DEPT OF BIOTECHNOLOGY

PG – SYLLABUS

(With effect from the academic year 2016-2017onwards)

J.J.COLLEGE OF ARTS & SCIENCE

(*AUTONOMOUS*)

(Reaccredited at 'A' Grade by NAAC)

PUDUKKOTTAI – 622 422

J.J. COLLEGE OF ARTS AND SCIENCE (Autonomous)
DEPARTMENT OF BIOTECHNOLOGY
M.Sc BIOTECHNOLOGY
Proposed Course Structure under Autonomous Status
Under Choice Based Credit System
(Applicable for the candidates admitted from academic year 2016-2017 onwards)

Sem	Course Code	Course Title	Hrs/ Week	Credit	Exam Hours	Marks		Total Marks
						Int	Ext	
I	P1RBTCC1	Cell biology	6	5	3	25	75	100
	P1RBTCC2	Microbiology	6	5	3	25	75	100
	P1RBTCC3	Bioinstrumentation	6	5	3	25	75	100
	P1RBTCC4P	Practical – I (Covering CC1, CC2 & CC3)	6	5	3	**40**	**60**	100
	P1RBTEC1	Bioinformatics	6	3	3	25	75	100
TOTAL			**30**	**23**	**-**	**-**	**-**	**500**
II	P2RBTCC5	Biochemistry	5	5	3	25	75	100
	P2RBTCC6	Genetics & Molecular biology	5	5	3	25	75	100
	P2RBTCC7	r-DNA Technology	5	5	3	25	75	100
	P2RBTCC8	Immunology and Immunotechnology	5	5	3	25	75	100
	P2RBTCC9P	Practical – II (Covering CC5, CC6, CC7 & CC8)	5	5	3	**40**	**60**	100
	P2RBTEC2	Mushroom technology and value addition	5	3	3	25	75	100
TOTAL			**30**	**28**	**-**	**-**	**-**	**600**
III	P3RBTCC10	Research Methodology	5	5	3	25	75	100
	P3RBTCC11	Plant & Animal Biotechnology	5	5	3	25	75	100
	P3RBTCC12	Environmental Biotechnology	5	5	3	25	75	100
	P3RBTCC13	Microbial and Bio process technology	5	5	3	25	75	100
	P3RBTCC14P	Practical – III (Covering CC11, CC12 & CC13)	5	5	3	**40**	**60**	100
	P3RBTEC3	Biostatistics	5	3	3	25	75	100
TOTAL			**30**	**28**	**-**	**-**	**-**	**600**
	P4RBTEC4	Medical laboratory technology	6	3	3	25	75	100
	P4BTCC15PW	Project Work	24	8	-			100
TOTAL			**30**	**11**	**-**	**-**	**-**	**200**
GRAND TOTAL			**120**	**90**	**-**	**-**	**-**	**1900**

CC-Core Course / EC – Elective Course / P – Practical / T – Theory* Carry over Paper (Either Practical or Theory) Total Credit – 90 Total Marks – 1900

CORE COURSES

1. CC1 - Cell biology
2. CC2 - Microbiology
3. CC3 - Bioinstrumentation
4. CC4P - Practical – I covering CC1, CC2 & CC3
5. CC5 - Biochemistry
6. CC6 - Genetics & Molecular biology
7. CC7 - r-DNA Technology
8. CC8 - Immunology & Immunotechnology
9. CC9P - Practical – II Covering CC5, CC6, CC7 & CC8
10. CC10 - Research Methodology
11. CC11 - Plant & Animal Biotechnology
12. CC12 - Environmental Biotechnology
13. CC13 - Microbial & Bio process technology
14. CC14P - Practical – III Covering CC11, CC12 & CC13

ELECTIVE COURSES

1. I Sem EC - Bioinformatics
2. II Sem EC - Mushroom technology & Value Addition
3. III Sem EC - Biostatistics
4. IV Sem EC - Medical Laboratory Technology

SEMESTER I: CELL BIOLOGY

Course code: P1RBTCC1 **Max Marks: 100**

Hours/Week: 6 **Internal Marks: 25**

Credits: 5 **External Marks: 75**

OBJECTIVES

- To acquire the basic knowledge on the fundamentals of the cell biology
- To study the principles on cell theory and cell organelles.
- To understand the nutritional transports among the cells.
- To study the cell divisions and cell cycle.
- To have a detail study on cellular organelles at structure and functional level.

UNIT I : Cell Theory & Methods of Study

Microscope and its principles & applications – Light, phase contrast and interference, Electron (TEM and SEM), Electron tunneling, Atomic Force Microscopy Fluorescence and Confocal. **Membrane Structure and Function :**Structural models: Cell, Cell theory and organization-Composition and dynamics; Transport of ions and macromolecules; Pumps, carriers and channels; Endo- and Exocytosis; Membrane carbohydrates and their significance in cellular recognition; Cellular junctions and adhesions; Structure and functional significance of plasmodesmata.

UNIT II : Organelles

Nucleus – Structure and function of nuclear envelope, lamina and nucleolus; Macromolecular trafficking; Chromatin organization and packaging; Cell cycle and control mechanisms; Mitochondria – structure, organization of respiratory chain complexes, ATP synthase, Structure-function relationship; Mitochondrial DNA and male sterility; Origin and evolution; Chloroplast– Structure-function relationship; Chloroplast DNA and its significance; Chloroplast biogenesis; Origin and evolution.

UNIT III : Endo-membrane System and Cellular Motility

Structure and function of microbodies, Golgi apparatus, Lysosomes and Endoplasmic Reticulum; Organization and role of microtubules and microfilaments; Cell shape and motility; Actin-binding proteins and their significance; Muscle organization and function; Molecular motors; Intermediate filaments; Extracellular matrix in plants and animals.

UNIT IV : Cellular Movements and Pattern Formation

Laying of body axis planes; Differentiation of germ layers; Cellular polarity; Model plants like Fucus and Volvox; Maternal gene effects; Zygotic gene effects; Homeotic gene effects in Drosophila; Embryogenesis and early pattern formation in plants; Cell lineages and developmental control genes in *Caenorhabditis*.

UNIT V : Differentiation of Specialized Cells

Stem cell differentiation; Blood cell formation; Fibroblasts and their differentiation; Cellular basis of immunity; Differentiation of cancerous cells and role of proto-oncogenes- Uni-potent, multi-potent, totipotent and pluripotent.

Plant Meristem Organization and Differentiation : Organization of Shoot Apical Meristem (SAM); Organization of Root Apical Meristem (RAM); Pollen germination and pollen tube guidance; Phloem differentiation Embryo and endosperm development; Heterosis and apomixis.

TEXT BOOKS

1. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott.
2. Gupta, P.K. (2015) - A Text Book of Cell & Molecular Biology, Rastogi Publications.
3. Singh, S.P. and Dr. B.S. Tomar, 10th Edition, (2015). Cell Biology, Rastogi Publications.
4. Gupta, Cytology, P. K. (2015) Genetics & Molecular Biology, Rastogi Publications
5. Free-E-book:http://www.nature.com/scitable/ebooks/essentials-of-cell-biology-14749010/what-is-a-cell-what-are-the-14751770 (Unit- I-V)

REFERENCES

1. Rost, T.L. Gifford, Jr. & Ernest, M. (1977) – Mechanism and control of cell division Academic Press, N.Y.
2. Encyclopedia of Cell Biology.
3. Gomperts, B.D. (1976) – The Plasma membrane: Models for its structure & Function Academic Press.

SEMESTER I: MICROBIOLOGY

Course code : P1RBTCC2 **Max Marks: 100**

Hours/Week: 6 **Internal Marks: 25**

Credits: 5 **External Marks: 75**

OBJECTIVES

1. To know about the Microorganisms, its structure and classification.
2. To learn about the isolation and general characteristics of Microorganisms.
3. To study about the pathogens, its diagnostic methods, prevention and treatment for the diseases.
4. Motivate the students to become a successful Entrepreneur.

UNIT - I: INTRODUCTION & CLASSIFICATION OF MICROORGANISMS : Introduction, History and Scope of Microbiology. Classification and characteristic features of Microorganisms (Archaebacteri, Eubacteria, Cyanobacteria, Mycoplasma, Rickettsiae, chlamydiae, Spirochaetes, Actinomycetes, Fungi, Algae, Protozoa and Viruses). General methods of classifying Bacteria, Bacterial taxonomy –new approach, Concept of taxa, species, strain, nomenclature and Bergey`s manual.

UNIT - II: STERILIZATION AND MICROSCOPY : Methods of disinfection, Sterilization and special methods. Microscopic principles and applications-Bright field, Dark field, Fluorescence, Phase contrast, Polarizing, Con focal and Electron Microscopy (TEM and SEM).

UNIT - III: STRUCTURE, NUTRITION AND GROWTH OF BACTERIA : Ultra structure of Bacteria: Capsule, Cell wall, Cell membrane, Cytoplasmic membrane, Cytoplasm, Cell inclusions, Mesosomes, Ribosomes, Magnetosomes - Flagella and Pilli. Aerobic and anaerobic nutritional requirements, Micronutrients, Macronutrients, Nutritional types of Microorganisms. Growth factors, Growth curve, Factors influencing and affecting microbial growth.

UNIT - IV: MICROBIAL MEDIA AND ISOLATION: Types of media: Simple media, differential media, enriched media, Preparation of Media-Methods of isolation of

microorganisms: Plating techniques, cultivation of anaerobic microorganisms, Culture of Viruses, preservation and storage of Cultures, Culture collection centres.

UNIT - V: APPLIED MICROBIOLOGY: Introduction, transmission, epidemiology, pathogenecity, laboratory diagnosis,prevention and treatment of the following diseases : Chickenguniya, Flu fever, Dengue fever, Ebola and Rota virus. Fermented foods : Sauerkraut, Pickles, Buttermilk, Yogurt and Cheese. Production of biofertillizers: Rhizobium, Azospirillum, Azolla - Anabaena and VAM.

TEXT BOOKS:

1. A text book of Microbiology – R.C.Dubey, Dr.K.Maheswari, M.Chand Publishers 1st Edition (2012).
2. Text book of Microbiology – D.R.Arora and B.Arora CBS Publications; 3rd Edition (30 December 2008).

REFERENCES:

1. Microbiology-M.J. Pelczar, Jr., E.C.S. Chang and N.R. Krieg, McGraw Hill Company, New York (1986).
2. Microbiology L.M. Prescott, J.P. Hareley D.A. Klein W.M.C. Brown publishers.Dutique.Jawa.Melbourne.1993.
3. Basic and Practical Microbiology-Ronald M. Atlas, Mac. Milleen Company, New york.
4. Microbiology-Concepts and applications, M.J. Pelczar, Jr., E.C.S. Chang and N.R. Krieg, McGraw Hill Company, New York (1993).
5. Microbiology: Theory And Practice – Arun Shridhar Phadke., Adhyayan Publishers & Distributors (2008).
6. .General Microbiology Vol. II – Dr.CB Powar and Dr.H.F.Daginawala ., Himalaya Publishing House (2010).

NET REFERENCES:

1. www.microbeworld.org

2. www.microbiology.org

SEMESTER I: BIOINSTRUMENTATION

Course code : P1RBTCC3 **Max Marks: 100**

Hours/Week: 6 **Internal Marks: 25**

Credits: 5 **External Marks: 75**

OBJECTIVES

1. Thorough understanding of the analytical techniques and equipment used in Biological science**.**
2. To have a fundamental knowledge regarding the Microscopy, Spectroscopy, Centrifugation.
3. To acquire knowledge on the Chromatographic method for the separation of biological products**.**

UNIT - I: BASIC INSTRUMENTS: Balance, pH meter, Autoclave, Hot air oven , isoelectric focusing. Unit conversions, Reagent preparations. Buffers. Principles and application of light microscopy, phase Contrast, Bright and Dark field Microscopy fluorescence Microscopy, Electron Microscopy- TEM, SEM, Confocal microscopy. Atomic absorption microscopy.

UNIT - II: SEPERATION TECHNIQUES: CENTRIFUGES: - Basic principle of centrifugation**,** and its types - Ultra Centrifugation (Preparative and analytical), Density gradient Centrifugation, Rate zonal centrifugation, Differential centrifugation. Standard Sedimentation coefficient. **CHROMATORAPHY: -** Chromatography - Principle, instrumentation and application of Paper Chromatography, Adsorption chromatography, Ion exchange Chromatography, Thin layer Chromatography, Affinity chromatography , HPLC and GC.

UNIT - III: DIFRACTION METHODS : Principles, Components and applications of X-ray crystallography. Braggs equation, Reciprocal lattice concept, Miller index and Unit cell, Determination of crystal structure, colorimeter, Spectroscopy – Raman effect, UV-Visible, Mass spectroscopy, Atomic Absorption spectroscopy, NMR –Experimental techniques and instrumentation, ESR. LASER and MASER - Principle and applications

UNIT - IV: TRACER TECHNIQUES: Radio active and stable isotopes: Pattern and rate of radioactive decay isotope-Half life, GM Counter, solid and Liquid scintillation counter, Radiation dosimetry, Radio tracer technique, Autoradiography. Application of isotopes in Biology.

UNIT - V: ELECTROPHORETIC TECHNIQUES : Electrophoresis- Agarose Gel Electrophoresis, SDS-PAGE, Native Gel, 2D gel and gradient Gel Electrophoresis, Pulsed field Gel Electrophoresis (PFGE).

Textbooks

1. Biophysical chemistry – principles and techniques, Upadhyay , Upadhyay and Nath, 3 rd edition , 2002, Himalaya publishing home.
2. Laboratory manual in biochemistry, J.Jayaram 1981, Wiley publisher.
3. Bioinstrumentation, L. Veerakumari, 1st edition 2011, MJP publishers**.**

Reference books

1. Analytical biochemistry and separation techniques-A laboratory manual, P.Palanivelu 2nd edition 2001 tulsi books centre**.**
2. Principles and techniques of practical biochemistry, Keith Wilson and John walker, 5th edition 2000, Cambridge University press.
3. Analytical biochemistry, D. Holme and H.Peck, 3rd edition 1998, longman.
4. Physical biochemistry- application to biochemistry and molecular biology, Freifelder, 2nd edition, 1982, W.H.Freeman and company, San Fransisco.

Net References

1. www.explainthe stuff.com
2. www.chemguide.co.uk.

SEMESTER I: PRACTICAL I (COVERING CC1, CC2 AND CC3)

Course code: P1RBTCC4P **Max Marks: 100**

Hours/Week: 6 **Internal Marks: 40**

Credits: 5 **External Marks: 60**

OBJECTIVES

1. To understand the cells of Microbes/Plants/Animals
2. To know the operations and functions of basic instruments.
3. To learn the various techniques in Micro-biology.

CELL BIOLOGY

1. Demonstration of instrumentation methods for cell biology, (microscope, Micrometry, microtome. etc.,).
2. Equipments used in cell culture laboratory general practice and maintenances (demo only).
3. Morphological characterization of various types of cells –prokaryotes & Eukaryotes
4. Histochemical staining techniques (students are advised to familiarize various staining techniques)-Demo
5. Chemical/enzymatic disaggregation of tissue cells.
6. Cell organelle separation by centrifugation methods.
7. Isolation of Leydig cells (testis) and Islet cells.
8. Enumeration of cell (any type of prokaryotic/eukaryotic cells).
9. Identification and characterization of different types of Blood cells.
10. Enumeration of Red Blood Cells.
11. Enumeration of White Blood Cells.
12. Identification of various stages of cell division (mitosis and meiosis).

GENERAL MICROBIOLOGY

1. Dos and Donts.

2. Preparation of solutions in different concentration .
3. Working principle, operation and application of basic instruments: Light microscope, Binocular microscope, Autoclave, Hot air oven, Laminar air flow chamber, Incubator, Ph meter and Centrifuge
4. Preparation of solid and liquid culture media,
5. Pure culture techniques – pour plate, spread plate and streak plate method.
6. Identification of microorganisms: Macroscopic, Microscopic: staining techniques – simple, gram staining,capsule staining and spores staining. Motility- Hanging Drop Technique and stabbing. Biochemical tests –IMViC tests, Carbohydrate fermentation, Amylase production, TSI and
7. Microscopic identification of fungi – Lactophenol cotton blue wet mount
8. Measurement of microorganisms – Micrometry
9. Determination of microbial growth: Turbidity method and by using counting chamber
10. Isolation and cultivation of algae from different water sources.

BIOINSTRUMENTATION

1. Determination of pH of Biological samples (Blood,Plasma,Urine,Saliva).
2. Preparation of Buffers.
3. Estimation of Protein by Lowry/ Biuret method
4. Estimation of Amino acid by Ninhydrin method.
5. Separation of Sugars by Paper Chromatography and Column Chromatography.
6. Separation of amino acid by Thin layer Chromato graphy.
7. Agarose gel Electrophoresis.
8. Poly Acrylamide Gel Electrophoresis.
9. Biochemical Estimation of DNA/ RNA using Spectrophotometer.

Reference Books:

1. Analytical biochemistry and separation techniques-A laboratory manual , P.Palanivelu, 2nd edition 2001 ,tulsi books centre.
2. Laboratory manual in biochemistry, j.jayaram 1981, wiley publisher.

3. Principles and techniques of practical biochemistry, Keith Wilson and John walker, 5th edition 2000, Cambridge university press.

SEMESTER I: BIOINFORMATICS

Course code: P1RBTEC1 **Max Marks: 100**

Hours/Week: 6 **Internal Marks: 25**

Credits: 3 **External Marks: 75**

OBJECTIVES

1. To learn in detail about Biological databases.
2. To let the students know the recent evolution of Biological science.
3. To acquire knowledge regarding the tools in Bioinformatics.

UNIT - I: Databases: Introduction to Computers - Bioinformatics**.** Biological databases - protein sequence databases – PIR, SWISS-PROT, Nucleic acid sequence database, GenBank, structural DB – SCOP, CATH specialized genome sequence database.

UNIT - II: Sequence Alignment : Pairwise alignment – Dot plots – scoring matrices – Blosum matrices – PAM matrix – Gap penalty – Alignment algorithms: Needle man – Wunsch global – Alignment algorithm: Smith – Waterman local alignment algorithm.

UNIT - III: Structure Prediction : Secondary structure prediction – chou – Fasman – Jpred – Q3 – Transmembrane protein prediction- Tertiary structure prediction – Comparitive modeling – Fold recognition – Ab initio prediction – modeler – RASMOL – SWISS PDB Viewer.

UNIT - IV: Phylogenetic Analysis : Evolutionary analysis: distances – clustering methods — rooted and un-rooted tree representation – Bootstraping strategies – Construction of phylogenetic trees, Molecular clocks Vlidation methods, Softwares for Phylogenetic analysis.

UNIT - V: Genomic and Proteomics : DNA microarrays – structural genomics – functional genomics – proteomics comparative genomics – whole cell simulation – human genome project – systems biology – Biodiversity informatics. Pharmacogenomics.

Text Books

1. Introduction to Bioinformatics, Sundarajan. S and R. Balaji (2205) Himalaya Publishing House, Mumbai.
2. Bioinformatics-Concepts, skills and applications,S.C.Rastogi,2nd Edition,2009,CBS Publications**.**

Reference Books

1. Introduction to bioinformatics, Arthur M.Lesk,1st Edition,2002,Oxford University Press.
2. Bioinformatics – Sequence, structure and databanks, D. Higgins and W. Taylor (Eds), Oxford University Press, New Delhi (2000).
3. Introduction to computational Biology Michael S. Watermann, Chapman & Hall (1995).

Net References

1. www.bioinformaticsworld.com
2. bioinformatics web.net/tools.html
3. www.genome.jp/en/gn_tools.html.

SEMESTER II: CORECOURSE - V

BIOCHEMISTRY

Course Code: P2RBTCC5 **Max Marks: 100**

Hours/Week: 5 **Internal Marks: 25**

Credits: 5 **External Marks: 75**

OBJECTIVES

1. To have a detailed knowledge about the structure and function of biomolecules
2. The properties of biomolecules.
3. The importance of biomolecules.

UNIT – I: Bioenergetics and Biological oxidation

Electron transport chain, oxidative phosphorylation, glycolysis, citric acid cycle, cori.s cycle, glyoxalate pathway. Oxidation of fatty acids- mitochondrial and peroxisomal ß-oxidation, á and ù oxidation, oxidation of unsaturated and odd chain fatty acids, ketone bodies. Photosynthesis, urea cycle, hormonal regulation of fatty acids and carbohydrates metabolisms.

UNIT - II: Carbohydrates

H_2O, pH, pK. acid, base, biological buffer system . Water- Principles of thermodynamics. Carbohydrates: Nomenclature, classification, structure, chemical and physical properties of carbohydrates. Metabolisms: glycogenesis, glycogenolysis, gluconeogenesis, pentose phosphate pathway.

UNIT – III: Amino acids and Protein

Nomenclature, Classification, structure, chemical and physical properties of amino acids and proteins. Metabolisms: Biosynthesis of amino acids. Degradation of proteins, nitrogen metabolisms and carbon skeleton of amino acids. Over all in born error metabolisms.

UNIT – IV: Lipids

Nomenclature, classification, structure, chemical and physical properties of fatty acids. Metabolisms: biosynthesis of fatty acids, triglycerols, phospholipids, glycol lipids. Cholesterol biosynthesis, bile acids and salt formation. Eicosanoids, sphingolipids and steroid hormones.

UNIT – V: Nucleic acids

Nomenclature, Classification, structure, chemical and physical properties of purine and pyrimidines. In de novo and salvage synthesis of purines, pyrimidine bases, nucleosides and nucleotides. Catabolisms of purines and pyrimidines bases. Synthetic analogues of nitrogenous bases.

TEXTBOOKS

1. Sathyanarayana,U ,Charapani,C.(2010).Biochemistry. Books and allied (P) Ltd
2. Deb,A.C., (1989). Fundamentals of Biochemistry (3rd Edition). New central agency.
3. Jain, J.L., (2005). Fundamentals of Biochemistry (6th Edition), S.Chand Publications
4. Ashokan .P. (2006) Enzymes .Chinna Publications
5. Freifelder, D. (1996) Molecular Biology, II Edition, Narosa Publishing House, New Delhi.

REFERENCES

1. David E. Metzler. And Carol M. Metzler (2001). Biochemistry-The chemical reactions of living cells- Vol1&2.(2nd edition).Harcourt/Academic press, Newyork.
2. Donald Voet and Judith G. Voet (1995). Biochemistry – Second Edition. John Willey and Sons, Inc.
4. Leninger,A.L., Nelson, D.L., Cox, M.M., (1993). Principles of Biochemisry,(2nd Edition).CBS Publishers,
3. Geofferey, L and Zubay (1998). Biochemsitry. (Fourth Edition) Wm. C. Brown Publishers.
4. Stryer, L. (1995). Biochemistry. 4th Ed. W.H. Freeman and Company, New York

SEMESTER II: CORECOURSE - VI

GENETICS AND MOLECULAR BIOLOGY

Course Code: P2RBTCC6 **Max Marks: 100**

Hours/Week: 5 **Internal Marks: 25**

Credits: 5 **External Marks: 75**

OBJECTIVES

1. This paper in genetics has been structured to give the student an in depth knowledge of the what is DNA and chromosome
2. The major objective of the paper is to envisage thorough knowledge in genetics about the replication, recombination and protein synthesis
3. After successful completion of the paper the students will get an overall view about genetic makeup of organisms and can take up a career in research.

UNIT – I: Classical Genetics

Gregor Mendel's work and contribution,Laws of inheritance: Mendel's Laws, test cross, Monohybrid and dihybrid crosss,concept of dominance, segregation, independent assortment; Chromosome theory of inheritance.

Allelic and non-allelic interactions: Concept of alleles, types of dominance -Over dominance and co dominance, Lethal alleles, Pseudo alleles, multiple alleles, Epistasis.

UNIT – II: Prokaryotic Genetics

Nucleotides-DNA and RNA as a genetic material. Types, Forms, structure and functions of DNA and RNA. Details of *E.coli* chromosome, Brief account of plasmid – structure, properties types and its significance. Transposable elements in bacteria – Transposons. Genetic code, Gene Structure, Concept of gene-expression, transcription, translation, post-translational and transcriptional modification Gene regulation - Lac operon, trp operon.

Gene transfer mechanism in bacteria-conjugation, transformation, transduction- generalized and specialised .

UNIT – III: Eukaryotic Genetics

Chromatin structure: Histones, DNA, nucleosome,Repetitive DNA, Giant chromosomes: Polytene and Lampbrush chromosomes, RNA splicing and transcription,Ribozyme,Translation Linkage and Crossing over, Population genetics, Life cycle of *Neurospora crassa* ,Types-breakage,Rejoining and models of recombination-The Holliday model.

UNIT – IV Replication of DNA, Mutuation & DNA repair mechanism

Replication of DNA – Enzymes involved, Models-, rolling circle model, Theta Model. Replication of RNA – reverse transcriptase. **Mutation**-mutants, Types and significance of mutation- Frame shift, Silent, Point, Sense and Nonsense mututation, **DNA repair mechanism**-Photoreactivation, Excision repair, Proof reading activity of DNA polymerases. Transposable elements in eukaryotes

UNIT – V Human Genetics

Introduction to Human Genetics-Human Chromosomes: Structure and organization of DNA, Chromosome abnormalities– Euploidy, Polyploidy. Genetic disorders- autosomal dominant and autosomal recessive disorders, Sex linked inheritance - x-linked and Y linked disorders, cancer and diabetes, Inborn errors of metabolism, Eugenics, Euthenics and Genetic counseling

Text Books

1. Essential of molecular biology, Freifelder D. 2008, 4th edition, Jones and Bartlett publishing (Unit I-IV)
2. Cell Biology and Genetics: 1 by Cecie Starr & Ralph Taggart , 11th Revised edition (2005), Publisher: Brooks/Cole

References

1. Molecular cell Biology, by Darnell, Lodish, Baltimore, Scientific American Books, Inc., 1994.
2. Recombinant DNA technology- Watson J.D, M Gil man et al., scientific American books-WH free man publishers
3. Cell Biology : Organelle Structure And Function Sadava D. E Released: 2009

Publisher**:** Cbs

4. Human genetics, A.Gardner, R.T.Howell and T.Davies, Published by Vinod Vasishtha for Viva Books private limited, 2008.
5. Molecular spectros. Ist rev.ed (english) 1st edition (s) j. D. Graybea 2014,Mcgraw hill

Net References

http://agridr.in/tnauEAgri/eagri50/GBPR111/index.html

http://www.genome.gov/10000013

http://www.ncbi.nlm.nih.gov

SEMESTER II: CORECOURSE - VII

r - DNA TECHNOLOGY

Course Code: P2RBTCC7 **Max Marks: 100**

Hours/Week: 5 **Internal Marks: 25**

Credits: 5 **External Marks: 75**

OBJECTIVES

1. To understand the application of rDNA technology to various fields of Biotechnology.
2. To acquire knowledge in principles and methods in Genetic Engineering.
3. Able to use these tools in industry/Institutes where ever necessary.

UNIT I : Basic requirements and principles

Genes, Concept of restriction modification. Restriction endonucleases, ligases, DNA modifying enzymes. Plasmid: Bcteriophages: M13 vectors, Phagemids, Lambda vectors, Insertion and Replacement vectors: Cosmids, Artificial chromosomes, Viral vectors, Expression vectors, Plant based vectors.

UNIT - II: Host vector system

Cloning vectors of *E. coli*, cloning vectors of eukaryotes – methods of transformation – cloning strategies, construction of genomic and cDNA libraries, probe construction, selection and screening of recombinants – molecular cloning

UNIT - III: Analysis of expression

Analysis of recombinant DNA (selection methods – antiobiotics, expression basis, GUS assay) mutagenesis, altered expression and engineering genes. Site directed mutagenesis. PCR, RAPD, RFLP, Blotting techniques.

UNIT - IV: Applications of rDNA technology in plants

Mechanism of gene transfer in plants **-** Transgenic plants with reference to virus and pest resistance, herbicide and stress tolerance – cytoplasmic male sterility, delay of fruit ripening – resistance to fungi and bacteria. Bio pharmaceuticals and secondary metabolites

UNIT - V: Applications of rDNA technology in animals

Transgenic animals, production of therapeutic proteins (Insulin, vaccines, hormones) - farm animal production. Gene therapy – Haematopoetic stem cells, genetically engineered bone marrow cell, skin fibroblasts, hepatocytes, myoblasts and genetically modified lymphocytes

Text Books

1. Genes to clones ,Winnacker, 2nd Edition, scientific American books/Academic press
2. Molecular biology and Genetic Engineering , P.K. Gupta 1st edition, 2005. Rastogi publications.

Reference books

1. Gene cloning , T.A Brown -3rd edition . Stanley Thrones publishers
2. Recombinant DNA technology- Watson J.D, M Gilman et al., Scientific American books-WH free man publishers
3. Principles of gene manipulation by R.N old and SB Primrose , Black well scientific publication

NET REFERENCES:

www.medicinenet.com

www.animalresearch.info

www.nlm.nih.gov

SEMESTER II: CORECOURSE - VIII
IMMUNOLOGY AND IMMUNOTECHNOLOGY

Course Code: P2RBTCC8 **Max Marks: 100**

Hours/Week: 5 **Internal Marks: 25**

Credits: 5 **External Marks: 75**

OBJECTIVES

1. Understanding the immune system, antigen antibody reactions, applications of immunological techniques, humoral and cell mediated immunity, hypersensitivity reactions and hybridoma technology.
2. To expose the students with various immune systems of human body.
3. This course will provide the student insights into the various aspects of Immunology such as classical immunology, clinical immunology, Immunotherapy and diagnostic immunology.

UNIT - I: Introduction, cells and organs of immune systems

History and scope of immunology. Important terminology. The Immune System: Innate Immune response and its role in protection. -Type of immunity -Adaptive Immune response, the humoral and cellular component of the Immune response- Innate and adaptive immunity. Cells involved in the Immune response: Macrophages, B and T lymphocytes, Dendritic cells, Natural killernand Lymphokine activated killer cells, Eosinophils, Neutrophils and Mast cells. Haemopoiesis and differentiation, Lymphoid organs - primary and secondary.

UNIT – II: Antigens, Immunoglobulin and Complement

Antigens-types and functions, Immunoglobulin - types, structure, domain structure, properties and function. Major Histocompatibility Complex: MHC molecules and organization of their genes, Structure and function of MHC gene products. Antigen Presentation and processing, role of MHC and non-MHC molecules in antigen presentation. Complement: pathway, biological functions.

UNIT – III: Immunology and disease

Hypersensitivity reaction: type I to type V- hemolytic anemia - Rh incompatability - mantoux reaction, Auto immune disorders, Tumour immunology, immunodeficiency disorders.

UNIT – IV: Immunodiagnostics

The various immunotechniques for detection and quantification of antigens/antibodies:ODD, immunoelectrophoresis, rocket immunoelectrophoresis, RIA, ELISA, ELISPOT, Principle, methodology and applications of RIA, RIST, RAST. Immunoflouresence, blotting techniques, flow cytometry and immunofluorescence microscopy including *in situ* localization techniques such as FISH and GISH. Hybridoma technology

UNIT – V: Immunotherapy

Vaccine-types and production, Cytokines and interferons - types,properties, production, drugs used for cancer, HIV and diabetics – Monoclonal antibodies, Interleukins, lymphokines, immunology of transplantation

Text Books

1. Immunology by I.M. Roitt, J.Brostoff and D.K Male(1993) Gower medical publishing, London
2. Immunology – short course by E.Benjamini, G.sunshine and Leskpwitz willy-liss 1996
3. Richard M.hyde 1995 Immunology III edition ELBS London
4. J.Kuby, 2003, Immunology 5th edition, W.H. Freeman and Company, Newyork.. 2. C.V.Rao. 2002,

References

1. An Introduction to Immunology, Narosa Publishing House, Chennai. 3. K.M.Pavri. 1996, Challenge of AIDS, National Book Trust, India.
2. I.R.Tizard, 1995, Immunology: An Introduction, 4th edition, Saunders College Publishers, New York. 5.
3. I.Roitt, 1994, Essential Immunology, Blackwell Science, Singapore.
4. A. Bul and K.Abbas, 1994, Cellular and Molecular immunology

SEMESTER II: CORECOURSE - IX P

PRACTICAL II (COVERING CC5, CC6, CC7 AND CC8)

Course Code: P2RBTCC9P **Max Marks: 100**

Hours/Week: 5 **Internal Marks: 40**

Credits: 5 **External Marks: 60**

OBJECTIVES

1. To learn the techniques in the concern subjects.
2. To know the importance, methodologies and applications of all techniques.
3. Encourage them to learn all advanced and research based techniques.
4. Motivate the students to start a Industries and R&D based labs.

BIOCHEMISTRY

1. Reaction of carbohydrates: glucose, fructose, lactose and sucrose.
2. Qualitative test for amino acids, lipids.
3. Estimation of protein by – Lowry method, Bradford method.
4. Estimation of serum cholesterol by Zak's method.
5. Estimation of glucose by Ortho-toluidine method, total sugars by Anthrone method
6. Determination of amino acid by ninhydrin method.
7. Titrimetric determination of sugars by benedict's method

GENETICS AND MOLECULAR BIOLOGY

1. Isolation of DNA from bacteria,plant and animal tissues
2. Estimation of DNA
3. Isolation of plasmid DNA
4. Isolation of Auxotrophic mutants.
5. Mutagenesis in Bacteria : The Ames test
6. Transformation in *E.coli*..
7. Isolation of phage from sewage and determination of phage.
8. Replica plate technique.

RECOMBINANT DNA TECHNOLOGY

1. Isolation of genomic DNA from Plant and Animal tissues.
2. Preparation of Competent Plasmid.
3. Restriction digestion and Ligation.
4. Screening of recombinants.
5. Electroporation.
6. PCR.
7. SDS- PAGE.
8. RFLP.

IMMUNOLOGY AND IMMUNOTECHNOLOGY

1. ABO blood grouping, Rh Typing
2. WIDAL test, CRP and ASO
3. Double immuno diffusion
4. Radial immuno diffusion
5. Immuno electrophoresis
6. Rocket immuno electrophoresis
7. Total count of RBC
8. Total count of WBC
9. Differential staining of Blood cells
10. Demonstration of ELISA
11. Demonstration of Lymphoid organs in rat
12. Demonstration of Western blotting.

References

1. Microbiology - James, C. Cappuccino, The Benjamin/Cummings Pub. Co.California (1996).
2. Experiments in Microbiology, Plant Pathology and Biotechnology Aneja, K.R. , 4th Edition 2013,Narosa publication house Delhi.
3. Immunology methods manual – vol 1 – lefkovits, Ivan.london Ap professional, 1997
4. Text books of practicals and clinical Immunology – Talwar.G.P. New delhi :CBS , 2005

5. Practical microbiology – R.C. Dubey and D.K. Maheswari.S.Chand and company ltd., (2002) M.J.1995.
6. Cappuccino, J and Sherman, N. (2002) Microbiology. A Laboratory Manual . 6th Edition. Pearson Education Publication, New Delhi.
7. Medical laboratory technology – A procedure manual for routine diagnostic tests – Vol – 1 – Kanai. L. Mukherjee, tata Mc Graw –Hill Publishing company limited, New delhi (1998).
8. Recombinant DNA laboratory Manual,Dr.Judith W.Zyskind,1989,Academic press.
9. Laboratory manual for Biotechnology and Laboratory Science-The basics,Lisa .A.seidman,2011,Benjamin Cummings

SEMESTER II: ELECTIVE COURSE - II
MUSHROOM TECHNOLOGY AND VALUE ADDITION

Course Code: P2RBTEC2 **Max Marks : 100**

Hours/Week: 5 **Internal Marks: 25**

Credits: 3 **External Marks : 75**

OBJECTIVES

1. To study the general characteristics and structure of Mushrooms.
2. To know about the importance and need of Mushrooms.
3. To acquire knowledge regarding the cultivation and contamination possibilities of Mushrooms.
4. Motivate the students to form a Mushroom cultivation unit.

UNIT – I: INTRODUCTION TO MUSHROOMS

Introduction – edible and non-edible mushrooms - History of mushrooms; Classification and distribution of mushrooms; most commonly cultivated mushrooms in the world - life cycle of mushroom – Applications of mushroom in various fields.

UNIT – II: SPAWN PREPARATION AND CULTIVATION

Spawn preparation - Isolation of pure culture; Nutrient media for pure culture – layout of spawn preparation room – raw material of spawn - sterilization – preparation of mother spawn and multiplication. Cultivation of mushroom – layout of mushroom shed - small scale and large scale production unit. Types of raw material – preparation and sterilization; Mushroom bed preparation – maintenance of mushroom shed – harvesting method and preservation of mushrooms.

UNIT - III: NUTRIENT VALUES OF MUSHROOMS

Nutrient values of Mushrooms – protein, carbohydrate, fat, fibre, vitamins and amino acid contents – short and long term storage of Mushrooms – preparation of Indian and Western dishes from Mushrooms. Medicinal value of Mushrooms.

UNIT - IV: **CULTIVATION AND ECONOMIC IMPORTANCE**

Cultivation of following types of mushroom – milky Mushroom, oyster Mushroom, button Mushroom and any one medically valuable Mushroom - Preparation of compost and cultivation of *Agaricus bisporus* and *Pleurotus flabelltus*.

Economics of mushroom cultivation : Fixed assets, recurring expenditure, labour, economics of cultivation throughout the year and seasonal growing. Formulation of project report for getting finance from funding agencies.

UNIT - V: **MUSHROOM RECIPIES AND RESEARCH CENTRES**

Soup, cutlet, omlette, samosa, pickles, curry, chutney and Briyani.Research centers: International level, National level and Regional level.Cost benefit ratio : Marketing in india and abroad – Export value.

Text Books

1. Marimuthu et al., 1991. Oyster Mushrooms. Dept. of Plant pathology, TNAU, Coimbatore.
2. Tewan and Pankaj Kapoor S.C. 1993. Mushroom cultivation. Mittal Publication. Delhi.

References

1. Nita Bahl. 1988. Hand book of Mushrooms , II ed., Vol I & II.ct and environmental impact. 2nd ed., CRC press.
2. Paul Stamets, J.S. and Chilton, J.S. 2004. Mushroom cultivation: A practical guide to growing mushrooms at home, Agarikon Press
3. Shu Fing Chang, Philip G. Miles and Chang, S.T. 2004. Mushrooms: Cultivation, nutritional value, medicinal effe1.
4. Singh, Reeti and Singh, V.C. (2005). Modern Mushroom Cultivation. Agrobios, India.
5. Swaminathan, M 1990. Food and Nutrition, Bappco. The Bangalore Printing and Publishing Co. Ltd., Bangalore

SEMESTER III: CORECOURSE - X

RESEARCH METHODOLOGY

Course Code: P3RBTCC10	**Max Marks : 100**
Hours/Week: 5	**Internal Marks: 25**
Credits: 5	**External Marks: 75**

OBJECTIVES

1. To impart scientific, statistical and analytical knowledge for carrying out research work effectively.
2. To understand science frameworks for scientific inquiry
3. To understand the various methods for conducting empirical research
4. To examine trends and patterns in the use of various research methods
5. To get knowledge to prepare research documents for publication
6. To screen and select the correct journals to publish their research findings
7. To articulate informed opinion about the value of empirical research
8. To get knowledge on research proposal preparation and apply to the sponsoring agencies.
9. To appreciate the benefits through socio-research networks.

UNIT - I

Biosafety regulations - Good laboratory practices - Good manufacturing practices in industry. Storage and disposal of hazardous wastes: radioactive materials – pathogenic strains. GMO's and their release in environment. Experimental protocol approvals -Levels of containment - Environmental aspects of biotech applications.

UNIT – II

Research: research in Biological sciences- Objective – thrust areas and research priorities in Biotechnology to meet global competency- Origin of the research problem - Collection of literature: Internet –library – index card preparation - Experimental approach. Setting up of a Laboratory: laboratory administration – collaborations - inventories and inspections – personnel – Recruitment hiring – mentoring - promoting and terminating.

UNIT- III

Science communication: Introduction – manuscript preparation: Original – review – short communication. Thesis writing - Proof correction – symbols used for correction- preparation for Oral and poster presentation – preparation of Power Point presentations - communication skills for effective presentation.

UNIT – IV

Standards of journals: national and international – online and printed – paid and unpaid – peer reviewed journal – SCI journals – impact factor- h-index. Research engines: Elsiever, Springer, Pubmed, Google scholar, Academic journals, online digital library- Social network for research community: Research gate, Research Pages, Frontiers Research Network, Elsevier Lab.

UNIT – V

Writing research proposal for getting financial support – Sponsoring agencies – (DST, DBT, UGC, CSIR, ICMR, MoEF, MoEs, DRDO, DRDE, TNSCTE, TNSCST and NABARD). Research ethics – Intellectual property Rights – Overcome the difficulties in biological research.

Text Books

1. Gurumani N, 2009. Research methodology for biological science, MIP publisher (Unit-I-III).
2. Geofferey R, Marczyk, David De Mattea, David Festinga, 2005. Essentials of Research Design & Methodology, John Wiley & Sons Publisher.
3. Free Study material for Unit- III: http://www.unom.ac.in/asc/Pdf/Session%201-%20Financial%20resources%20for%20research%20&%20development%20sponsored%20agencies.pdf

References

1. Ann M. Korner, 1996. Guide to publish a scienctifc paper, Bioscript Press (Unit- II).
2. Rober A. Day, 1996. How to write and Publish a scientific paper, Cambridge Univeristy Press (Unit- II).
3. Arora, PN and Malhan, PK. Bio-Statistics. Himalaya Publishing House (Unit- IV-V).
4. Veer Bala Rastogi. Fundamentals of Bio-Statistics. Ane Book India (Unit- IV-V).

SEMESTER III: CORECOURSE- XI

PLANT AND ANIMAL BIOTECHNOLOGY

Course Code: P3RBTCC11 **Max Marks: 100**

Hours/Week: 5 **Internal Marks: 25**

Credits: 5 **External Marks: 75**

OBJECTIVES

1. To study the details of plant cells, organ and tissue culture.
2. To learn and gain the knowledge about the plant tissue culture for transgenic plant production.
3. To make the student understand conservation of biological resource through plant biotechnology
4. To educate the theoretical knowledge on secondary metabolite production
5. To get knowledge on secondary metabolite production to meet the global competence.
6. To understand the principles of Animal cell culture and its applications.
7. To understand and develop new technologies using molecular biology, embryo manipulation and cell culture.

UNIT-I

Plant tissue culture - history – Introductory - Scope and importance - laboratory organization – types of tissue culture medium - growth regulators – Auxins, Cytokinin and Gibberellins - sterilization techniques – Explant collection and preparation - totipotency - Direct and Indirect organogenesis. Somatic embryogenesis, cytology of callus- Hardening- plant let acclimatization.

UNIT - II

Haploid production: Anther – Ovule - Pollen cultures. Protoplast isolation, fusion and culture - Somatic hybridization (Symmetric, Asymmetric, Cybrids). Somaclonal variation - applications and limitations – screening procedures. Synthetic seeds. Cryopreservation and *ex situ* conservation of germplasm- Secondary metabolite production- biodegradable plastics, therapeutic proteins, lysosomal enzymes.

UNIT - III

Production of therapeutic antibodies and edible vaccine from plants (with any examples) - Herbal biotechnology: production of herbal medicine through plant biotechnology, Genetic diversity: conservation of RET, endemic, Medicinally important plants.

UNIT - IV ANIMAL CELL CULTURE TECHNIQUES

a) Animal Cell Culture: Equipments and materials for animal cell culture technology. Various systems of tissue culture, their distinguishing features, advantages and limitations.

b) Culture medium: natural media, synthetic media, sera. Introduction to balanced salt solutions and simple growth medium. Brief discussion on the chemical, physical and metabolic functions of different constituents of culture medium, role of carbon di oxide, serum and supplements

c) Characteristics of cells in culture: Contact inhibition, anchorage dependence, cell-cell communication etc.; Cell senescence;

UNIT - V TRANSGENIC ANIMALS

Gene transfer methods in Animals – Microinjection, Embryonic Stem cell gene transfer, Retrovirus & Gene transfer. Transgenic Animals – Mice, Cow, Pig, Sheep, Goat, Bird, Insect. Applications of Transgenic animals.

Text Books

1. Satyanarayanan, U. 2005. Biotechnology, Books and allied (p) Ltd., (Unit I-V)
2. Bhojwani, and Razdan, M.K . 2004. Tissue Culture Theory and Practice. (Unit I,II, V)
3. Chawla, H.S. Biotechnology in crop improvement. International Book distributing Company (1998). Unit (I-V)
4. Guptha, P.K. Elements of Biotechnology. Rastogi and Co. Meerut, (1996).
5. Animal biotechnology,R.Sasidhara,2006,MJP Publishers.
6. Text book of Animal Biotechnology,Dr.P.Ramadass,Dr.S.Meera rani,2nd Edition 2002, MJP publishers.

References

1. Fu, T-J., Singh, G. and Curtis, W.R. (Eds). 1999. Plant Cell and Tissue Culture for the Production of Food ingredients. Kluwer Academic/Plenum Press.

2. Hammond, J., McGarvey, P. and Yusibov, V. (Eds.). 2000. Plant Biotechnology. Springer Verlag.
3. Henry, R.J. 1997. Practical Application of plant Molecular biology. Chapman and hall.
4. Paul Christou and Harry Klee. 2004. Hand Book of Plant Biotechnology. Vol I& II. John Wiley & Sons. Ltd
5. Animal Biotechnology, M.M.Ranga, 2nd Edition, 2003,Agrobios India.
6. Animal Cell Culture: A practical approach, Freshney, E.D., 2000, John Wiley Pub., NewYork.

SEMESTER III: CORE PAPER-XII

ENVIRONMENTAL BIOTECHNOLOGY

Course Code: P3RBTCC12 **Max Marks: 100**

Hours/Week: 5 **Internal Marks: 25**

Credits: 5 **External Marks: 75**

OBJECTIVES

1. To understand the energy sources, environmental pollution and remediation using biotechnology and its control.
2. Students will get an idea about the hazards to our environment, solutions to protect and for sustainable development.
3. This course is important in the era of industrialization leading to environmental hazards and hence will help students to take up a career in tackling industrial pollution and also who is willing to take up the research in areas like development of biological systems for remediation of contaminated environments (land, air, water), and for environment-friendly processes such as green manufacturing technologies and sustainable development.

UNIT - I: Basic concepts of ecology

Interaction between environment and biota; Concept of habitat and ecological niches; Limiting factor; Energy flow, food chain, food web and tropic levels; Ecological pyramids and recycling, biotic community-concept, structure, dominance, fluctuation and succession; N.P.C and S cycles in nature. Population ecology.

UNIT - II: **Environmental pollution**

Types of pollution, methods for the measurement of pollution, air pollution and its control, Air pollution – Source of air pollution, Classification of air pollutants and its control – Electrostatic precipitator Global environmental problems: ozone depletion, green house effect and acid rain, Land and noise pollution.

UNIT – III: Water Pollution and control

Need for water management, measurement and sources, water pollution. Waste water treatment: waste water collection, physico-chemical properties of waste water, physical, chemical and biological treatment processes. Eutrophication. **Water treatment processes:** Primary treatment Secondary treatment.

UNIT - IV: Solid waste management

Sewage sludge treatment and utilization, refuse disposal, excreta disposal in unsewered area; composting and vermiculture.; biodegradation of noncellulosic wastes for environmental conservation and fuel; bioconversion of cellulosic wastes into protein and fuel; biodegradation of xenobiotics; bioremediation of contaminated soils and waste lands; radioactive product waste disposal.

UNIT - V: **Hazardous waste management**

Biodegradation of Xenobiotics, Pesticides, Oil biodegration – Superbug, Bioleaching, Bioremediation – *In situ* and *ex situ* bioremediation. Biotechnological applications for Hazardous waste management, uses and constraints of Genetically Engineered Microorganisms (GEMs) in the environment.

Text Books

1. Environmental Biotechnology- Dilip Kumar MarKandey and Neelimn Rajvaidya (APH publishing corporation, New Delhi)
2. Applied Biotechnology – LP Rema (MJP publishers, Chennai).

References

1. Environmental Biotechnology by Alan Scragg. Pearson Education Limited, England.
2. Environmental Biotechnology by S.N. Jogdand. Himalaya Publishing House.Bombay.
3. Wastewater Engineering – Treatment, Disposal and Reuse. Metcalf and Eddy, Inc., Tata Mc Graw Hill, NewDelhi
4. Environmental chemistry by A.K. De Wiley Eastern Ltd. NewDelhi

SEMESTER III: CORECOURSE - XIII

MICROBIAL AND BIOPROCESS TECHNOLOGY

Course Code: P3RBTCC13 **Max Marks: 100**

Hours/Week: 5 **Internal Marks: 25**

Credits: 5 **External Marks: 75**

OBJECTIVES

1. To study the principles and methodologies of Bioprocess technology.
2. To get an idea about the applications of Biotechnology in Industries.
3. To know about the structure, principles and applications of Bioreactors and Fermentors.
4. Motivate the students to form a Bioprocess based Industries and R&D Labs.

UNIT- I : INTRODUCTION AND HORIZONS OF MICROBIAL TECHNOLOGY

Introduction - Scope and applications – horizons of Microbial technology. Microbes:Living factories for macromolecules – production of Proteins in Bacteria and Yeast; recombinant and synthetic Vaccines; Microbial Enzymes – application in Starch processing, textile designing, detergents, Polysaccharides and Polyesters, Pharma and Therapeutic enzymes. Immobilization of Cells and Enzymes.

UNIT - II: MICROBIAL PRODUCTS:

Recombinant proteins (Insulin, Biopolymers), Biotransformations (Steroids,Chirals), Vaccines (BCG, DPT, polio, hepatitis) alcohol (ethanol, methonol), acid (citric acid, acetic acid, Itaconic acid), solvents (glycerol), Therapeutic Proteins (Interferons, Insulin, Streptokinase, Erythoropoietin), antibiotics (penicillin, streptomycin, amphicillin and tetracycline), amino acids (lysine, glutamic acid) SCP (algae and fungi), Probiotics. Food production- cheese, bread, Yoghurt, whey, sauerkraut, beverages- wine and beer. Food Additives: lipids, vitamins, flavours.

UNIT -III: DESIGN OF FERMENTORS AND BIOREACTORS

Design and components of fermentor. Structure of Bioreactor: stirrer, agitator, aerator, seal, valves, steam trap, sterilization unit. Types of fermentor - batch, continuous, air-driven, tower. specialized bioreactors: Fluidized bed reactor, photo bioreactor, packed bed and pulsed

reactor. Sensors – measurement and control of process variables. Control systems and computer controlled fermentor.

UNIT - IV: UPSTREAM PROCESSING

Introduction and scope of bioprocess engineering. Microbial growth and death kinetics-Batch, continuous and fedbatch culture. .Types of media, composition, carbon source, nitrogen source, vitamins, minerals, inducer, precursor and inhibitor. Factors affecting microbial growth. Sterilization: air and media sterilization-moist heat, dry heat, filter, gas, pasteurization-types, batch sterilization and continuous sterilization. Screening of industrially important microorganisms, Strain improvement - Preservation and storage of cultures. Inoculum preparation, development of inocula for bacteria, yeast mycelia and vegetative fungal process. Aseptic inoculation.

UNIT V: DOWNSTREAM PROCESSING

Downstream processing**:** Bio-separation - Biomass disruption and removal, Filtration centrifugation, sedimentation, flocculation. Cell disruption: Physical and chemical methods. Purification: Chromatography and membrane based technique- Ultra-filtration, reverse osmosis, and dialysis – solvent extraction, Precipitation (salting-in and salting-out) drying and crystallization. Industrial process and process economics.

Text Books

1. Bioprocess Technology (Volume 1) – PT.Kalaiselvan and I.Arul Pandi ., MJP Publishers, (January 11, 2007).
2. Biotechnology: A text book of Industrial microbiology – Wulf crueger and Anne liese crueger (second editon), Panima publishing corporation, New Delhi/Bangalore (2000).

References

1. Principles of fermentation technology - P.F. Stanbury, A. Whitaker and S.J. Hall Elsevier publication, second edition, 2005.
2. Industrial microbiology – L.E. Casida, New Age International (P) Ltd, New Delhi.
3. Industrial Microbiology – A.H.Patel,Mac Millan India Limited, 2nd Edition (2011).

4. Instrumentation and measurement and analysis, Nakra BC and chaudry KK 2004. II edition tata McGraw hill publishing co. ltd, New Delhi
5. Fermentation microbiology and biotechnology. Mansi El Mansi and Charli Bryce, 2002 Taylor and Francis ltd., London
6. Bioseparation and engineering Roger G. Harrison, Paul W. Todd, Scott R.Rudge and Dometri Petrider 2003: oxford university press.
7. Biochemical reactors, Akitson b. 1974. Pion Ltd.London
8. Industrial Microbiology. Prescott and Dunn's. Macmillan Publishers,5th Edition (2009).

Net References

www.indiastudychannel.com/resource/41331-osmania-university-m-sc-microbiology-mb-microbial-biotechnology.aspx
www.forsight.org/eoc/index.html.

SEMESTER II: CORECOURSE- XIV P

PRACTICAL III (COVERING CC11, CC12 AND CC13)

Course Code: P3RBTCC14P **Max Marks: 100**

Hours/Week: 5 **Internal Marks: 40**

Credits: 5 **External Marks: 60**

OBJECTIVES

1. Encourage the students to get self employability by learning all these techniques.

PLANT BIOTECHNOLOGY

1. Preparation of plant tissue culture medium for organ culture (Node, internode, leaf and shoot tip)
2. Initiation and regeneration of callus culture
3. Production of Synthetic seeds
4. Isolation, fusion and culture of Protoplast
5. Demonstration of RFLP and RAPD in plants
6. Production of Secondary metabolite and their evaluation for antimicrobial assay.

ANIMAL BIOTECHNOLOGY

1. Preparation of Media for cell culture.
2. Trypsinization.
3. Cell viability test.
4. Cell counting.
5. Cytotoxicity testing

ENVIRONMENTAL BIOTECHNOLOGY

1. Detection of Coliforms for determination of purity of fresh water – MPN technique.
2. Determination of total dissolved solids of Water.
3. Determination of hardness of water.
4. Determination of Chloride of Water.
5. Determination of DO,BOD COD of Water.

MICROBIAL AND BIOPROCESS TECHNOLOGY

1. Isolation of industrially important microorganisms.
2. Screening of industrial microorganisms
3. Factors influencing and affecting the growth of microorganisms .
4. Microbial products : Ethanol, Citric acid, Lactic acid and Amylase.
5. Determination of quality of milk : Methylene blue reduction test.

References

1. Animal Cell Culture:A practical approach, Freshney, E.D., 2000, John Wiley Pub., New York.
2. Bhojwani and Razdan, M.K, 2004. Plant Tissue culture theory & practical.
3. Hurse P.I. and Patterson., M.K. Tissue culture, methods and application,
4. Marchan, D,J. Handbook of cell and Organ culture (2^{nd} ed). Burgess Pub. Co., Minneapolis, USA. (1964).
5. Dixon, L.A. and R.A. Gonzales. Plant cell culture – A Practical Approach, Revan Press, New Your.
6. Quak, F. Plant Tissue Culture Methods and Applications in Agriculture Academic Press, New York. (1981)

SEMESTER III: ELECTIVE COURSE - III

BIO – STATISTICS

Course Code: P3RBTEC3	**Max Marks: 100**
Hours/Week: 5	**Internal Marks: 25**
Credits: 3	**External Marks: 75**

OBJECTIVES

- To study about the Correlation and its real life applications.
- Calculate descriptive statistics related to public health.
- Enables graphical ideas to descriptive statistics.
- To analysis the results by testing hypotheses.

UNIT – I: Correlation

Correlation Analysis: correlation – Correlation coefficient – Scatter Diagram – spearman's rank correlation coefficient. (related problems)

UNIT – II: Regression

Regression Analysis: Regression – Regression coefficient – properties – Linear Regression line.(related problems)

UNIT - III: **Probability Distribution**

Theoretical Distribution – Binomial, Poisson and Normal Distributions.

UNIT - IV: **Sampling**

Basic Concepts of Sampling – Simple random sample, stratified sample and systematic sampling. Sample statistic. Sampling distribution and standard error. Tests of significance – Test for mean and difference of means.

UNIT - V: **Testing of Hypothesis**

Student t – test, Chi – Square test, F-test, ANOVA: one way and two way classification,

Text Books

1. " Biostatistics" – P.N.Arora and P.K. Malhan, Himalaya Publication House,2006.

   Unit I : Chapter 8:8.1,8.4-8.7

   Unit II : Chapter 9: 9.1-9.3,9.5

   Unit III: Chapter 11: 11.1 to 11.5, 11.9, 11.11- 11.13,11.15, 11.17-11.21.

   Unit IV: Chapter 12 : 12.1 to 12.5.

   Unit V : Chapter 13: 13.8,13.9.13.10 ; Chapter 14: 14.7,14.8; Chapter 15: 15.4: Chapter 8: 8.1 and 8.6 and Chapter 9: 9.1 and 9.2.

References

1. "Fundamentals of BioStatistics" Veer BalaRastogi, Ane Books Pvt. Ltd, 2009.
2. "Biostatistics" - P.Ramakrishnan - Saras Publications,1995.

SEMESTER III: ELECTIVE COURSE- IV

MEDICAL LABORATORY TECHNOLOGY

Course Code: P3RBTEC4	**Max Marks: 100**
Hours/Week: 6	**Internal Marks: 25**
Credits: 3	**External Marks: 75**

OBJECTIVES

1. To understand the basic principles and procedure followed in medical laboratory
2. To develop a skill in that field for initiating the laboratory

UNIT-I:

Introduction-Organization of Clinical laboratory-basic needs, functional components-Basic laboratory safety, Carcinogens, Chemicals and radioactive substances, Corrosive chemicals, , Explosive chemicals, Fire fighting equipment, First aid in laboratory accidents, Flammable chemicals-First Aid in laboratory accidents. General comments on Specimen collection-Blood, Urine, Sputum, Throat swab, Wounds, Stool, Cerebrospinal fluid, etc. Handling of specimens-Transport of Specimens –Preservation of Specimens. Sterilization, Sterilization by heat, Dry heat, Moist heat , Ultraviolet Radiation, Filtration, Chemical Sterilization, Glassware preparation for use, Pasteur pipettes, Choice of syringes and needles

UNIT-II:

Introduction to Body organs and system, Physiology of Organs and system-Cardiovascular system, Respiratory system, excretory system. Units of measurement: The Metric system- Preparation of reagent Solutions (Molar, percentage)-Laboratory calculations.

UNIT-III:

Haematology: Components of Blood and their functions-Human Blood group systems-Rh Blood group-Collection of Blood-transportation of Blood-storage of Blood-Haematopoietic system of the body-Determination of Haemoglobin concentration. **Clinical haematology**, Anticoagulants, Blood cell counts, Blood film examination, , Complete blood count (CBC), Differential cell count, Erythrocyte sedimentation rate (ESR), Examination of a blood film,

Haemoglobin (Hb), Blood banking, ABO grouping, ABO testing procedures, Blood donors, Blood group antibodies, Blood group testing in microplates, Blood transfusion complications

UNIT-IV:

Microbiology: Laboratory Identification of infectious bacterial agents-Mycotic infections- Human parasites. Media used for culturing of Pathogens-Pathological features of *Salomonella typhi, Vibrio cholerae* and *Mycobacterium tuberculosis.* Emerging viruses and diseases

UNIT-V:

Urine analysis-Abnormal porphyrin metabolism, Blood in urine, Calcium in urine, Casts in urine, Causes of hyperbilirubinuria, Causes of ketonuria, Chemical examination of urine, Collection of urine, Colour and appearance**, Semen analysis**-Semen examination, Evaluation of infertility, Expensive examination of the female, Microscopic examination, Sperm Counts, Sperm morphology, Chemical examination of semen, **Pregnancy test-** Advantages of serum testing, Dipstick ICT pregnancy test, ELISA pregnancy test, ICT techniques for urine, Interpretation of test results, Material provided with the kit, Performance characteristics, Slide test for pregnancy. **Diagnostic skin tests**- Brucellergen test, Candida, Common skin tests, Delayed reaction type of skin tests, Immediate reaction type of skin tests, Immunologic basic for skin tests, Mumps and herpes simplex tests, Technique of skin tests-Tuberculin test.

References

1. Kanai L. Mukherjee Medical laboratory technology vol I, II and III
2. Basic and Practical Microbiology-Ronald M.Atlas,Mac.Milleen Company,New york.
3. Harper's illustrated biochemistry, 27th edition 2006, David A. Bender et al., Mc Graw Hill, New Delhi.