohydrates, Metabolism of carbohydrates- Glycolysis, Gluconeogenesis, Glycogensis, Glycogenolysis, HMP shunt, TCA, and glyoxylate cycle.	**12**
III	**Proteins -** Classification and structure of amino acids, peptides and poly peptides, classification and functions of Proteins, Protein architecture. Metabolism of aminoacids Transamination, Deamination.	**12**
IV	**Lipids -** Classification, Structure, functions and reactions of Lipids. Biosynthesis of saturated fatty acids, Triglycerides, phospholipids and Sterols, Catabolism of Fatty acids – Oxidation. Structure and functions of Glycolipids and Lipoproteins. **Nucleic acids -** Classification, structure, functions and reactions. Biosynthesis of Purines and pyrimidines – Denovo and Salvage pathway, Degradation of Purines and Pyrimidines	**12**
V	**Enzymes -** Classification and nomenclature. Active site. Theories of enzyme - substrate complex formation. Factors affecting enzyme activity. Michaelis Menten equation and its transformations. Enzyme inhibition: Reversible – Competitive, Noncompetitive, uncompetitive, Irreversible inhibition. Coenzymes – structure & functions. Isoenzymes – LDH, Allosteric enzymes, and abzymes. Mechanism of action of Lysozyme.	**12**

References

Text

Books

1. Homas, M. Devlin, H.J. (2006). Text book of Biochemistry with clinical Correlations. Wiley and sons publications. 6th edition.
2. Murray, R.K. Granner, D.K. Mayes, P.A and Rodwell, V.W. (1993). Harpers Biochemistry. Practise Halt International.
3. Smith et al., (1998). Principles of Biochemistry. McGraw Hill International book Company, 8th edition.
4. Stryer. 2002. Biochemistry. 5th edition.
5. Zubay, Biochemistry. WCB Publishers. 4th edition,
6. . Satyanarayana, U. (2008). Biochemistry. Books and Allied (P) Ltd., Kolkata.
7. Dubey, R.C. Biochemistry. S. Chand Publications.

Publications

1. Lehninger, Nelson, Cox. (2005). Principles of Biochemistry. CBS publishers.
2. Voet et al., (2000). Fundamentals of Biochemistry. Jhon Wiley and Sons Inc.

SEMESTER –I
CORE PAPER-III-MICROBIOLOGY

PAPER CODE: 14P1BT03 **Total Hours: 60 hours**
CREDITS : 5 **Hrs/Week : 5**
hoursSubject description

This course presents the types, morphology, biochemical, physiological characteristics of microorganisms.

Goals

To make the student to understand the concept of the biology of Microorganisms.

Objectives

On successful completion of the subject, student should have to understand history and development of Microbiology and Taxonomy. Basic concepts in cultivation of bacteria and Microbial physiology.

UNIT	CONTENT	HOURS
I	**History of Microbiology:** Biogenesis, Discovery of role of microbes in causation of disease, pure culture, Koch Postulates. Microscopy: Light Microscope – Bright- field, phase contrast, fluorescent. Electron Microscope: TEM and SEM. Staining – simple, Differential stain: Gram's, Acid fast. Special stain – capsule, spore. Applicationsof Microbiology.	12
II	**Classification of microorganisms:** Five kingdom system Classification of bacteria – Bergey's system(prokaryote). Morphology: Morphology of bacterial cells, Pichia, Yeast and Algae. Structure and functions of bacterial cell. Mechanism of transport in bacterial cell. Molecular characterization-16Sr RNA	12
III	**Methods in Microbiology:** Methods of culturing bacteria, – Aerobes and Anaerobes, pure culture and its maintenance, culture characteristics. Screening of Pichia, Yeast and Algae. Microbial growth – microbial nutrition, nutritional requirements and nutritional classification. Growth - Measurement of growth, growth curve. Culture media – preparation and types of media. Sterilization – Physical and Chemical methods.	12
IV	**Medical Microbiology:** Bacterial diseases (Tuberculosis, Cholera, Typhoid, Syphilis), Viral diseases (Dengue fever, Hepatitis – B, AIDS), Fungal diseases (Candidiasis, Dermatophytosis), Protozoan disease (Malaria).	12
V	**Microbial Ecology:** Biogeochemical cycles – Carbon, Carbon Sequestration, Nitrogen, Phosphorous and Sulphur. Nitrogen fixation. Microbial Interactions – symbiosis, amensalism, competition, parasitism and predation.	12

References

Text Books

1. Ananthanarayan, R and Jayaram Paniker, C.K. (2000). Text book of Microbiology. 6th edition, Orient Longman Limited, Chennai.
2. Cerald, J.T. Berdell, R.F. and Christine, I. (1955). Microbiology- An Introduction. 5th edition, The Benjamin/ Cummings Publishing Co. Inc., USA.
3. Dubey, R.C and Maheswari, K. A text book of Microbiology. S.Chand Publications, New Delhi.
4. Larry, M. and Judy, K. (1996). Microbiology: Essential and Applications. 2nd edition, McGraw Hill Inc.
5. Prescott, Harley, Klein. (1999). Microbiology. 4th edition. McGraw Hill Inc.
6. Roger, Y. Stanier. J. Ingraham, Mark. I. Wheelis, I. and Page R. P. (1986). Microbiology. 5th edition, Macmillion Press Ltd, Hampshire.

Publications

1. Jacquelyn, G.B. (2008). Microbiology- Principles and explorations. John Wiley and sons Ltd.
2. Michael, J. Pelczar, J.R. Chan, E.C.S. and Noel, R.K. Microbiology, TATA McGraw-Hill publication.

SEMESTER – I
ELECTIVE-I-BIOPROCESS & MICROBIAL TECHNOLOGY

PAPER CODE: 14P1BTE01 **Total Hours: 60 hours**
CREDIT : 5 **Hrs/ Week: 5 hours**

Subject description

The Bioprocess Technology is designed to prepare individuals to work as Process Operators in biological products manufacturing facilities. Students will combine basic science and communication skills, manufacturing technologies, and good manufacturing practices in the course of study. The Microbial technology presents the principles and applications of microorganism for the production of useful biological materials.

Objectives

To develop a strong basic science foundation with a sound understanding of the major technologies employed by the industry. They will also be expected to develop collaborative and disciplined work ethics while consistently practicing problem-solving skills.

Goal

Upon successful completion of the program, individuals should posses the necessary skills to qualify for employment in a variety of Bioprocessing industries. To learn various microbial Biotechnology applications.

UNIT	CONTENT	HOURS
I	**An introduction to fermentation process**. Isolation of industrial important microorganisms- direct isolation method, enrichment culture method-general and special enrichment system. Screening of industrial important microorganisms-primary screening, secondary screening, Strain improvement-physical, chemical, biological method. Immobilization techniques-cell and enzyme.	10
II	**Media formulation**- nutritional requirement of microorganisms, Types of fermentation – Batch, Fed batch and Continuous. Sterilization of fermentation media - Batch and Continuous. Inocula development-criteria, development of inocula for bacterial process. Types and Designing of fermentor and Scale-up, Instrumentation for Monitoring and Controlling Bioreactors-Computer aided control and Monitoring, Photo bioreactors.	15
III	**Downstream Processing** – Disruption of Microbial Cells, Centrifugation, Filtration of Fermentation Broths, Cell Processing & Cell separations, Ultrafilteration, Liquid- Liquid Extraction, Chromatography - Ion Exchange, Molecular Sieve, Affinity, HPLC. Distillation, Fluid Extraction & Electrodialysis.	10
IV	**Production of industrially important products**: Enzymes – Amylase, Lipase and Cellulase. Beverages – Wine, Beer and Whisky. Dairy products – Cheese and yogurt. Production of SCP. Mushroom –types and cultivation. Spirullina-Production and cultivation. Biofertilizer- Rhizobium and Azolla.	10
V	**Industrial Biotechnology** – Microbial synthesis of commercial products – Amino acids – Lysine, Glutamic acid. Vitamins – B_2 and B_{12}. Antibiotics – Penicillin, Tetracycline and Streptomycin. Organic acids – Acidic acid and citric acid, Organic Solvents- Methanol and Ethanol.	15

References

Text Books

1. Peter F.S. Principles of Fermentation technology. Butterworth-Heinmann Science Ltd.
2. Crueger, W. and Cruger, A. Biotechnology: A Text Book of Industrial Microbiology. Science Tech Publishers, USA.
3. Sathyanarayana, U. Biotechnology. Books and Allied (Pvt) Ltd.
4. Moo-Young, M. Comprehensive Biotechnology. 1-4 Volumes, Pergamon Press Ltd.
5. Glazer et al. (1995). Microbial Bitechnology. W.H. Freeman and Co., New York.
6. Dubey, R.C. Text Book of Biotechnology.

Publictions

1. Patel, A.H. Industrial Microbiology, MacMillan Publishers.
2. Casida. (2006). Industrial Microbiology, New age Publishers.

CORE PRACTICAL- I
LAB IN CELL & MOLECULAR BIOLOGY AND BIOCHEMISTRY

PAPER CODE : 14P1BTP01 **Total Hours: 60 hours**
CREDIT : 3 **Hrs/Week : 5 hours**

Subject Description

This course deals with the study of biochemical analysis of various biomolecules.

Goals

To learn the various techniques in Cell Biology and biochemistry for the study of biomolecules.

Objectives

After the successful completion of the course the students will be aware of various biochemical analysis.

CONTENT

Cell Biology

1. Microscopy and usage of Pointer and Camera Lucida.
2. Micrometry – Stage and Ocular micrometer
3. Demonstration of various stages of mitosis using onion root tip
4. Demonstration of various stages of meiosis using grasshopper testis squash
5. Preparation of Buccal Smear squash.
6. Observation of specialized cells

Molecular Biology

7. Isolation of genomic DNA from microbes and separation by Agarose gel electrophoresis
8. Isolation of genomic DNA from plant cells by using CTAB and SDS.
9. Isolation of genomic DNA from animal cells
10. Separation of proteins by Native PAGE and SDS - Polyacrylamide gel electrophoresis(SDS-PAGE)
11. Staining of proteins by Coomassie Brilliant blue and determination of molecular weight of the unknown protein

Biochemistry

12. Principles of Colorimeter, UV-Visible spectrophotometer-Beer Lamberts Law verification by Copper Sulphate
13. pH meter Calibration and preparation of Borate buffer
14. Estimation of DNA by Diphenyl amine method and RNA by Orcinol method
15. Estimation of proteins –Lowry‟s method
16. Estimation of sugars – Anthrone‟s method
17. Separation of amino acids by Paper chromatography (circular and ascending) & TLC

References

1. Boyer. (2000). Modern Practical Biochemistry.
2. Jayaraman, J. (2007). Practical Biochemistry.
3. Palanivelu, P. (2001). Analytical biochemistry and separation techniques- A Laboratory Manual, 2nd edition. Tulsi book centre publication, Madurai, Tamilnadu.
4. Sadasivam., et al. (1991). Practical Biochemistry.
5. Sambrook, J. Fritsch, E.F. Maniatis, T. (1989). Molecular cloning: a laboratory manual.
6. Wilson, K. and Walker, J. (2003). Practical Biochemistry-Principles and Techniques. 5th edition, Cambridge University Press.

SEMESTER I

CORE

PRACTICAL- II

LAB IN MICROBIOLOGY AND BIOPROCESS MICROBIAL TECHNOLOGY

PAPER CODE : 14P1BTP02 TOTAL HOURS : 60 hours

CREDIT : 3 Hrs/Week : 5 hours

Subject Description

This course deals with the laboratory handling in Microbiology, use of microorganism and in bioprocess production enzymes, ethanol, wine etc., were handled

Goal

To learn the various techniques in microbiology and bioprocess microbial technology

Objectives

After the successful completion of the course the students will be aware of handling of microorganisms and production of enzymes antibiotics etc.,.

Content

1. Bright Field Microscopy-Parts and functions
2. Culture media preparation –Selective and differential media (EMB, XLD, SS Agar,Mac Conkay Agar, Blood Agar)
3. Enumeration of Bacteria, Fungi, Yeast, Pichia, algae and Actinomycetes from soil.
4. Pure culture techniques – Pour, Streak and Spread plate –*Pseudomonas Sp*. and *E. coli*.
5. Bacterial staining – Simple, Gram, Spore and Fungal wet mount – LCB
6. Motility test- Hanging drop Method.
7. Bacterial growth curve- Turbidometry method.
8. Antibiotic sensitivity test- Kirby boyer method.
9. Immobilization of Yeast and enzymes.
10. Production of alcohol by yeast.
11. Biochemical tests- carbohydrate fermentation test. IMVIC, TSI test, catalase test, oxidase test and urease test.
12. Production of extrcellular and intracellular enzyme from bacteria by shake flask method – Amylase.
13. Production of wine and estimation of alcohol.

References

6. Aneja, K.R. (2009). Experiments in Microbiology.
7. Dubey, R.C. and Maheswari, D.K. (2005). A Text book of Microbiology. S.Chand and Company Ltd., New Delhi.
8. James, G. Cappuccino. and Natalie, S. (2004). Microbiology: A laboratory Manual.
9. Kannan, N. (2000). Microbiology manual. Palani Paramount Publ.
10. Pelczar, M.J. Chan, E.C.S. and Kreig, N.R. (1993). Microbiology. MC Graw-Hill Inc., New York.
11. Prescott, L.M. Harley, J.P. and Klein, D.A. (1993). Microbiology. 2nd edition, WM, C Brown Publishers.

SEMESTER
II CORE
PAPER – IV
IMMUNOLOGY AND IMMUNOTECHNOLOGY

PAPER CODE : 14P2BT04 Total Hours: 60
CREDIT : 5 Hrs/Week 5

Subject description
The course elucidates the mechanism of defense in higher vertebrates against invading pathogens.

Goals
To make the student to understand the basics of defense mechanism, their regulations and the applications of fundamental immunological techniques

Objectives
On successful completion of the paper the student will have a thorough understanding regarding the defense mechanism of the immune system and the underlying principles as well as its applications.

UNIT	CONTENT	HOURS
I	**History and Scope of Immunology**. Types of Immunity. Cells of Immune system. Organs of Immune response and their functions. Haematopoiesis. Antigen- properties, classes, epitopes, haptens and adjuvants. Factors influencing antigenicity. Immunoglobulin- Structure, types, properties and functions.	12
II	**Recognition of antigen by B and T Lymphocytes**. Antigen presentation. Major Histocompatibility complex (MHC). Humoral immune response- B Cell maturation, activation, differentiation and proliferation. Cell mediated immune response – T- cell maturation, activation and differentiation. Organization and expression of immunoglobulin genes. Cytokines: types and functions; Complement system	12
III	**Antigen and Antibody interactions**: Precipitation and agglutination reactions. RIA, ELISA, Western blotting, Immunofluorescence and Immunoelectron microscopy. Hybridoma technology: Production of Monoclonal antibodies and its applications; Abzymes.	12
IV	**Hyper sensitivity reactions**: Auto immunity, Immunodeficiency disease (HIV), Pregnancy immunology.	12
V	**Transplantation immunology:** graft rejection, tissue typing andimmunosuppressive therapy. Immune response to infectious diseases (bacteria, viruses and parasites). Vaccines and its types	12

References

Text Books

1. Harlow and David, L. (1988). Antibodies A laboratory Manual. Cold spring harbor laboratory.
2. Ivan, R. (1988). Essentials of Immunology. 6th edition, Blackwell Scientific Publications, Oxford.
3. Kuby, J. (1997). Immunology. WH Freeman and Company, New York.
4. Paul, W.E. (1988). Fundamentals of Immunology. Ravan press, New York.
5. Robert, M.C. (1992). Fundamental Immunology. 2nd edition. C.Brown Publishers.
6. Tizard. (1995). Immunology. 4th edition. Saunders college publishers, New York.

Publications

1. Benjamini, E. (1991). Immunology-A short course. Wiley Publishers, New York.

SEMESTER-II

CORE PAPER-V-GENETIC ENGINEERING, IPR AND BIOETHICS

PAPER CODE: 14P2BT05 **Total Hours: 60**

CREDIT: 5 **Hrs/Week: 5**

Subject description

The course describes about the methods and techniques involved in genetic engineering and importance of IPR and bioethics

Goals

To make the student to understand the enzymes and methods of genetic engineering, patents and biosaftey guidelines in biotechnology

Objectives

On successful completion of the paper the student will have a thorough knowledge aboutthe r DNA technology, WTO, TRIPS, GATT and world summits, biosaftey and patents in biotechnology

UNIT	CONTENT	HOURS
I	**Recombinant DNA:** Method of creating rDNA. Enzymes: Restriction Endonuclease, Restriction mapping, Vector: Plasmid (PBR 322, PUC8), Phage(Lambda Phage) and packing.	12
II	**Introduction of rDNA into cells:** Transformation, Transduction and transfection. Physical methods: Electroporation, Biolistics,Microinjection. Screening of rDNA: Genetic method, Colony screening and Plaque Hybridization.	12
III	**Basic Techniques:** Agarose Gel Electrophoresis, Southern Blotting, PCR, RFLP, SSR, AFLP and DNA Sequencing methods. Application of genetic engineering in Medical and Agriculture.	12
IV	**IPR:** Introduction. Definitions. General Agreement on Trade and Tariff (GATT) and World Trade Organizations. Establishment and functions of GATT, WTO and WIPO. WTO Guidelines and Summits. Physical and Intellectual Property. TRIPS. Different types of intellectual property rights (IPR). Requirement of patentability. Biotechnological examples of patents, trademark, trade secret and copy right.	12
V	**BIO ETHICS** The legal and socioeconomic impacts of biotechnology. Biosafety regulation and national and international guidelines r-DNA guidelines, Good laboratory Practices (GLP) and cGMP procedures. Experimental protocol approvals, levels of containment Environmental aspects of biotech applications, Use of genetically modified organisms and their release in environment Special procedures for r-DNA based product production.	12

References

Text Books

1. Brown, T.A. (1991). Genomes. Bioscientific publishers Ltd, Oxford.
2. Dubey, R.C. A Text Book of Biotechnology. S.Chand and Co Ltd., New Delhi.
3. Glazer, A.N. and Nikaido, H. (2007). Microbial Biotechnology: Fundamentals of Applied Microbiology. 2nd edition, Cambridge University Press.
4. Glick, B.R. Pasternak, J.J. and Patten, C.L. (2010). Molecular Biotechnology: Principals and Applications of Recombinant DNA. 4th edition, ASM Press.
5. Old and Primrose. (1989). Principles of Gene Manipulation. 3rd edition.
6. Recombinant DNA safety guidelines. (1990). Department of Biotechnology, Ministry of Science and Technology, 2nd revised. Government of India, New Delhi.
7. Sathyanarayana, U. (2008). Biotechnology. Books and Allied (P) Ltd.
8. Singh, K. Intellectual Property Rights on Biotechnology. BCIL, New Delhi.
9. Watson, J.D. Baker, T. A. Bell, S. P. Gann, A. Levine, M. and Losick, R. (2004). Molecular Biology of the Gene. 5th edition. Pearson Education Inc.

Publications

1. Sasson, A. (1993). Biotechnologies in developing countries present and future. UNESCO Publishers.

SEMESTER-

II CORE

PAPER VI

BIOSTATISTICS AND BIOINFORMATICS

PAPER CODE: 14P2BT06 **Total Hours: 60**

CREDIT: 5 **Hrs/Week : 5**

Subject Description

Biostatistics which helps to works on the biotechnological data's, this paper explains about basics, correlation and regression coefficient. Bioinformatics is one of the leading subject in biotechnology, this paper explains the basic, software's, clustering and phylogenetic analysis.

Goal

To enhance the students to understand bioinformatics software's, gene sequence alignment, clustering, biostatistics basics and different types of tests to data calculation in biotechnology.

Objectives

This paper aims to improve the knowledge on biostatistics and bioinformatics related to biotechnology.

UNIT	CONTENTS	HOURS
I	**Bio-Statistics**: Introduction, Scope, application and use of statistics, Collection and classification of data, Census and sampling graphs and diagrams, Arithmetic mean, median, standard deviation. Population parameters and sample statistics. : Sample techniques, simple random sampling, stratified random sampling, systematic sampling, and standard error of mean. Estimation, point and interval, confidence interval for population mean and proportion.	**12**
II	**Concept of Test of hypothesis**, Null & Alternative hypothesis, level of significance, Chi square test & its applications, Small sample test - T-test for Means, Paired T-test, Analysis of variance and Co-variance, One-Way ANOVA, Two way ANOVA, F-test, Simple regression and correlation, Test of regression coefficient and correlation Coefficient.	**12**
III	**Bioinformatics** – Biological Databases- Nucleic acid sequence databases – GenBank/NCBI, EMBL, and DDBJ. Protein sequence databases – UniprotKB and PIR, Structure databases – PDB, CATH and SCOP. Specialized Databases – BLOCKS, PRINTS and Pfam, Microarrays- Microarray data analysis, Proteomic data Analysis.	**12**
IV	**Sequence Analysis**- sequence alignment, Dot plot, pairwise Sequence Alignment- Local alignment and Global alignments- Dynamic programming algorithm for sequence alignment, Scoring matrices, gap penalties. Multiple sequence alignment- scoring methods-clustalW- Phylogenetic Analysis- tree construction methods- Maximum likelihood and maximum parsimony- distance methods- Database similarity search- Basic Local Alignment search tool (BLAST).	**12**

V	**Gene prediction methods** – ORF finder, Restriction site analysis. Protein secondary structure prediction – GOR and ChauFasman methods- Comparative Modeling -Drug Designing– Drug discovery pipeline- Molecular Docking; Pharmacophores-Structure-based methods to identify lead compounds; *de novo* ligand design.	**12**

References

1. Baxevanis, A.D. and Ovellette, B.F.F. (2002). Bioinformatics: A practical guide to the analysis of genes and proteins. Wiley-Interscience.
2. Das, H.K. (2004). Textbook of Bioctechnology. Wiley Dreamtech India Pvt. Ltd.
3. Medhi, J. (1992). Statistical Methods. Willey Eastern Limited.
4. Primrose, S.B. and Twyman, R.M. (2002). Principles of Genome analysis and genomics. Blackwell Science Ltd.

Publications

1. Daniel, W.W. (1983). Biostatistics- A foundation for Health Science. John Wiley Publications.
2. Meyes, A. (1995). Molecular and Biotechnology- A comprehensive desk reference. RVCH Publishers Inc.

SEMESTER II

ELECTIVE – II-

BIOPHYSICS

PAPER CODE : 14P2BTE02 **Total Hours : 60 hours**

CREDIT : 5 **Hrs/Week : 5**

hoursSubject description

This course presents the basic concepts of Biophysics.

Goal

To make the student to understand the fundamentals of Biophysics, biomedical imaging techniques, radiation physics etc.,

Objectives

On Successful completion the subject student should have understand fundamentals of Biophysics, physical and biomedical imaging techniques, confirmations of aminoacids, andradiation biophysics

UNIT	CONTENT	HOURS
I	Scope and methods of Biophysics. Structure and properties of water. Basic principles of spectrophotometry. The laws of absorption, principles and instrumentation for UV- visible and IR spectroscopy. Principles, theory and applications of spectrofluorometry, and Flame photometry.	12
II	Physical & Biomedical method of Imaging techniques – X – ray, CAT – SCAN, ECG, EEG, Autoradiography, X – ray crystallography.	12
III	Proteins: Amino acids – Conformations. Phi and Psi angles. Ramachandran plot. Peptides – peptide bond isomerisation. Disulphide bonds, short range repulsion, electrostatic forces, van der waals interaction. Hydrogen bonds, Determination structure of proteins: NMR, FTIR, Protein folding, Protein stability - Forces stabilizing structures.	12
IV	The physics of Nucleic acid - Transitional angles and their ranges. Sugar puckering models, the pseudorotation cycle, syn – anti orientation of glycosyl bond. Details geometries of Watson-Crick and Hoogsteen base pairs- Thermodynamic description of stacking interactions – classification of A,B and Z type double helices. Biophysics of protein – DNA Interactions.	12
V	Radiation Biophysics – Basic concepts of radiography. Measurement of radioactivity –GM counter, Liquid and solid scintillation counter. Advantage and disadvantage of radio active compounds.	12

References

Text Books

1. Cantor and Schinmel. (2002). Biophysical chemistry.
2. Palanivelu, P. (2001). Analytical Biochemistry and separation techniques. Tulsi BookCentre, Madurai, Tamil Nadu.
3. Upadhyay Nath, U. (1997). Biophyscial chemistry- principles and Techniques.

Publications

1. Arora. Biophysics. 1st edition, Himalaya Publications, New Delhi.

SEMESTER II

CORE PRACTICAL III

LAB IN IMMUNOLOGY AND IMMUNOTECHNOLOGY

PAPER CODE: 14P2BTP03 **Total Hours 60**

Credit : 3 **Hrs/Week 5**

Subject Description

This course designed to allow the students to get opportunity and utilize the theories andconcepts of Immunology in practical and experimental projects.

Goal

The goal of this laboratory course is to provide students with experience in a variety of immunological techniques.

Objectives

As a result of successfully completing this course, the student will be able to demonstrate a practical knowledge of equipment and procedures common to immunological experimentation and analysis as well as be able to perform a variety of immunological assays.

Content

1. Identification of blood cells.
2. Total counting of blood cells – RBC & WBC using Haemocytometer. Differential count of white blood.
3. Preparation of serum and plasma.
4. Agglutination test- ABO blood grouping
5. Agglutination test -Widal test for typhoid fever (qualitative and quantitative test)
6. Passive agglutination test- Anti- streptolysin (ASO) test
7. Passive agglutination test- C- reactive protein (CRP) test
8. Passive agglutination test -Rhematoid arthritis (RA) test
9. Agglutination inhibition test- Pregnancy test- Detection on HCG
10. Flocculation test -Rapid PlasmaReagin test (RPR)
11. Precipitation test- Radial Immuno diffusion (RID)
12. Precipitation test -Rocket Immuno Electrophoresis (RIE)
13. Precipitation test- Ouchterlony double immunodiffusion technique (ODD)
14. Precipitation test -Counter current immunoelectrophoresis (CIE)
15. Precipitation test- Immuno Electrophoresis (IE)
16. Laboratory Animals in Immunology -Inoculation routes in fish and Raising of antiserum.
17. ELISA- Dot and Plate reader
18. Western Blotting- Demonstration

References

1. Barbara, D. and Noel, R. Rose. (2002). Manual of Clinical Laboratory Immunology. 6th sub edition, American Society Microbiology.
2. Myers, R.L. (1995). Immunology: A Laboratory Manual. 2nd edition, C. Brown Publishers, Dubuque, IA 52001.

LAB IN GENETIC ENGINEERING &BIOINFORMATICS

PAPER CODE : 14P2BTP04 **Total Hours: 60 hours**

CREDIT : 3 **Hrs/Week : 5**

hours

Subject Description

This course deals with the study of Genetic engineering and Bioinformatics.

Goals

To learn the various techniques in genetic engineering and bioinformatics

Objectives

After the successful completion of the course the students will be aware of various techniques of genetic engineering and different tools of bioinformatics .

GENETIC ENGINEERING

1. Isolation of genomic DNA from bacteria
2. Isolation of genomic DNA from plant tissues
3. Isolation of genomic DNA from animal tissues
4. Isolation of RNA
5. Isolation of plasmid DNA
6. DNA and RNA – Agarose gel electrophoresis
7. PCR
8. Restriction digestion
9. Ligation experiments

BIOINFORMATICS

1. Retrieval of protein and nucleotide sequences from suitable databanks

2. Similarity searches using BLAST and FASTA

3. Phylogenic analysis.

References

1. Baxevanis, A.D. and Ovellette, B.F.F. (2002). Bioinformatics: A practical guide to the analysis of genes and proteins. Wiley-Interscience.
2. Meyes, R.A. (1995). Molecular and Biotechnology-A comprehensive desk reference. VCH Publishers Inc.
3. Sambrook and Russell.Molecular Cloning- A Laboratory Manual.

PAPER-VII

PLANT MOLECULAR BIOLOGY AND BIOTECHNOLOGY

PAPER CODE: 14P3BT07 **Total Hours: 60**

CREDIT: 5 **Hrs/Wee: 5 Hours**

Subject description

This paper deals the genome organization and its regulation, molecular marker techniques, plant transformation techniques and genetic engineering in plants.

Objectives

To make the students to understand the basic knowledge about the molecular marker techniques and transgenics production.

Goal

To enable the students to learn the various techniques in genetic analysis, To DNA sequences, and genome mapping.

UNIT	CONTENT	HOURS
I	**Genome Organization:** Nucleus, Chloroplast and Mitochondrial genomeorganization, Transposable elements in maize.	12
II	**Regulation of gene expression in plants:** Nuclear genes, Signaling mechanismsin gene regulation, Gene regulation in plant development.	12
III	**Molecular Biology techniques** – PCR, RFLP, RAPD, AFLP. Techniques for plant Transformation: Agrobacterium mediated transformation and Direct transformation. Molecular biology of nitrogen fixation.	12
IV	**Plant gene expression cassettes:** Plant selectable markers, reporter genes. Promoters in plant vectors. Molecular biology of plant – pathogen interaction.	12
V	**Transgeneic plants:** Insect resistance, Herbicide resistance, Virus resistance, Saline tolerance, Delayed fruit ripening, Golden rice, transgenic tomato, Production of Antibodies and Viral antigens, Cytoplasmic Male sterility and terminator seed technology.	12

References

Text Books

1. Adrian, S. Nigel, S. and Mark, F. (2006). Plant Biotechnology. Oxford University Press.
2. Hans, W.H. Plant Biochemistry. 3rd edition, Academic press, Elsevier.
3. Henry, R.J. (1997). Practical Applications of Plant Molecular Biology. 1st edition, Chapman and Hall, London.
4. James, D.W. Recombinant DNA Technology. 2nd edition.
5. Peter, J.R. (1998). Genetics. 5th edition, Addison Wesley Longman Inc., Menlo Park.

Publications

1. Dey, P.M. and Harborne, J.B. (2000). Plant Biochemistry. Harcourt Publishers International Company, Singapore.

EMESTER-III
CORE PAPER
VIII
ANIMAL CELL CULTURE TECHNOLOGY

PAPER CODE: 14P3BT08 **Total Hours: 60**
CREDIT: 5 **Hrs/Wee: 5 Hours**

Subject description:

The prescribed course work on animal cell culture technology provides basic knowledge on establishment of animal cell culture laboratory, culture of animal cells.

Objectives:

To prepare the students to culture and maintain animal cell lines, perform viability assays and establish specific cell lines for purpose of tissue engineering

Goal:

To enable the students to utilize cell culture techniques to produce transgenic animals, stem cell applications and perform tissue engineering

UNIT	CONTENT	HOURS
I	**Introduction to animal cell culture:** Historical background- Scope and applications- Advantages and limitations of cell culture- Terminologies in cell culture	8
II	**Animal cell culture laboratory:** Laboratory design and layout- Equipments- Aseptic techniques- Culture vessel & substrate- Media and supplements: Physiochemical properties, balanced salt solution, complete media and biochemical ingredients. Serum free media. Preparation and sterilization- Control, testing and storage of media. Safety, bioethics and validation	15
III	**Cell culture techniques:** Types of cell culture & properties. Biology of cultured cells, evolution of cell lines & senescence. Primary cell culture- Disaggregations of tissue-types. Subculture & establishment of cell lines.	12
IV	**Cloning and selection:** Cell cloning- Cell separation- Characterization & authentication- Differentiation- Transformation, immortalization & tumorgenicity. Contamination. Cryopreservation & cell banks. Quantification of cell culture. Cytotoxicity: Viability, toxicity and survival assay	12
V	**Culture of specific cell & Specialized techniques:** Epithelial cells, Mesenchymal cells, Neuroectodermal cells, Haematopoetic cells, Gonads & Stem cells. Culture of tumor cells. Organotypic culture, Histotypic culture. Tissue engineering. Scale up of monolayer and suspension culture. Cell synchronization. FACS, Confocal Microscopy, *Insitu* Molecular hybridization.	13

References

Text Books

1. Florence, P.R. (2006). Animal Biotechnology. Dominant Publishers and Distributors.
2. Freshney, R.I. (2005). Culture of animal cells: A manual of basic technique. 5th edition, John Wiley and Sons.
3. John, R.W.M. (2000). Animal cell culture- A practical approach. 3rd edition, Oxford University press.
4. Migel, J. (2005). Animal Cell Biotechnology- Methods and Protocols. Humana press.
5. Purohit, S.S. (2006). Biotechnology-Fundamentals and Applications. 3rd edition.
6. Ranga, M.M. (2006). Animal Biotechnology.
7. Satyanarayana, U. (2005). Biotechnology. Books and allied (P) Ltd.
8. Shivangi, M. (2009). Animal cell and tissue culture. Agrobios.

Publications

1. Ramadass, P. (2008). Animal Biotechnology. MJP Publishers.
2. Sasidhara, R. (2008). Animal Biotechnology. MJP Publishers.
3. Shaleesha, A.S. (2008). Cell Biology for Biotechnologists. Narosa Publishing House.

GENOMICS AND PROTEOMICS

PAPER CODE:14P3BTE03 **TOTAL HRS : 60**
CREDIT : 5 **Hrs/Week : 5**

Subject description

This course presents the basic biological and chemical properties of chromosomes, molecular techniques, cloning strategies and application of genomics. The human genome projet reveals the locations of all genes.

Objectives

To equip the students with basic knowledge and principles in genomics, genome sequence and human genome project.

Goal

To enable the students to learn the various techniques in genetic analysis, To DNA sequences, and genome mapping.

UNIT	CONTENT	HOURS
I	**Genomics**-Overview of Genome anatomies-Prokaryotic Genome-Organization – operons-speciation events-Eukaryotic Genomes- Nuclear Genomes-families of genes- Organelle genomes-origin- Repetitive DNA contents-Tandem repeats – DNA transposons	**15**
II	**DNA sequencing methods**- shot gun sequencing – Contig assembly-techniques for gene location – ORF-Northern Hybridization-RT-PCR-RACE-S1nuclease mapping – exon trapping- transcriptome analysis-SAGE	**10**
III	**Genome Mapping** – Genetic Mapping – RFLP-SSLP-SNP-Human pedigree analysis– physical Mapping – Restriction site Mapping- FISH – STS mapping – Human genome organization.	**15**
IV	**Tools of Proteomics** – the proteome – the life cycle of protein-analytical techniques- protein seperation-1D PAGE-2D-PAGE-RPHPLC-protein digestion –peptide analysis- MALDI-TOF-ESI – tandem Mass analyzers-peptide Mass finger printing-protein identification with MS data.	**10**
V	**Applications of Proteomics** –protein mining - SALSA algorithm for mining specific features-protein expression profiling – identifying protein – protein interactions-mapping protein modifications-protein microarrays	**10**

References

1. Brown, T.A. (2002). Genomes. 2nd edition, Bios Scientific Publishers.
2. Daniel, C.L. (2002). Introduction to Proteomics- tools for the New biology. Humana press, Totowa, NJ.
3. Pennington, S.M. and Dunn. (2001). Proteomics: From Protein Sequence to Function. 1st edition, Bios Scientific Publishers.
4. Tom, S. and Andrew, P. R. (1999). Human Molecular Genetics. 2nd edition, Bios Scientific Publishers.

MEDICAL LABORATORY TECHNOLOGY

PAPER CODE: 14P3AMBED1 **TOTAL HRS : 52**

CREDIT : 4 **Hrs/Week : 4**

Objectives

The objective of this program is to conduct various diagnostic tests, analysis and bring forth important and vital information about the status and particulars of an individual's health. Medical Laboratory Technology provides skill oriented training to students to equip them to work in a variety of laboratory settings. This course equip the students in

Goal

Laboratory Quality Control Standards of Practice, Ethics & Legislations Collection, Handling & Sorting Specimens for Analysis Prepare Body Fluids & Tissues for MicroscopicExamination & AnalysisPrepare Reagents, Stains MediaPerform Routine Technical Procedures Medical Terminology

UNIT	CONTENT	HOURS
I	The Laboratory- Introduction - Basic laboratory principles and procedures – Types- standardized clinical laboratory set up – Lab accidents, Laboratory safety – Universal work precautions (UWP) - Preparation and cleaning of glasswares. Sterilization- Principles and Methods. Quality control in sterilization. Testing of Disinfectants.	12
II	Culture media – preparation and types – Inoculation methods - anaerobic cultivation methods Preservation of cultures - Stains and staining techniques- Identification of Bacteria – Biochemical tests - Antibiotic sensitivity test.	12
III	Immunohaematology - Introduction – Blood - Composition - Component preparation - Complete Blood count (CBC) – ABO and Rh blood group systems - Other major blood group systems - Blood grouping and Rh typing – Compatibility testing, Antibody screening and identification – Screening of blood donors - Transfusion reactions, Haemolytic Disease of the Newborn, HLA/Tissue typing – Anticoagulants and Preservative solutions.	12
IV	Collection and examination of clinical specimens - Urine, Blood, Faeces and CSF. Concentration techniques in stool. Examination of blood smears for malaria. Laboratory methods of diagnosing fungal Infection – Microscopy - KOH and LCB mount - Cultivation methods and staining.	12
V	Antigen - Antibody reaction – General principles and their application in the diagnosis of infectious diseases, Precipitation, Agglutination, Immunofluorescence, Immunoelectrophoresis, RIA, ELISA, HAT, Immune blot technique - Western blot.	12

References

1. Ananthanarayanan and Jayaram, P. Text book of medical microbiology.
2. Barbara, E. and Anna, P.R. Basic clinical laboratory techniques.
3. Kanai, l. M. Medical laboratory technology. Vol I, Vol II and Vol III.
4. Laboratory biosafety manual. 2nd edition, WHO, Geneva.
5. Monica, C. District laboratory practice in Tropical countries.
6. Monica, C. Medical laboratory manual for tropical countries. Vol I and Vol II.
7. Praful, K. G. Text book of Medical laboratory technology.
8. Ramnik, S. Text book of Medical laboratory technology.
9. Satish, G. Short textbook of Medical laboratory for technicians.
10. Satya Dev, G. Lynch's Hand book of Medical laboratory technology.
11. Stanley, R. Medical laboratory technology.

SEMESTER-III
CORE PRACTICAL-V
LAB IN PLANT MOLECULAR BIOLOGY AND BIOTECHNOLOGY

PAPER CODE: 14P3BTP05 **TOTAL HOURS: 60**

CREDIT : 3 **Hrs/Week : 5**

1. Surface Sterilization.
2. Preparation of plant cell culture Media.
3. Organ culture.
4. Callus propagation, organogenesis, transfer of plants to soil.
5. Isolation and fusion of protoplast.
6. Production of haploids: Anther culture.
7. Pollen culture.
8. Agrobacterium induction reporter gene (GUS) assay.
9. Isolation of plant genomic DNA.
10. Separation of plant proteins by SDS-PAGE

References

Text

Books

1. Purohit, S.S. (2005). Practical Plant Biotechnology. Student edition, Mrs. Saraswathi publications.
2. Rajan, S. and Selvi Christy, R. (2010). Experimental procedures in Life Sciences. Anjanaa book house.

Publications

1. Aneja, K.R. Experiments in Microbiology, Plant pathology and Biotechnology. New Age International Pvt. Ltd. Publishers.
2. Gamborg, G.C. Phillips. (2005). Plant Cell, Tissue and Organ culture fundamentals. Nerosa Publishing house.
3. Mary A. Schuler and Raymond, E.Z. (1989). Methods in Plant Molecular Biology. Published by Elsevier.

LAB IN ANIMAL CELL CULTURE TECHNIQUES

PAPER CODE : 14P3BTP06 **TOTAL HOURS:60**
CREDIT : 3 **Hrs/Week 5**

1. Washing and Sterilization of glass wares for animal cell culture
2. Preparation of animal cell culture media
3. Preparation of sera
4. Primary cell culture
5. Preparation of established cell lines
6. Trypsinization and subculturing cells from monolayer
7. Subculture of suspension cell lines
8. Cell counting and viability assay (dye exclusion & dye uptake)
9. Staining of animal cells
10. Preservation of cells
11. Routes of egg inoculation & culture of virus in chick embryo
12. Chick embryo fibroblast technique for virus cultivation (*invitro*)
13. MTT assay

References
Text
Books

1. Jeffrey, N.P. and John. M.W.W. (1997). Basic cell culture. 2nd edition, Humana press.
2. John, R.W.M. (2000). Animal cell culture-A practical approach. 3rd Edition. Oxford University press.
3. Migel, J. (2005). Animal Cell Biotechnology- Methods and Protocols. Humana press.
4. Rajan, S. and Selvi Christy, R. (2010). Experimental procedures in Life Sciences. Anjanaa book house.

Publications

1. Alan Doyle, J.B. and Ryan, G. (1998). Cell and Tissue culture- Laboratory procedure in Biotechnology. John Wiley and sons Publications.

NANOBIOTECHNOLOGY

PAPER CODE: 11P4BT09 **Total Hours: 60**

CREDIT: 5 **Hrs/Week : 5**

Subject Description:

Nanobiotechnology deals with the synthesis of nanostructures using living organisms. The subject provides basic platform for biotechnology students to understand the principles in nanosciences, nanoparticles and applications of nanotechnology in medical field.

Objectives:

To equip students with knowledge in nanobiotechnology, nanoparticles, nanobiosensors and provide in depth knowledge in application of nanoparticles in health &human welfare.

Goal:

This paper aim to provide students with concepts of Nanobiotechnology, nanobiomaterials and its application in medical and instruments designing.

UNIT	CONTENT	HOURS
I	**Concepts Of Nanobiology:** Nano-definitions prospects & challenges, Topology of DNA,protein, lipid assembly, biological networks, Molecular motors, bionanoparticles, Lipidbased nanoparticles, nanocomposites, Nanotubes,nanarods and dendrimers	12
II	**Biomaterial Science:** Nanobiomaterials- Type of biomaterials. Biodegradable polymers. Biodegradation of solid polymers. Modes of erosion (Surface & bulk). Molecular effectson hydrolytic breakdown.	12
III	**Fabrication and Characterization of Nanostructures:** Techniques to construct nanostructures. Fabrication methods - Topdown Bottom up approach. Nanoscale lithography. Techniques to predict nanostructures: TEM SEM, AFM. Scanning tunnelingmicroscopy. Determination of properties of nanoparticles: Mechanical testing; elasticity; toughness; effect of fabrication on strength.	12
IV	**Nano-Biosensors:** Biomedical sensors and biosensors-Biotinylation of sensors. Biosensors-definition and classification-potential based sensors: electrochemical sensors; acoustic/mechanical sensors: thermal and phase transition sensors: sensors in modern medicine-Biomembrane based sensors. Diagnostic imaging techniques (digital imaging; molecular imaging), DNA analyzer as biochip-microarray.	12
V	**Nanomedicine and Novel Drug Delivery Systems:**Drug delivery systems-polymer therapeutics: polymer drug conjugates; polymeric micelles, liposomes. Application of nanomaterials in medicine: Nanostructures in cancer research & Therapy. Cardiovascular medical devices; tissue regeneration (tissue engineering). Medical, Social and Economic status of Nanobiotechnology.	12

References

Text Books

1. Buddy, D.R. Allan, S.H. Frederick, J.S. and Jack, E.L. Biomaterials Sciences: An Introduction to Materials in Medicine. 2nd edition.
2. David, L.N. and Michael, M.C. (2006). Lehninger‟s principles of Biochemistry. 4th edition.
3. David, S. and Goodshell, J. (2006). Bionanotechnology: Lessons from Nature.
4. Molecular Design and Synthesis of Biomaterials. (2005). Biological Engineering Division, MIT Open Course Ware.

Publications

1. Mard, R. and Daniel, R. (2002). Nanotechnology: A Gentle Introduction to the Next Big Idea. Pearson Educaiton Publishers.
2. Nalwa, H.S. (2004). Encyclopedia of Nanoscienes and Nanotechnology. American Scientific Publishers, California.
3. Niemayer, M. and Mirkin, A. (2004). Nanobiotechnoogy: concepts, applications and perspectives. Wiley VCH publishers.

SEMESTER IV
ELECTIVE-IV
RESEARCH METHODOLOGY AND ENVIRONMENTAL BIOTECHNOLOGY

PAPER CODE: 14P4BTE04 **TOTAL HRS : 60**
CREDIT : 5 **Hrs/Week : 5**

Subject description:
This course presents the basic or researh, research purpose, problem solving in research, statistical methods used in research, data description, waste water treatments and alternative source of energy

Objectives:
To equip the students with basic knowledge of how to do research, problem solving in research and to know about the different waste water treatments and different energy sources.

Goal: To enable the students to learn about the basics of research and was

UNIT	CONTENT	HOURS
I	**Introduction:** Definition and objectives of Research – Types of research, Various Steps in Research process, Mathematical tools for analysis, Developing a research question-Choice of a problem Literature review, Surveying, synthesizing, critical analysis, reading materials, reviewing, rethinking, critical evaluation, interpretation, Research Purposes, Ethics in research – APA Ethics code.	**15**
II	**Quantitative Methods for problem solving:** Statistical Modeling and Analysis, Time Series Analysis Probability Distributions, Fundamentals of Statistical Analysis and Inference, Multivariate methods, Concepts of Correlation and Regression, Fundamentals of Time Series Analysis and Spectral Analysis, Error Analysis, Applications of Spectral Analysis. ANOVA and Chi-Square Tests. Use of statistical soft ware SPSS, GRETL etc in research	**10**
III	**Tabular and graphical description of data**: Tables and graphs of frequency data of one variable, Tables and graphs that show the relationship between two variables, Relation between frequency distributions and other graphs, preparing data for analysis Structure and Components of Research Report, Types of Report, Layout of Research Report, Mechanism of writing a research report, referencing in academic writing.	**15**
IV	**Waste Water treatment**: Definition, source, types and composition of waste water, domestic sewage and industrial waste water. Methods of analysis of waste water- Std. parameters for physical, chemical and biological analysis, microbiological analysis, rationales and methods, their significance and limitations. Primary treatment: (Chemical/Physical) sedimentation, screening, coagulation, flocculation, dilution, neutralization, equalization etc. Secondary treatment: (Biological/ biochemical) Activated sludge process, Trickling filters, anaerobic filters, sludge digestion, Aerated lagoons, Algal ponds, Evapo-transpiration system.	**10**
V	**Alternate Source of Energy**, Biomass as a source of energy, Biocomposting, Vermiculture, Biofertilizers, Organic farming, Biofuels, Biomineralization, Bioethanol and Biohydrogen, Bioelectricity through microbial fuel cell, energy management and safety.	**10**

References

Text Books

1. Donald, C. and Pamela, S. Business Research Methods. 9th edition, TMGH.
2. Alan, B. and Emma, B. Business Research Methods.Oxford University Press.
3. Kothari, C.R. Research Methodology.
4. Mattock, G.E.D. (1978). New Processes of Waste water treatment andrecovery. Ellis Horwood.
5. Standard Method for Examination of Water and Waste water (1985). 14thedition. American Public Health Ass.
6. Lee, C.C. and Lin, S. (1999). Handbook of Environmental EngineeringCalculations. Mc Graw Hill, New York.
7. Hendricks, D. (2006). Water Treatment Unit Processes-Physical and Chemical.CRC Press, New York.

Publications

1. Metcalf and Eddy. (1991). Waste water Engineering Treatment, Disposal andReuse. Mc Graw Hill Publishers.
2. Jogdand, S.N. (1995). Environmental Biotechnology. Himalaya PublishingHouse, New Delhi.