J.J. COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS), PUDUKKOTTAI – 622 422
DEPARTMENT OF MICROBIOLOGY
M.Sc. MICROBIOLOGY
Proposed Course Structure under Autonomous Status
Under Choice Based Credit System - 2019-2020 onwards

Sem	Course Code	Course Title	Hrs/ Week	Credit	Exam Hrs	Marks		Total
						Int.	Ext.	
I	P1R1MBCC1	CC1 - Advanced Microbiology	6	5	3	25	75	100
	P1R1MBCC2	CC2 - General Biochemistry	6	5	3	25	75	100
	P1R1MBCC3	CC3 –Microbial Physiology	6	5	3	25	75	100
	P1R1MBCC4P	CC4 - Practical – I (Covering CC1, CC2 & CC3)	6	5	6	40	60	100
	P1R1MBEC1	Any One from the List	6	3	3	25	75	100
		Total	**30**	**23**	**-**	**-**	**-**	**500**
II	P2R1MBCC5	CC5 - Microbial Genetics	5	5	3	25	75	100
	P2R1MBCC6	CC6 – Molecular Biology & Genetic Engineering	5	5	3	25	75	100
	P2R1MBCC7	CC7 - Immunology	5	5	3	25	75	100
	P2R1MBCC8	CC8 – Medical Microbiology	5	5	3	25	75	100
	P2R1MBCC9P	CC9 - Practical – II (Covering CC5, CC6, CC7 & CC8	5	5	6	40	60	100
	P2R1MBEC2	Any One from the List	5	3	3	25	75	100
		Total	**30**	**28**	**-**	**-**	**-**	**600**
III	P3R1MBCC10	CC10 – Virology	5	5	3	25	75	100
	P3R1MBCC11	CC11 – Environment and Agricultural Microbiology	5	5	3	25	75	100
	P3R1MBCC12	CC12 – Microbial Biotechnology	5	5	3	25	75	100
	P3R1MBCC13	CC13 - Fermentation Technology	5	5	3	25	75	100
	P3R1MBCC14P	CC14 - Practical – III (Covering CC10, CC11, CC12 & CC13)	5	5	6	40	60	100
	P3R1MBEC3	Any One from the List	5	3	3	25	75	100
		Total	**30**	**28**	**-**	**-**	**-**	**600**
	P4RIMBEC4	Any One from the List	5	3	3	25	75	100
IV	P4R1MBPW15	CC15 - Project Work	25	8	-	-	-	100
		Total	**30**	**11**	**-**	**-**	**-**	200
Grand Total			**120**	**90**	**-**	**-**	**-**	**1900**

CC-Core Course / EC – Elective Course / P – Practical / T – Theory, Total Credit – 90 Total Marks – 1900

Passing Minimum for CIA = 10

Passing Minimum for Exam = 30

Aggregate Pass Mark = 50

Elective Courses (EC)

1. **Biological Techniques** **2. Microbial Nanotechnology** **3. Molecular Taxonomy & Phylogeny**
4. **Marine Microbiology** **5. Food and Dairy Microbiology** **6. Bioethics, Biosafety &IPR**
7. **Biostatistics & Bioinformatics** **8. Medical lab Technology**

CC- 1 ADVANCED MICROBIOLOGY

Course Code: P1R1MBCC1 **Semester: I**
No. of Credits: 5 **No. of hours per week: 5**
Max Marks: 25+75=100 **Total Inst. Hrs: 72**

Objectives:

- To know the modern classification system
- To become familiar with structure and function of cellular components
- To prepare the student to involve in various research fields by learning culture collection and preservation methods

Unit I: Classification of Microorganism **16 hrs**

Definition and systematics, Nomenclatural rules and identification of microbes in the living world classification systems – Haeckel's three kingdoms, Whittaker's five kingdoms approach, Carl Woes three domain system. Major characteristics used in taxonomy – morphological, physiological and metabolic, genetic and molecular. Outline classification of Bergey's manual of systematic bacteriology (2011-2013).

Unit II: Ultra Structure of Bacteria **14 hrs**

Morphological types; structure and composition of cell walls of Gram negative, Gram positive bacteria, halophiles. L-forms and Archaebacteria, capsule type's composition and function. Cell membranes in eubacteria, archaebacteria and cyanobacteria – membrane functions, periplasmic space. Structure and function of flagella, cilia and pili, gas vesicles, chlorosomes, carboxysomes, magnetosomes and phycobilisomes. Reserve food materials – polyhydroxybutyrate, polyphosphates, cyanophycin and sulphur inclusions. Nuclear material – bacterial chromosomes and bacterial plasmids.

Unit III: Fungi **14 hrs**

Cell wall – chemical composition and functions, membranes and their functions, nutritional strategies of fungi. Structure and life cycle of fungi – Ascomycetes (*Aspergillus*), Deuteromycetes (*Candia*), Zygomycetes (*Mucor*), Basidomyces (*Agaricus*).

Unit IV: Algae and protozoans **14 hrs**

Structure of algal cells – classification – reproduction and characteristics of Chlorophyta (Green algae), Chrysophyta (Golden Brown and Yellow), Green algae, Diatoms, Euglenophyta (Euglenoids). Rhodophyta (Red algae), Cyanophyta, Xanthophyta – Brief account of Protozoans.

Unit V: Culture Collection and Preservation **14 hrs**

Culture collection methods-aerobic and anaerobic culture collection and basic identification methods. Preservation methods of microbes for storage and microscopy studies, culture collections centers – ATCC and MTCC. Physical, chemical methods for controlling microorganisms. A note on fossil microorganism.

Unit VI: Latest Learning (for Continuous Internal Assessment only) Latest developments related to the course during the Semester

References:

1. PelczarJr,M.J.Chan, E.C.S. and Kreig,N.R. (1993). Microbiology, Mc,GrawHill.Inc, New York (All units covered).
2. Prescott,L.M. Harley,J.P. and Klein, D.A.(2003). Microbiology (5th edition) McGraw Hill, New York (All units covered).
3. Madigan,M.T. Martinko,J.M and Parker,J..Brock, T.D.(1997). Biology of Microorganism (8th edition). Prentice Hall International lnc, London (All units covered).
4. GeetaSumbali and Merhrotra R.S. (2009).Principles of Microbiology.Tata McGraw Hill Education private Limited.
5. SambamurtyA.V.S.S (2005).Text Book of Algae .I.K.InternationalPvt Ltd.
6. Alexopoulus, C.J. and Mims,C.W.(1993). Introductory Mycology (3th edition). Wiley Eastern Ltd, New Delhi.
7. Elizabeth Moore- Landecker.(1996). Fundamentals of the fungi. (4th edition). Prentice Hall International, lnc London.
8. Holt,J.S.Kreig, N.R. Sneath, P.H.A and Williams,S.T. Bergey's Manual of Determinative Bacteriology (9th edition),Williams and Wilkins., Baltimore.
9. John Webster (1993). Introduction to Fungi (2th edition). Cambridge University Press, Cambridge.
10. Salle, A.J.(1996). Fundamental principles of Bacteriology, (7th edition).Tata McGraw- Hill publishing company Ltd, NewDelhi.

Outcome

After completion of this course, students would be able to

- ♣ Get information about Nomenclature rules and modern classification system
- ♣ Get knowledge on algae and protozoan classification, reproduction and characterization
- ♣ Clear idea on culture collection and preservation

CC 2: GENERAL BIOCHEMISTRY

Course Code: P1R1MBCC2 **Semester: I**
No. of Credits: 5 **No. of hours per week: 5**
Max Marks: 25+75=100 **Total Inst. Hrs: 72**

Objectives:

- To have a detailed knowledge about the structure and function of biomolecules
- To know the properties of biomolecules.
- To understand the importance of biomolecules

Unit- I Chemistry of Biomolecules **16 hrs**

Structure of atoms, molecules and chemical bonds; Covalent and Noncovalent interactions - Van der Waals, Electrostatic, Hydrogen bonding and hydrophobic interactions. Chemical foundations of Biology: pH, pK, acids, bases and buffers, Henderson - Hasselbach equation, biological buffer solutions. Energy metabolism (concept of free energy); Principles of thermodynamics; Kinetics, dissociation and association constants.

Unit –II Carbohydrates and Lipids **14 hrs**

Monosaccharides, Disaccharides, Polysaccharides – Types, properties & their role. Homoglycans: structure and properties of starch, glycogen and cellulose. Heteroglycans: structure and properties of agar, alginic acid (sea weed polysaccharide), glycosaminoglycans and pectins. Lipids: Triglycerides, phosphoglycerols, derived lipids-steroids, prostaglandins and leukotrienes. Membrane lipids and their alignment in membrane.

Unit – III Amino Acids and Proteins **14 hrs**

Amino acids: General structure and classification. Glutathione: synthesis and function. Phenylalanine and tyrosine metabolism, Tetrapyrole from glycine, Cysteine and methionine metabolism, Coenzyme A from valine, aspartate and cysteine. Polyamines from methionine and arginine. Proteins: Peptide bond, Primary structure of proteins (Ramchandran map), structural comparison at secondary, tertiary levels, quaternary and domain structure. Protein sequencing strategies –chemical and enzymatic.

Unit – IV Concept of Enzymes and Kinetics **14 hrs**

Classification of enzymes. Mechanisms of enzyme action; Estimation of Michaelis - Menten parameters, Lineweaver – Burk Plot, types of inhibition & models for substrate and product. Allosteric regulation of enzymes, factors affecting enzyme activity, Enzyme immobilization.

Unit – V Metabolism **14 hrs**

General scheme of metabolism, glycolysis – aerobic and anaerobic, regulation. Krebs cycle and its regulation; HMP shunt, glyoxylate and glucoranate pathways Cori's cycle. Glycogenesis, gluconeogenesis and glycogenolysis and their regulation. TCA cycle and its central role in metabolism. Biosynthesis of purines and pyrimidines, Oxidation of fatty acids; Biosynthesis of fatty acids. Biosynthesis and degradation of amino acids (An overview).

Unit VI: Latest Learning (for Continuous Internal Assessment only) Latest developments related to the course during the Semester

References:

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.
6. Mohan P. Arora.(2004).Biomolecules.1st Edition. Himalaya Publication House
7. David E. Metzler. And Carol M. Metzler (2001). Biochemistry-The chemical reactions of living cells- Vol1&2.(2nd edition).Harcourt/Academic press, Newyork.
8. DonaldVoet and Judith G. Voet (1995). Biochemistry – Second Edition. John Willey and Sons, Inc.
9. Leninger,A.L., Nelson, D.L., Cox, M.M., (1993). Principles of Biochemisry,(2nd Edition).CBS Publishers,
10.Geofferey, L and Zubay (1998). Biochemsitry. (Fourth Edition) Wm. C. Brown Publishers.
11.Stryer, L. (1995). Biochemistry. 4th Ed. W.H. Freeman and Company, New York

Outcome

After completion of this course, students would be able to

- Get information clearly about the biomolecules.
- 2Clear knowledge on Carbohydrates and Lipids
- To enable knowledge about on amino acids and proteins.
- Acquire knowledge on Enzymes
- Gain knowledge on energy production

CC-3 MICROBIAL PHYSIOLOGY

Course Code: P2R1MBCC3 **Semester: II**
No. of Credits: 5 **No. of hours per week: 5**
Max Marks: 25+75=100 **Total Inst. Hrs: 72**

Objectives:

- To understand of the basic functions of a cell
- To know the dynamics of microbial growth
- To be familiar with microbial pigments
- To be aware of how physiology is applicable in industries
- To learn about the thermodynamics

Unit I - Cell Structure and Function **16 hrs**

Cell structure and function - Biosynthesis of peptidoglycan - outer membrane, Teichoic acid – Exopolysaccharides; cytoplasmic membrane, pili, fimbriae, S-layer, cell inclusions. Transport mechanisms – active, passive, facilitated diffusions – uni, sym, antiports. Iron uptake - Pinocytosis and Phagocytosis.

Unit II - Microbial Growth **14 hrs**

Microbial growth - Phases of growth – growth curve – measurement of growth – calculations of growth rate – generation time – Batch, Continuous and synchronous growth – induction of synchronous growth, synchrony index – factors affecting growth – pH, temperature, substrate and osmotic condition. Survival at extreme environments – starvation – adaptative mechanisms in thermophilic, alkalophilic, osmophilic and psychrophilic. Bioluminescence - mechanism – advantages.

Unit III - Microbial Pigments **14 hrs**

Microbial pigments - Autotrophs - cyanobacteria - photosynthetic bacteria and green algae – heterotrophs – bacteria, fungi, myxotrophs. Brief account of photosynthetic and accessory pigments – chlorophyll – fluorescences, phosphoroscenses - bacteriochlorophyll – rhodopsin – carotenoids – phycobiliproteins;

Unit IV - Spore Physiology **14 hrs**

Spore Physiology: Types, endospores and other persistent forms, Classification of endospore forming bacteria, spore formation, Initiation process of sporulation. Genes with reference to *Bacillus subtilis*. Other persistent forms: Cyst, Exospores and Myxospores.

Unit V – Bioenergetics **14 hrs**

Laws of Thermodynamics, High energy phosphate and their role in redox reaction. Enzymes involved in biological oxidation – redox potential, Role of respiratory chain in mitochondria, in energy capture; respiratory chain in mitochondria; in energy capture; respiratory control. Mechanism of Oxidative phosphorylation; Chemiosomotic theory; uncouplers of oxidative phosphorylation. Inhibitors of electron transport chain.

Unit VI: Latest Learning (for Continuous Internal Assessment only) Latest developments related to the course during the Semester

References:

1. Lansing M. Prescott, John P. Harley and Donald A. Klein. (2003). Microbiology.(5th edition).McGraw-Hill company, New York
2. Moat, A.G., Foster, J.W. and Spector, M. P (2002). Microbial Physiology (4th Edition). John Wiley & Sons, New York
3. Hans G. Schlegel (1995) General Microbiology, Seventh edition, Cambridge University Press
4. S.Sundarajan (2003). Microbial Physiology, 1st edition, Annol Publications.
5. Pelczar, Jr, M.J.Chan, E.C.S and Kreig, N.R. (1993). Microbiology, Mc.GrawHill.Inc, New York.
6. Caldwell, D.R. (1995). Microbial Physiology and metabolism, Wm. C. Brown, Publishers, USA
7. Salle,A.J. (1996). Fundamental principles of Bacteriology (7th edition).Tata McGraw-Hill publishing company limited, NewDelhi.
8. White, D. (1995). The physiology and biochemistry of Prokaryotes, Oxford University, Press, Oxford, New York.
9. Rabert Poole, K. (2007) Advances in Microbial Physiology, Volume 53 Elsevier Science & Technology

Outcome

After completion of this course, students would be able to

- ♣ Acquire knowledge on cell structure and function
- ♣ Become educated on pigments
- ♣ Come to know about spore physiology
- ♣ Enable them to work on fermentation industry
- ♣ Get information about energy production

Core Course IV (CC)
Practical I
Advanced Microbiology, General Biochemistry & Microbial Physiology
Paper code: P1R1MBCC4P

Advanced Microbiology

1. Principles and methods of sterilization.
2. Direct microscopic observations of bacterial shape – cocci, rods, chains, fungal spores, Mycelium, yeast budding.
3. Preparation of Media: Nutrient broth, Nutrient agar, plates, slants, soft agar.
4. Micrometry – Counting and Measurements.
5. Pure culture techniques: Streak plate, spread plate, pour plate methods and stab culture techniques
6. Measurement of microbes – Micrometry and Dry weight.
7. Motility of bacteria – Hanging drop method
8. Enumeration of bacterial / yeast cells-viable count (Plate count) Total count (Haemocytometer count).
9. Isolation and purification of Cyanobacteria, Actinobacteria, Fungi.
10. Staining methods: Simple, Acid fast, Gram staining , Spore, Capsule,
    Lactophenol cotton blue staining - Fungal slide culture

General Biochemistry

1. Preparation of Buffer; (Tris, phosphate, acetate buffer).
2. Determination of (H^+) ion concentration
3. Verification of Beer-Lambert's law using coloured solution (CuSO4).
4. Preparation of standard graph for the following and estimating the concentration in a Microbial sample (i) Glucose – Anthrone method (ii) Bovine Serum Albumin - Lowry's method and Nucleic acid – DNA (diphenylamine method), RNA (Orcinol method).
5. Separation of aminoacids by paper chromatography and identification of aminoacid.
6. Separation of proteins by SDS – PAGE.

Microbial Physiology

1. Bacterial growth curve – Turbidity method
2. Effect of pH, Temperature and Salinity.
3. Biochemical tests:
   a) IMViC Test
   c) Urease
   d) Catalase
   e) Oxidase
   f) TSI
   g) Hydrogen sulphide
   h) Coagulase and
   i) Nitrate reduction test
   j) Starch, Casein, Gelatin and Lipid hydrolysis tests

References:

1. Wilson, K. and Walker, J. (2000). Practical Biochemistry, 5th Edition, Cambridge University Press.
2. Cappuccino and James, G (1996) Microbiology a laboratory manual, Addison Wesley Publishing Company Inc. 4th edition, England, California.
3. David R. Brooke. Bergey's Manual of Systematic Bacteriology (Vol. I), Eastern Halz, Springer Publication.
4. Gerhardt, P., Murray, R.G., Wood, W.A. and Kreig, N.R. (1994) Methods of General and Molecular Bacteriology, Ed. American Society for Microbiology, Washington D.C.
5. James T. Stanley, Marvin P. Bryant. Bergey's Manual of Systematic Bacteriology (Vol.II), Nobert Fleming Springer Publishers.
6. Wilson K. Walker (1995). Practical Biochemistry, Principles and Techniques, Cambridge University Press.
7. Gerhardt, P., Murray, R.G., Crood, W.A. and Kreig, N.R. (1994) Methods for general and molecular bacteriology, ASM, Washington D.C.
8. Jeanne Dejkstra, Ces.P.de Jager (1998) Practical plant virology, Springer Verlag, Lab Manual, Berlin, Heidel Berg, New York.
9. Miller, J.H. (1992) A short course in bacterial genetics, Cold Spring Harbor.

CC-5 MICROBIAL GENETICS

Course Code: P2R1MBCC5	**Semester: II**
No. of Credits: 5	**No. of hours per week: 5**
Max Marks: 25+75=100	**Total Inst. Hrs: 60**

Objectives:

- To understand of the basic concepts of genetics
- To know the organization of microbial genetics
- To understand the central dogma of molecular biology
- To familiarize with the knowledge of gene regulation

Unit I: Microbial Genetics **12 hrs**

Microbial Genetics: Definition and scope of Genetics. Pre-Mendelian genetics concepts – Performation, Epigenesis, Inheritance of acquired characters, Germplasm theory. Hereditary and Environment, Genotype and Phenotype, Clones, Pure-lines and Inbred lines. Microbes as tools for genetic studies.Organization of Prokaryotic and Eukaryotic genome.

Unit II: Bacterial Genetics **12 hrs**

Bacterial Genetics: Organization of genetic material in bacteria, Gene transfer mechanisms: Conjugation, Transformation and Transduction. Recombination in bacteria. Natural transformation systems- *Streptococcus pneumonia* and *Haemophilus influenzae*.. Transfection and forced competence. Bacterial Conjugation: Properties of the F plasmid, F+ x F - mating, F’ x F- conjugation. Transduction: Generalized and specialized transduction.

Unit III: Viral Genetics **12 hrs**

Viral Genetics: General characteristics of viral genome, T4 virulent Phage: Structure- life cycle. Lambda temperate phage: Structure - Lytic and lysogenic cycle, lysogenic repression. Genetic mapping of viruses, Recombination in viruses; Genetics of Bacteriophage.

Unit IV: Transcription and Translation **12 hrs**

Transcription – initiation, elongation – termination. Synthesis of mRNA in prokaryotes and eukaryotes. Synthesis of rRNA and tRNA. RNA processing – capping and polyadenylation. Genetic code, Translation – initiation, elongation and termination. Signal sequences and protein transport.

Unit V: Regulation of Gene expression **12 hrs**

Regulation of gene expression: operon concept, catabolic repression instability of bacterial RNA, positive and negative regulation, inducers and corepressors. Negative regulation - *E. coli* lacoperon; positive regulation- *E.coli* ara operon; regulation by attenuation his and trp operons. DNA binding sites on DNA, Global regulatory responses: heat shock response, stringent response and regulation by small molecules such as ppGpp and cAMP, regulation of rRNA and tRNA syntheses.

Unit VI: Latest Learning (for Continuous Internal Assessment only) Latest developments related to the course during the Semester

References:

1. David Frifelder, (2012).Microbial Genetics, Narosa Publishing House,New Delhi.
2. Old RS and Primrose,S.B..Principles of gene Manipulation, 5th edition.Black Well Scientific Publication.London.
3. Nancy Trun& Jasmine Trampy (2004). Fundamental of Bacterial Genetics (2004). 1st edition. Blackwell publishing company.
4. C.B.Powar (2003). Gene Regulation.1st edition. Himalaya publication.
5. S.Sambamurthy (2007). Molecular Genetics. Jones and Bartlett Publishers.
6. Darnell.J. 1995.Molecular Cell Biology, Scientific American Books, USA.
7. Weaver.R.F., Philip.P.W.1989, Genetics, WMC Brown Publishing, USA.
8. Lodish H., Baltimore D., Berk ,A., Zipsary S.L., Matsudaira P., Darnell J.(1995).Molecular Cell Biology .Scientific American Books.
9. Antony J F., Griffiths, Gilbert WM., Wewontin R C., Miller J H., (2000(Modern GeneticAnalysis, Integrating Genes and Genomes, 2ndedition, W H
10. Gardner E.J., Simmons M J., SnustadD.P. (1991).Principles of Genetics .John Wiley and Sons.
11. Lewin B. (2008).GenesVIII 8th edition.Oxford University. Pratice Hall publications.
12. Watson JD,Hopkins NH,Roberts JW,SteitzJA,Weiner AM .(2004).Molecular Biology of the Gene , 5th edition.Benjamin /Cummings Publishing Company.
13. Daniel L.Harti and W.Jones (2001). Genetics. 5th edition. Jones & Bartlett publications.

Outcome

After completion of this course, students would be able to

- ♣ Become well-known in Genetics concepts in central dogma of Molecular Biology
- ♣ Become knowledgeable in Viral Genetics
- ♣ Knowledge on gene regulation is imparted

CC-6 MOLECULAR BIOLOGY & GENETIC ENGINEERING

Course Code: P2R1MBCC6	**Semester: II**
No. of Credits: 5	**No. of hours per week: 5**
Max Marks: 25+75=100	**Total Inst. Hrs: 60**

Objectives:

- To be familiar with gene mutation
- To use vectors in genetic engineering
- To understand enzymes responsible for manipulating the genetic materials
- To know the techniques in genetic engineering
- To understand the functional genomics and applications

Unit I: Gene and Mutation **12 hrs**

Mutations – spontaneous and induced, base pair changes, frame shifts, deletions, inversions, tandem duplications, insertions. Mutagens - Physical and Chemical mutagens. Outlines of DNA damage and repair mechanisms. Genetic recombination in bacteria – Conjugation, Transformation and Transduction.

Unit II: Plasmid and Cloning Vectors **12 hrs**

Plasmid features and biology - structural and functional organization, plasmid replication and copy number - stringent and relaxed plasmids, incompatibility of plasmid maintenance. Construction of an ideal vector, co-integrate vectors. Salient features of cloning vectors, restriction enzymes, their classification, mode of action and target sites.Types of cloning vectors: plasmids, cosmids,phasmids, shuttle vectors, BAC, YAC, bacteriophage and other viral vectors.

Unit III: Gene Manipulating Enzymes **12 hrs**

Enzymes in Genetic Engineering - DNA polymerase, RNA polymerases, Polynucleotide kinase, DNA ligases -Nick translation system, Terminal deoxynucleotidyltransferase,Topoisomerases, Reverse transcriptase, Restriction endonucleases Type I & II. Restriction modification systems.

Unit IV: Techniques of Genetic Engineering **12 hrs**

Strategy of recombinant DNA technology – Cloning strategies - Use of linkers, adaptors, homopolymer tails - cDNA cloning and gene libraries. Recombinant selection and screening methods. Expression of cloned genes – problems and solutions. Whole genome analysis - physical method of DNA sequencing - automated sequence; chromosome walking. Methods of introducing recombinant DNA in to bacteria, plants and animals - Ca-mediated transfection, particle bombardment, microinjection, electroporation and lipofection.

Unit V: Functional Genomics and Applications of Genetic Engineering **12 hrs**

Molecular screening - DNA chips and microarrays - site directed mutagenesis, transgenic animals and gene knockout techniques, cell culture based techniques. Genetic diagnosis - Applications in medical field, transgenic plants, transgenic animals, Recombinant vaccines development. Gene therapy; Molecular basis of genetic diseases, genetic counseling.

Unit VI: Latest Learning (for Continuous Internal Assessment only) Latest developments related to the course during the Semester

References:

1. David Frifelder. (2012).Microbial Genetics, 2nd Edition. NarosaPublishingHouse, New Delhi.
2. Old RS and Primrose,S.B.Principles of gene Manipulation,5thedition.Black Well Scientific Publication.London.
3. Lewin B. (2000).GenesVII.Oxford University.
4. Watson JD,Hopkins NH,RobertsJW,SteitzJA,Weiner AM .(1998).Molecular Biology of the Gene , 4th edition. Benjamin /Cummings Publishing Company.
5. Gardner E.J., Simmons M J., Snustad D.(1991).Principless of Genetics.8th edition John Wiley and Sons.
6. Darnell.J .,1995.Molecular Cell Biology, Scientific American Books, USA.
7. Weaver.R.F., Philip.P.W.1989, Genetics, WMC Brown Publishing, USA.
8. Lodish H., Baltimore D., Berk ,A., Zipsary S.L., Matsudaira P., Darnell J.(1995).Molecular Cell Biology .Scientific American Books.
9. Antony J F., Griffiths, Gilbert WM., Wewontin R C., Miller J H., (2000(Modern GeneticAnalysis, Integrating Genes and Genomes, 2ndedition, W H

Outcome

After completion of this course, students would be able to

- Seek knowledge on mutation and its types
- Gain insight in cloning vectors
- Become aware of enzymes
- Better understand of cloning techniques
- Get an idea on genomics

CC-7 IMMUNOLOGY

Course Code: P2R1MBCC7 **Semester: II**
No. of Credits: 5 **No. of hours per week: 5**
Max Marks: 25+75=100 **Total Inst. Hrs: 60**

Objectives:

- To understand of the basic functions of Immune system
- To know the properties antigens and antibodies
- To understand the structure and functions of immune cells
- To familiarize with the knowledge of Immunity to infections
- To develop skills in immunotechniques

Unit I: Immune System **12 hrs**

Milestones in immunology - evolution of immunology Infection, immunity, types of immunity - innate and adaptive, phagocytosis and extracellular killing, immunity to specific infection,. Anatomy of the lympho - reticular system, primary lymphoid organs - Secondary lymphoid tissues - Hematopoiesis , immuno reactive cells - T & B lymphocytes, macrophages, granulocyte and NK cells, Lymphocyte Traffic.

Unit II: Antigen and Antibody Molecules **12 hrs**

Antigen types and its properties, Antigen engineering for better immunogenicity - Use for vaccine development- immunization schedule, whole cell vaccines, recombinant vaccines, DNA vaccines, synthetic peptide, multivalent subunit and anti-idiotype vaccines, Edible vaccines. Antibody structure and function, Classification of immunoglobulins, Antibody engineering – Monoclonal Antibody production - Hybridoma Technology. Antibody for diagnosis, Antibody for therapy.

Unit III: MHC, Cytokines and Complements **12 hrs**

Concept of Histocompatibility - Genetic organization of H2 and HLA complexes. Class I and class II MHC molecules, structure and function. Antigen processing and presentation by MHC molecules. Cytokine structure and their receptors - Cytokine therapy, Complements – membrane attack complex – classical and alternate pathway.

Unit IV: B and T cell Activation **12 hrs**

B cell receptor complex (BCR), B cell activation and maturation, Generation of antibody diversity, Understanding self-nonself discrimination, TH Cell subpopulation, Organisation of T cell receptor, T cell receptors (TCR), APC-Tcell interaction, T cell activation and maturation, Th1 and Th2 cells. Cell mediated effector responses. Lymphocyte Migration and Inflammation, Hypersensitivity reactions - auto immunity.

Unit V: Immunotechnology and its applications **12 hrs**

Precipitation techniques, agglutination techniques, radiology in immunotechniqes, Enzyme-Linked immunosorbent assay (ELISA), Western blotting, immunofluorescence, Flowcytometry and immunoelectron microscopy. Infectious diseases - immune system in AIDS, transplantation immunology, cancer and the immune system.

Unit VI: Latest Learning (for Continuous Internal Assessment only) Latest developments related to the course during the Semester

Refernces:

1. Ivan Roitt. Jonathan Brostoff and David Male. (2007). Immunology(7th edition).Elsevier science Ltd., New York
2. Janis Kuby (1994). Immunology. (2nd edition). W.H. Freeman and company,New York.
3. N.V.Shastri (2005). Principles of Immunology.(5th Edition).Himalaya Publishing House, Mumbai.
4. I.Kannan (2007). Immunology. MJP Publishers.
5. S.C.Rastogi (2008). Elements of Immunology. CBS publishers, New Delhi.
6. Lydyard, Whelan and Fanger (2002), Instant notes in Immunology, Bios scientific publishers.
7. Charles A. Janeway,Jr. Paul Travers. Mark Walport and Donald Capra,J.(1999). Immunobiology-The immune system in health and disease.(4th edition).Current Biology Publications, London.
8. Richard A.,.Goldsby Thomas J. Kindt and Barbera A. Osborne. (2002). Kuby Immunology.(5th edition).W.H. Freeman and company, New York.
9. Abul K. Abbas. Andrew H. Lichtman and Jordan S.Pober.(1994). Cellular and Molecular Immunology.(2nd edition).W.B. Saunders company, Philadelphia.
10. Ian.R.Tizard (2004). Immunology – An introduction.4th Edition.
11. Joshi & Osama (1998). Immunology (Serology, Hematology), Agro Botanica.

Outcome

After completion of this course, students would be able to

- ♣ Get educated on immunity and its types
- ♣ Seek information on vaccines and its types
- ♣ Learnt on MHC moecules
- ♣ Acquired skills on B and T cells
- ♣ Developed expertise on immunotechniques

CC-8 MEDICAL MICROBIOLOGY

Course Code: P2R1MBCC8 **Semester: II**
No. of Credits: 5 **No. of hours per week: 5**
Max Marks: 25+75=100 **Total Inst. Hrs: 60**

Objectives:

- To understand of the basic concept of medical microbiology.
- To provide technical knowledge on collection and processing of clinical samples
- To learn the technique for isolation and identification of pathogens
- To know the pathogenicity of medically important microbes.
- To develop the knowledge on diagnosing microbial infections.

Unit-I: Introduction of Medical Microbiology **12 hrs**

History of Medical Microbiology, Scope of Medical Microbiology. Normal Microbial flora of healthy human host, Host Microbial interaction – Invasivesness. Infectivity and Pathogenic potentials – Epidemiology of Infectious diseases. Zoonotic diseases. Hospital born infections.

Unit-II: Laboratory Diagnosis **12 hrs**

Collection and transport of clinical samples – Urine, Blood, Stool, CSF. Isolation of pathogenic bacteria and fungi from clinical samples like Blood, Urine, Stool and sputum. Assessment of parasitic infection using clinical samples. Antibiotic sensitivity assay, MIC, MBC, IC50 determination

Unit-III: Systematic Medical Bacteriology **12 hrs**

Study of bacterial pathogenic diseases of international importance – Pneumonia (*Streptococcus* and *Klebsiella*), Gonorrhoea, Cholera, Diptheria, Tuberculosis, Leprosy, Lyme disease, Meningitis, Syphillis, Gastroenteritis, Typhoid, Anthrax.

Unit-IV: Viral Diseases **12 hrs**

Study of diseases associated with viruses – swine flu, bird flu, Measels, Mumps, Rubella, Polio, Chicken Pox, small pox, Hepatitis, Dengu, Japanease Enchepalitis, Ebola haemoraggic fever, Rabies, AIDS, Yellow fever.

Unit-V: Mycology & Protozoology **12 hrs**

Superficial, Cutaneous, Subcutaneous, Systemic and opportunistic Mycoses, Causative agent, Lifecycle, pathogenesis and treatment of following protozoan and helminthic diseases – Amoebiasis, Giardiasis, Malaria, Sleeping sickness, *Filariosis* and *Ascariasis.*

Unit VI: Latest Learning (for Continuous Internal Assessment only) Latest developments related to the course during the Semester

References:

1. Ananthanarayanan, R and C K JayaramPanicker. 2009. Textbook of Microbiology, 9th edition, Orient Longman
2. Chakraborty P 1995, A Text book of microbiology, New Central Book Agency Pvt Ltd. Calcutta
3. David Greenwood. Richard C.B Slack and Jhon F.Peuthere.2000.Medical Microbiology 15th edition, ELBS with Churchill Livingston Publi

4. Chatterjee K.D.2007. Medical Microbiology, 7th edition.
5. Prescott, Harley, Klein's. 2007. Microbiology. 7th edition, McGraw Hill Medical Publications Division.
6. Chaechter M. Medoff G. and Eisenstein BC. (1993) Mechanism of Microbial Diseases.2nd Edition. Williams and Wilkins, Baltimore.
7. Collee, JG. Duguid JP, Fraser AG, Marimon BP. (1989) Mackie and McCartney Practical Medical Microbiology, 13th Edition. Churchill Livingstone.
8. Hugo WB and Russell AD. (1989) Pharmaceutical Microbiology IV edition.Blackwell Scientific Publication, Oxford.
9. Joan Stokes E, Ridgway GL and Wren MWD. (1993). Clinical Microbiology, 7thEdition. Edward Arnold. A division of Hodder and Stoughton.
10. Ronald M. Atlas. (1989) Microbiology. Fundamentals and Application

Outcome
After completion of this course, students would be able to

- ♣ Students come out with basic ideas about medical microbiology.
- ♣ Get knowledge in specimen collection and processing
- ♣ Become technically expert which will helpful to work in clinical laboratory
- ♣ Familiar in the emerging diseases.
- ♣ Acquire knowledge on control measures of diseases

Core Course 9 (CC)
Practical II
Microbial Genetics, Molecular Biology & Genetic Engineering, Immunology and Medical Microbiology
Microbial Genetics
Paper code: P2R1MBCC9P

Microbial Genetics

1. Isolation of antibiotic resistant microbes
2. Isolation of Streptomycin resistance mutant by gradient plate technique
3. Transformation (competent cell preparation) and Transduction using P1.
4. Isolation of Auxotrophic mutant

Molecular Biology & Genetic Engineering

1. Isolation of Genomic DNA from bacteria
2. Isolation of Plasmid DNA from bacteria
3. Characterization of DNA by Agarose gel electrophoresis
4. Restriction digestion and Ligation of DNA
5. Transformation of plasmid DNA
6. Polymerase Chain Reaction
7. Blotting techniques - Southern and Western Blotting

Immunonology

1. Collection of venous blood and separation of serum/plasma
2. Double immunodiffusion – Ouchterlony's method
3. Counter immuno electrophoresis
4. Immunolectrophoresis – Graber and Williams technique
5. Blood grouping
6. Latex agglutination test – ASO, RF
7. WIDAL tube and slide agglutination technique
8. Enzyme Linked Immunosorbent Assay (ELISA)
9. Handling of Laboratory animals and raising antibodies

Medical Microbiology

1. Collection and transport of clinical specimens for microbiological examinations
2. Isolation and identification of upper respiratory tract bacterial pathogen – *Streptococcus pyogens/ Klebsiella pneumoniae*
3. Isolation and identification of lower respiratory tract bacterial pathogen – *Pseudomonas aeuroginosa/ Klebsiella pneumonia/S. pneumonia.*
4. Isolation and identification of gastrointestinal bacterial infection – *Salmonella / Shigella /Vibrio*
5. Isolation and identification of urinary tract infection (UTI) – *E. coli & Klebsiella pnemoniae*
6. Isolation and identification of bacteria from the cases Typhoid fever – *Salmonella typhi, S. paratyphi* A & B
7. Isolation of fungal skin pathogens – Trichophytons, Microsporum. Dermatophytes & *Candida*
8. Demonstration of intestinal parasites (trophozoites / cysts / ova) – Saline and iodine wet mount.
9. Antibiotic susceptibility test – Disc diffusion method (Kirby - Bauer)
10. Determination of MIC

References:

1. Atlas Ronald.M. Bartha and Richard (1987). Microbial Ecology 2nd edition. Benjamin/Cummings Publishing company
2. Dirk, J.Elasas, V, Trevors, J.T., Wellington, E.M.H. (1970). Modern soil microbiology, Marcel Dekker INC, New York.
3. Ec Eldowney, S, Hardman D.J, Waite, S. (1993). Pollution Ecology and Biotreatment – Longman Scientific Publishers
4. Mitchel, R. (1992). Environmental Microbiology. Wiley-John Wiley and Sons. Inc Publications New York.
5. Clescri, L.S., Greenberg, A.E and Eaton, A.D. (1998). Standard Methods for examination of water and waste water, 20th edition, American Public Health Association.

CC-10 VIROLOGY

Course code: P3R1MBCC10 **Semester: III**
No. of Credits: 5 **No. of hours per week: 5**
Max Marks: 25+75=100 **Total Inst. Hrs: 60**

Objectives

- To learn about the various basic characteristics of viruses.
- To know the structure and composition of viruses.
- Making aware of viral diseases.

Unit I: General Virology **12 hrs**

Brief outline on discovery of viruses, nomenclature and classification of viruses; Distinctive properties of viruses; morphology & ultrastructure. Capsids and their arrangements - types of envelopes and their composition-viral genome, their types and structures. Brief account of Cyanophages, phycophages, mycophages and Insect viruses. Viroids, prions – Viral related agents.

Unit II: General Methods of Diagnosis and Serology **12 hrs**

Cultivation of viruses in embryonated eggs, experimental animals, and cell cultures. Primary & secondary cell cultures and monolayer cell cultures; cell strains, cell lines and transgenic systems. Serological methods – haemagglutination& HAI; complement fixation; immunofluorescence methods, ELISA and radioimmunoassays. Assay of viruses– physical and chemical methods (protein, nucleic acid, radioactivity tracers, electron microscopy). Infective assay (plaque method, end point method).

Unit III: Bacterial Viruses **12 hrs**

Bacteriophage - structural organization - Lytic cycle - DNA replication - eclipse phase -phage production - burst size; lysogenic cycle. Brief details on M13, Mu, T4, Lambda and P1.

Unit IV: Plant Viruses **12 hrs**

Classification and nomenclature; effects of viruses on plants; RNA viruses- TMV, Cowpea, CMV, Mosaic viruses, Bromo mosaic viruses, Satellite viruses. Double stranded DNA viruses – CaMV, Single stranded DNA viruses –Gemini virus. Transmission and of plant viruses (with vectors) - insects,nematodes, fungi – (without vectors) contact, seed and pollens. Common viral diseases of crop plants - names of diseases, pathogens and symptoms only - paddy, cotton, tomato and sugar cane.

Unit V: Animal Viruses **12 hrs**

Classification and nomenclature of animal human viruses. Epidemiology, life cycle, pathogenicity, diagnosis, prevention and treatment of RNA Viruses - Picorna, Orthomyxo, Paramyxo, Rhabdo, Rota, HIV - Oncogenic viruses. DNA viruses; Pox, Herpes, Adeno, SV 40; Hepatitis viruses. Viral vaccines (including DNA Vaccines with examples) interferons, and antiviral drugs.

Unit VI: Latest Learning (for Continuous Internal Assessment only) Latest developments related to the course during the Semester

References:

1. Conrat HF, Kimball PC and Levy JA. (1988). Virology. II edition. Prentice Hall,Englewood Cliff, New Jersey.
2. AmithaBiswas(2007). An Introduction to viruses.Vikas Publishers
3. Maloy, S.R, Cronan Jr. J.E, Freifelder, D. (1998). Microbial genetics. Jones and Bartlett publishers.
4. Saravanan,P.(2006).Virology. MJP Publishers
5. Roger Hull (2002). Mathews' Plant Virology.(4thEdition).Academic press-A Harcourt Science and technology company,Newyork.
6. Flint, S.J., Enquist, L.W., Krung, R. Racaniello, VR. andSkalka, A.M. (2000). Principles of Virology, Molecular Biology, pathogenesis and control, ASM Press, Washinton D.C.
7. Alan J.Cann (1997). Principles of Molecular virology.(2nd edition). Academic press,California.
8. Ann GiudiciFettner (1990). The Science of Viruses. Quill William Marrow,Newyork.
9. Nicklin,J.Greame-Cook.and Killington, R. (2003). Instant Notes in Microbiology.(2^{nd}edition).Viva Books private limited,NewDelhi.
10. Robert I.Krasner (2002). The microbial challenge:Human Microbe Interactions.American society for Microbiology,Washington.
11. Tom Parker, Leslie, M. and Collie, H. (1990). Topley& Wilson’s Principles of Bacteriology, Virology and Immunity (VIII Edition).

Outcome

After completion of this course, students would be able to

- ♣ Students come out with basic ideas about viruses.
- ♣ Enable them to know diagnosis procedures in virology.
- ♣ Familiar in the viral diseases.

CC-11 ENVIRONMENT AND AGRICULTURAL MICROBIOLOGY

Course Code: P3R1MBCC11 **Semester: III**
No. of Credits: 5 **No. of hours per week: 5**
Max Marks: 25+75=100 **Total Inst. Hrs: 60**

Objectives:

- To know the various interaction and role of microbes in improving soil fertility.
- To become familiar with some important Indian crop diseases
- To inculcate the spread of air born and water borne diseases
- To Acquire the knowledge of Aquatic ecosystem
- To know the solid and liquid waste management

Unit I: Soil Microbiology **12 hrs**

Interactions among soil microorganisms - mutalism, - commensalism – amensalism – synergism - parasitism – predation -competition. Microbial interactions between plants – rhizosphere - phyllosphere - mycorrhizae - symbiotic association in root nodules. Biofertilizers – VAM, *Rhizobium, Frankia, Azospirillum, Azotobacter*cyanobacteria and Azolla.

Unit II: Plant Diseases and its control **12 hrs**

Some bacterial diseases of agricultural crops. Plant diseases, pathogens and symptoms and control measures with reference to paddy, cotton, maize, tomato, citrus,mango, potato. Plant protection – phenolics –phytoalexins and related compounds. Bioinsecticides – viral, bacterial and fungal- a brief note.

Unit III: Biogeochemical Cycles & Air Microbiology **12 hrs**

Soil microbes and fertility of soil. Roles of microbes in biogeochemical cycles – carbon, nitrogen, phosphorus, sulphur.soli microbes and fertility of soil. Aerobiology – a brief introduction - droplet nuclei – aerosols - air borne transmission of microbes and diseases; assessment of air quality.

Unit IV: Aquatic Microbiology **12 hrs**

Aquatic microbiology - factors that affect microbial growth – temperature – pressure – light – salinity - turbidity – pH -inorganic and organic constituents. Aquatic habitats - freshwater - lakes, ponds and streams; marine habitats - estuaries, deep sea, hydrothermal vents, saltpans, coral reefs and mangroves and their microbial communities; zonation – food chain and food web. Role of microorganisms in the productivity.

Unit V: Waste Treatment **12 hrs**

Types of wastes - characterization of solid and liquid wastes. Treatment of solid wastes – incinationcomposting, vermiform composting, sillage, pyrolysis, saccharification. Treatment of liquid wastes –primary and secondary treatment; anaerobic (methanogenesis) -aerobic - trickling, activated sludge, oxidation pond.

Unit VI: Latest Learning (for Continuous Internal Assessment only) Latest developments related to the course during the Semester

References:

1. Atlas Ronald, M., Bartha, and Richard (2009). Microbial Ecology. 4th Edition Benjamin/Cummings Publishing Company, California.
2. Subba Rao N .S (1995) Soil microorganisms and plant growth. Oxford and IBH publishing co. pvt. Ltd. New Delhi
3. Joseph, C. Daniel. (1999). Environmental Aspect of Microbiology (2nd Edition). Bright sun publication
4. Rengasawamy ,G., Bagyaraj, D.J. (2001) Agricultural Microbiology.Prentice.Hall of India (P) Ltd
5. Sharma, P.D. (2009). Environmental Microbiology. Narosa Publication
6. Aneja, K.R., Jain and Raman Aneja (2008). A text book of basic and applied microbiology. 1st edition. New Age Publications.
7. T.K.Saha. (2014).Ecology and Environmental Microbiology.
8. Dirk, J. Elasas, V., Trevors, J.T., Wellington, E.M.H. (1997). Modern Soil icrobiology, Marcel Dekker INC, New York, HongKong.
9. EcEldowney S, Hardman DJ, Waite DJ, Waite S. (1993). Pollution: Ecology and bio treatment – Longman Scientific Technical.
10. Mitchel, R. (1992). Environmental Microbiology. Wiley – John Wiley and Sons. New York.
11. Clescri, L.S., Greenberg, A.E. and Eaton, A.D. (1998). Standard Methods for Examination of Water and Waste Water, 20th Edition, American Public Health association.
12. Gerhardt, P., Murray, R.G., Wood, W.A. and Kreig, N.R. (1994). Methods for General and Molecular Bacteriology, ASM Publications, Washington D.C.
13. Patricia Cunning (1995). Official Methods of Analysis, Vol. I and II, 16th Edition, Arlington, Virginia, USA.

Outcome

After completion of this course, students would be able to

- Become familiar with Indian crop diseases
- Become knowledgeable in aquatic ecosystem
- Solid and liquid waste management techniques are imparted

CC - 12 MICROBIAL BIOTECHNOLOGY

Course Code: P3R1MBCC12 **Semester: III**
No. of Credits: 5 **No. of hours per week: 5**
Max Marks: 25+75=100 **Total Inst. Hrs: 60**

Objectives:

- To be aware of microbial production of enzymes
- To familiarize with the knowledge of microbial products like SCP
- To know the eco-friendly alternatives using microbes
- To understand transgenic models
- To understand the recycling and reuse of wastes

Unit I: Enzyme Technology **12 hrs**

Introduction- Biotechnology – Definition – History – Scope. Microbial production of enzymes- Protease- Pectinase- Lipase. Industrial application of microbial enzymes- Therapeutic- Manipulative- Analytical uses. Immobilization of enzymes and its application. Ribozymes- Abzymes- Synzymes.

Unit II: Microbial Products **12 hrs**

Biotechnological potential of microalgae – Food – Feed - Colourant – Fuel - Pharmaceutically valuable compounds. SCP (Bacteria and Yeast). Mushroom cultivation. Health care products- Insulin- Somatotrophin- Somatostatin- Interferon- Blood clotting factor VII- Vaccines. Production of IAA- Giberellin- Auxin

Unit III: Biofuel, Biosensors and Biochips **12 hrs**

Definitions- Bioethanol production-application. Biodisel production-application. Biogas production-application. Bio Hydrogen production - application. Biosensors –Types- Application. Biochips– Types- Application.

Unit IV: Transgenic Plants and Animals **12 hrs**

Development of Transgenic plants and animals- resistant to herbicide- insects-bacteria- virus and fungus. Transgenic rice, edible vaccine, bioplastic. Transgenic animals - ethical implications on transgenic animals

Unit V: Bioremediation **12 hrs**

Microbes involved in biodegradation - Microbial degradation of phenolics – metals – sewage nutrients (phosphate and nitrate) – hydrocarbons – xenobiotic compounds, bioaugmentation – bioaccumulation – biomagnification. Microbial leaching of ores – oil extraction. Microbial deterioration of materials – paper – leather – wood – paint – textiles – paint – metal corrosion.

Unit VI: Latest Learning (for Continuous Internal Assessment only) Latest developments related to the course during the Semester

References:

1. Singh, B. D. (2006).Biotechnology. Kalyani Publication.
2. Dubey, R.C. (2017). Text book of Biotechnology. Chand and company (P)Ltd

3. Trevan, M.D, Boffey, S. Coulding K. H., Stanburry.P. (1990). Biotechnology the basic principles-Tata McGraw Hill edition.
4. Sathyanarayana, U (2008). Biotechnology. Books and allied (P) Ltd
5. PradiptaKumar,Mohapatra (2006).Text Book of Environmental Biotechnology. I.K International.
6. Das, H.K., (2007).Text Book of Biotechnology. 3rd Edition. Wiley India (P) Ltd
7. Ramwat, K.G.,ShailyGoyal (2009).Comprehensive Biotechnology. Chand and company (P)Ltd
8. WiliamJ,Thieman ,Michael, A., Palladino (2009). Introduction to Biotechnology. Dorling Kindersley (India) Private Limited
9. Philose, P.M. (2006).A Text Book of Biotechnology. Dominant Publishers and Distributors.
10. Ramdass, P., Meerarani, S (2002).Text book of Animal Biotechnology. Library of congres cataloguing in Publishing in Data.

Outcome

After completion of this course, students would be able to

- ♣ Knowledge on microbial production of enzymes
- ♣ Idea on transgenic plants and animals
- ♣ Basic idea on microbial productions of pharmaceuticals products.

CC-13 FERMENTATION TECHNOLOGY

Course Code: P3R1MBCC13 **Semester: III**
No. of Credits: 5 **No. of hours per week: 5**
Max Marks: 25+75=100 **Total Inst. Hrs: 60**

Objectives:

- To know how the microbes are used in industries
- To be aware of the strain improvement for industrial purposes
- To know the different types of fermenters and their functions
- To familiar with large scale production of important products
- To understand the patent rights

Unit I – Industrially Important Microbes and their Development **12 hrs**

Screening methods for industrial microbes – detection and assay of fermentation products– classification of fermentation types – strain selection and improvement. Mutation and recombinant DNA techniques for strain development.

Unit II – Fermenter – Types and Function **12 hrs**

Fermenters – Basic functions, design and components – asepsis and containment requirements – body construction and temperature control – aeration and agitation systems – sterilization of fermenter, air supply, and medium; aseptic inoculation methods– sampling methods, valve systems – a brief idea on monitoring and control devices and types of fermenters.

Unit III – Large Scale Fermentation **12 hrs**

Fermentation media - Desired qualities - media formulation strategies – economic means of providing energy, carbon - nitrogen - vitamin and mineral sources - role of buffers,precursors, inhibitors, inducers and antifoams, effect of environment (temperature, pH, high nutrient concentration), types of fermentation. Sterilization, kinetics of thermal death of micro-organisms, batch and continuous sterilization.

Unit IV-Downstream Processing **12 hrs**

Objectives and criteria - foam separation - precipitation methods - filtration devices – chemical and electroflocculation and filter aids - industrial scale centrifugation and cell disruption methods - liquid-liquid extraction - solvent recovery – chromatography - two-phase aqueous extraction – supercritical fluid extraction - ultrafiltration, drying devices, crystallisation and whole broth processing.

Unit V –Industrial Products and IPR **12 hrs**

Commercial production of penicillin, ethanol, vinegar, vitamin B12, Protease from microbial sources.GATT and IPR, forms of IPR, IPR in India, WTO ACT, Convention on Biodiversity (CBD), Patent Co-operation Treaty (PCT), forms of patents and patentability, process of patenting, Indian and international agencies involved in IPR & patenting, Global scenario of Indian patents and , patenting of biological materials.

Unit VI: Latest Learning (for Continuous Internal Assessment only) Latest developments related to the course during the Semester

Refernces:

1. Stanbury P.F.A. Whitaker S.J. Hall, (1995) Principles of Fermentation Techniques.2nd ed.
2. Patel A.H. (2016). Industrial Microbiology, Rajiv Beri for MacMillan India Lte., New Delhi
3. Casida,J.R(2012).Industrial Microbiology. New age international (P) Limited.
4. Sateesh M.K, (2008).Bioethics and Biosafety .I.K.International Publishing house Pvt .Ltd.
5. Kalaichelvan, P T. & Arul Pandi (2007) Bioprocess Technology. MJP Publishers, Chennai.
6. Demain, A.L. and Davies, J.E. (1999). Manual of Industrial Microbiology and Biotechnology. ASM Press.
7. Glick, B.R. and Pasternak, J.J. (1998). Molecular Biotechnology, II Edition, ASM Press,New York.
8. Tortora, G.J., Fernke, B.R. and Case, C.L. (2001), Microbiology – An Introduction, Benjamin Cummings.
9. Prescott C., Dunn .G.(2002).Industrial Microbiology. Agrobios (India).

Outcome

After completion of this course, students would be able to

- ♣ Basic idea on strain improvement for fermentation industries
- ♣ Idea on different types of fermenters and their function and applications
- ♣ Knowledge on IPR

Core Course XIV (CC 14)
Practical III
Virology, Environment and Agricultural Microbiology, Microbial Biotechnology and Fermentation Technology
Paper code: P3R1MBCC14P

Virology

1. Isolation and characterization of bacteriophage and cyanophage from natural resources.
2. Phage titration – T4 or Lambda or M13.
3. Determination of lysogeny using Lambda Phage or Staphylococcal indicator systems.
4. Study of virus infected plant samples – animal tissue culture – chick embryo fibroblast Culture preparation (Demonstration).
5. Transmision method – mechanical.

Agricultural & Environmental Microbiology

1. Isolation and enumeration of soil microorganisms (fungi, bacteria and actinobacteria).
2. Staining of vesicular Arbuscular mycorrhizae from plant.
3. Isolation and culturing of *Rhizobium* from root nodules.
4. Study of the following diseases:
    a) Tobacco mosaic;
    b) Bacterial blight of paddy;
    c) Downy mildew of bajra;
    d) Powdery mildew of cucurbits;
    e) Head smut of sorghum;
    f) Red rot of sugar cane.
5. Isolation and identification of air-borne bio-particles using Andersen sampler.
6. Determination of DO of polluted/pond water.
7. Determination of BOD of polluted/pond water.
8. Determination of COD of polluted/pond water.
9. Assessment of water quality by MPN technique.

Fermentation technology

1. Production, quantification and characterization of followings:
    i) Alcohol,
    ii) Citric acid,
    iii) Amylase,
    iv) Lipase,
    v) Protease

References:

1. K.R.Aneja (2010). Experiments in Microbiology, Plant pathology and biotechnology. New Age International Pvt.Ltd.NewDelhi.
2. Atlas Ronald.M. Bartha and Richard (1987). Microbial Ecology 2nd edition. Benjamin/Cummings Publishing company
3. Dirk, J.Elasas, V, Trevors, J.T., Wellington, E.M.H. (1970). Modern soil microbiology, Marcel Dekker INC, New York.
4. Ec Eldowney, S, Hardman D.J, Waite, S. (1993). Pollution Ecology and Biotreatment – Longman Scientific Publishers
5. Mitchel, R. (1992). Environmental Microbiology. Wiley-John Wiley and Sons. Inc Publications New York.

6. Clescri, L.S., Greenberg, A.E and Eaton, A.D. (1998). Standard Methods for examination of water and waste water, 20th edition, American Public Health Association.

EC I - BIOLOGICAL TECHNIQUES

Course Code: P1R1MBEC1 **Semester: I**
No. of Credits: 3 **No. of hours per week: 6**
Max Marks: 25+75=100 **Total Inst. Hrs: 72**

Objectives

- To have a detailed knowledge about the instruments
- To understand the importance of instruments in industries
- To develop the instrumentation skills among the students

Unit I: Microscopy and Related Techniques **16 hrs**

Light Microscopy: Microscopic optics, components of microscopes. Basic principles and types of Bright field, Dark field, Phase contrast. Fluorescence, Polarization and confocal microscopes and their applications. Immunofluorescence – *In situ* hybridization. Electron Microscopy – Principle, Techniques and applications of Transmission Electron microscope (TEM) and Scanning Electron Microscope (SEM), Atomic Force Microscope (AFM). Photomicrography and Video micrography.

Unit II: Analytical Techniques **14 hrs**

Spectroscopic methods – UV-Visible, Atomic Absorption and Atomic Emission Spectroscopy. Spectroflurimetry, Luminometry. X- ray spectroscopy. Centrifugation – Principles and types centrifugation. Electroanalytical methods – electrolytic – Potentiometric, conductimetric, coulometric&voltametric analysis. Biosensors. Radioactive Analysis: Principles of radioactivity, GM counter & LS counter.

Unit III: Principles & Applications of Chromatographic Techniques **14 hrs**

Principles of chromatography, Thin layer chromatography, Adsorption – Ion exchange and gel permeation – affinity chromotography for separation of compounds GC and HPLC methods.

Unit IV: Electrophoresis Techniques **14 hrs**

Electropohoretic techniques – protein – nucleic acid – immuno – two dimensional electrophoresis.Isoelectric focusing, silver staining.Capillary electrophoresis, Native-PAGE.

Unit – V: Molecular Techniques **14 hrs**

Polymerase chain reaction – Principle, types and applications. Cloning techniques – vectors, enzymes and strategies. Blotting Techniques (Southern, Northern, western and dot blots).

Unit VI: Latest Learning (for Continuous Internal Assessment only) Latest developments related to the course during the Semester

References:

1. Veerakumari (2015). MJP Publishers.
2. Palaivelu.P(2002) Analytical Biochemistry, MKU University.

3. B.Sivakumar (2005). Bioseperatons - Principles and Techniques.Prentice-Hall of India Pvt.ltd.
4. P.Asokan (2002). Analytical Biochemistry. Chinna Publications.
5. Dubey, R.C. (2017). Text book of Biotechnology. Chand and company (P)Ltd.
6. P Sambrrok, J. and Ruseell, D.W. (2001) Molecular Cloning – A Laboratory Manual (3rd eidition, Vol. 1,2,3) Cold Spring Laboratory Press, New York. Ress
7. Glick, B.R. and Pasternak, J.J. (1994). Molecular Biotechnology, ASM Press.
8. John G. Webster. (2004). Bioinstrumentation. University of Wisconsin, John Wiley & Sons, Inc.
9. Wilson, K. and Walker.J (2005). Practical Biochemistry Principles and Techniques,6th edition, Cambridge University/
10. Holme.J and Peck.H (1993). Analytical Biochemistry 2nd edition. Longman Scientific and Technical.

Outcome

After completion of this course, students would be able to

- ♣ Acquire knowledge on different types of microscopes
- ♣ Become educated in chromatographic techniques
- ♣ Come to know about electrophoresis techniques

EC II - MICROBIAL NANOTECHNOLOGY

Course Code: P2R1MBEC2 **Semester: II**

No. of Credits: 3 **No. of hours per week: 4**

Max Marks: 25+75=100 **Total Inst. Hrs: 60**

Objectives

- Detailed introduction about history of nanotechnology and its development.
- Synthesis of nanoparticles and its vast applications.
- Different characterization methods for nano particles to know about its physical and chemical properties.

Unit – I **12 hrs**

History of nanotechnology, concept and future prospects – application in Life Sciences. Terminologies – nanotechnology, microbial nanotechnology, nanomedicine, nanowires, quantum Dots, nanocomposite, nanoparticles. Present status and future prospects of microbial nanotechnology.

Unit – II **12 hrs**

Molecular nanotechnology-nanomachines and collagen. Uses of nanoparticles- cancer therapy and manipulation of cell and biomolecules. Types of nanoparticles- physical, chemical and biological. Microbial synthesis of nanoparticles- mechanism.

Unit – III **12 hrs**

Nanoparticles-types and functions Physical and chemical properties of nanoparticles. carbon nanotubes - Characterization of nanoparticles using UV-Vis, FTIR spectroscopy, Electron Microscopy – HRTEM, SEM, AFM, EDS, XRD and nano particle size analyzer.

Unit – IV **12 hrs**

Advantages of nanoparticles: drug targeting, protein detection, MRI, development of green chemistry – commercial viability of nanoparticles. Disadvantages – health risk associated with nanoparticles, inadequate knowledge on nanoparticles research.

Unit – V **12 hrs**

Drug delivery-protein and nanoparticle mediated. Uses of nanoparticles in MRI, DNA and protein microarrays. Nanotechnology in health sectors. Toxicology in nanoparticles- Dosimetry.

Unit VI: Latest Learning (for Continuous Internal Assessment only) Latest developments related to the course during the Semester

References:

1. David SG. (2004). Bionanotechnology, Lessons from nature, John Wiley & Sons Inc. publication
2. Parthasarathy BK. (2007). Introduction to Nanotechnology, Isha Publication.
3. Elisabeth P and Aravind P. (2007). Bionanotechnology. Morgan & Claypool Publishers.
4. Bernd R. (2006). Microbial Bionanotechnology: -. Horizon Scientific Press.
5. David ER and Joseph DB. (2009). Bionanotechnology: Global Prospects. CRC Press.

6. Ehud G. (2013). Plenty of Room for Biology at the Bottom: An Introduction to Bionanotechnology, World Scientific Publishers.
7. Silva GA and Parpura V. (2011). Nanotechnology for Biology and Medicine: At the building block level, Springer Science.
8. Ibrahim K, Khalid S and Idrees K. (2017). Nanoparticles: Properties, applications and toxicities. Arabian Journal of Chemistry.
9.Yadav.R.K. (2007).Nanotechnology. Manglam Publishers.
10. https://www.igi-global.com/chapter/microbial-nanotechnology/165227

Outcome

After completion of this course, students would be able to

- Get knowledge on latest environmentally friendly research to human welfare
- Basic idea on Physical and chemical properties of nanoparticles
- Gain a better knowledge about targeting drug delivery by nanoparticles

EC III - BIOSTATISTICS AND BIOINFORMATICS

Course Code: P3RMBEC4	**Semester: III**
No. of Credits: 3	**No. of hours per week: 4**
Max Marks: 25+75=100	**Total Inst. Hrs: 60**

Objectives

- To develop skills of the students in the area of probability and statistics
- To know about the various reliability methods
- To learn the basics of computers
- To provide basic idea of bioinformatics databases and application for the students
- To know the basic knowledge of sequence alignment

Unit I: Introduction to Bio statistics **12 hrs**

Introduction to Bio statistics – Collection of data – Graphical representation, bar diagrams and Pie diagram: Measures of Central tendency: Arithmetic mean, median and mode. Measures of dispersion: Range, Mean Deviation and Standard deviation. Coefficient of Variation – Skewness and Kurtosis.

Unit II: Inferential statistics **12 hrs**

Inferential statistics – Probability distributions – Poisson, Binomial and Normaldistributions – Hypothesis testing: Student – t test, Chi-square test, F – test. ANOVA: one way and two way classification – Correlation and Regression.

Unit-III Introduction to Computers **12 hrs**

Basics of Computers-servers, workstations .Operating systems-Unix, Linux, WWW, Search Engine, Finding research articles- PUBMED.

Unit-IV Biological database **12 hrs**

Protein sequence database – PIR, SWISS-PROT, Gene sequence database-Gene bank, DDBJ and EMBL. Structure database – SCOP, CATH and PBD, Specialized databases.

Unit –V Sequence Alignment and Prediction 12 hrs

BLAST, FASTA. Pairwise sequence and Multiple sequence alignment.

Secondary Prediction-Primary structure PROTPARAM, Secondary Structure-SOPMA and Tertiary Structure,Protein Modeling –RASMOL,SWISS-PDB viewers, phylogenetic analysis.

Unit VI: Latest Learning (for Continuous Internal Assessment only) Latest developments related to the course during the Semester

References:

1. AroraMatham (2004^{ed}).Biostatistics.Himalaya Publication.
2. Jasra P.K. and Gur Deep raj – First edition (2000) Krishna PrakashamPvt.Ltd.
3. Bioinformatics (Sequence and genome analysis) (2002) 2nd edition by David W.Mount, CBS publication.UK.
4. Genomes by T.A.Brown 1stedition, Bios Scientific publication UK.
5. Gene Biotechnology (2nd Edition) byJoghand, S.N. Himalaya Publishing company, India.
6. Concepts of genetics by William Klug, MichealR.Cummings.Pearson Education, Delhi.
7. Genome Mapping and Sequencing by Ian Dunham (Hardcover - Sep 1, 2003).
8. Brendan Wren (Editor), Nick Dorrell (2002) Functional Microbial Genomics (Volume33) (Methods in Microbiology), Academic Press, UK.
9. Sandy B. Primrose Richard M. Twyman (2005) Principles of Genome Analysis and Genomics, Blackwell Publishing, USA.
10. Roderic D. M. Page, Edward C. Holmes (1998). Molecular Evolution: A Phylogenetic Approach. Blackwell publishing, USA.
11. Principles of Genome Analysis: A Guide to Mapping and Sequencing DNA from Different Organisms by S. B. Primrose (Paperback - Jan 1998).

Outcome

After completion of this course, students would be able to

- Understand the concepts of Sequence analysis and the prediction of structure.
- Gain the knowledge regarding the software and its application in research field.
- To identify the evolutionary distance between organisms or species.

EC IV - FOOD and DAIRY MICROBIOLOGY

Course Code: P4R1MBEC4 **Semester: IV**
No. of Credits: 3 **No. of hours per week: 4**
Max Marks: 25+75=100 **Total Inst. Hrs: 60**

Objectives

- Identify factors essential for the growth of microorganisms
- Relate the requirements for bacterial growth to the definition of potentially hazardous food
- Fermentation is the controlled action of selected microbes to alter the texture of foods
- Discuss the types of illness associated with food poisoning
- List the types of food preservations

Unit I: Introduction **12 hrs**

Importance of food and dairy microbiology- Types of microorganisms in Food Spoilage - source of contamination- Factors influencing microbial growth in food - extrinsic and intrinsic factors – pH, temperature, moisture, and oxygen reduction potential.

Unit II: Food Fermentations **12 hrs**

Methods of fermentations and organisms used - Cheese, bread, wine, beer. Fermented vegetables – Cabbage, cucumber, olives. Food and enzymes from microorganisms - single cell protein. Production of amylase and protease.

Unit III: Contamination, Spoilage and Preservation **12 hrs**

Cereals and cereals products, sugar and sugar products, vegetables and fruits, meat and meat products – fish and othe sea foods, egg and poultry – dairy and fermentative products (ice cream, yoghurt, kefir, kumiss and acidophilous milk), cheese production and its types.

Unit IV: Food Borne Diseases **12 hrs**

Intoxication and food poisoning – *Staphylococcus, Clostridium, Escherichia coli* and *Salmonella* infections, Hepatitis, Amoebiosis and Mycotoxins. Bacterial and fungal exo and endotoxins.

Unit V: Principles and Methods of Food Preservation **12 hrs**

Methods of preservations-Physical and chemical methods, food sanitations. Milk preservation methods – pasteurization. Good manufacturing practices (GMP) - hazard analysis, critical control points and personnel hygiene. Food sanitation in food manufacture and in the retail trade; Food control agencies and its regulations.

Unit VI: Latest Learning (for Continuous Internal Assessment only) Latest developments related to the course during the Semester

References:

1. Frazier and Westhoff, DC. 2014. Food Microbiology. 5th Edition. TATA McGraw Hill Publishing Company LTD., New Delhi
2. Adams, M.R and Moss, MO. 1995. Food Microbiology. The Royal Society of Chemistry, Cambridge

3. Banwart GJ. 2004, Basic food microbiology, Chapman & Hall, New York.
4. Sivasankar B. 2005. Food Processing and preservation, Prentice-Hall of India Pvt.Ltd.
5. James M.Jay. 2003. Modern Food Microbiology, 4^{th} edition, CBS Publishers and distributers.
6. John Garbutt.1997.Essential of Food Microbiology. Arnold Publications,London.
7. Andrews AT, Varley J. 1994. Biochemistry of milk products. Royal Society of Chemistry.
8. Robinson RK. 1990. The microbiology of milk. Elsevier Applied Science, London.
9. Ramanathan N. 2009.A Textbook of Food Microbiology, OM Sakthipathipagam
10. Shirly J. VanGarde, Margy Woodburn. 2005. Food Preservation and Safety, Surabhi Publications.
11. PelczerJ,M.J.Chan, E.C.S. and Kreig,N.R. (1996). 5^{th} Edition. Microbiology, Mc,GrawHill.Inc, New York.

EC - MOLECULAR TAXONOMY AND PHYLOGENY

Objectives

- To be aware of taxonomical positions of microbes
- To understand the use of different biochemical techniques used in taxonomy
- To focus on the identification of microbes in research level
- To know the sequence analysis
- To apply molecular phylogeny in taxonomy

Unit I: Microbial Taxonomy

Introduction to microbial taxonomy – morphological taxonomy, biochemical taxonomy, and molecular taxonomy. Numerical taxonomy – basic concepts of taxonomy. Positive and negative aspects of each taxonomical methods. Morphological phylogeny.

Unit II: Biochemical & molecular taxonomy

Chemotaxonomy - fatty acid, protein finger printing, Isozyme typing, pigments & polyamines. Biochemical phylogeny. Molecular taxonomy – G +C content, DNA –DNA hybridization, Plasmid profiles, RFLP, RAPD, STRR & LTRR, REP –PCR, rRNA based DNA finger printing methods

Unit III: rRNA Based Finger Printing

Types of rRNA – 23S rRNA, 16S rRNA& 5S rRNA. Importance of 16SrRNA inmicrobial identification and taxonomy. Methods of 16S rRNA / rDNA fingerprinting -Isolation of rRNA, RT-PCR, Isolation of DNA, amplification of 16S rDNA using PCR, Cloning, transformation, Blue-white screening, Plasmid isolation, Dot blot/Southern blot hybridization using specific probes sequencing of 16S rDNA using chain-termination method.

Unit IV: Sequence Analysis.

Submission of rDNA sequences in GenBank – Bankit& Sequin guidelines. NCBI, EMBL & DDBJ – retrieving sequences. RNA structure prediction, Restriction enzyme patterns. Ribosomal Database Project - Designing primers & probes. Sequence comparison, alignment and data base searching – Clustal W, FASTA & BLAST. DNA barcoding.

Unit V: Molecular Phylogeny.

Introduction to Molecular phylogeny – tree terminology, software programs for making phylogenetic trees – MEGA, Phylib, RAPDistance. Cladogram, additive trees and ultrametric trees, rooted, unrooted trees and tree shapes.

Unit VI: Latest Learning (for Continuous Internal Assessment only) Latest developments related to the course during the Semester

References:

1. Bioinformatics (Sequence and genome analysis) (2002) 2nd edition by David W.Mount, CBS publication.UK
2. Genomes by T.A.Brown 1st edition,Bios Scientific publication UK.
3. Gene Biotechnology (2nd Edition) by Joghand, S.N. Himalaya Publishing company, India. 4.
4. Concepts of genetics by William Klug, MichealR.Cummings. Pearson Education, Delhi.
5. Genome Mapping and Sequencing by Ian Dunham (Hardcover - Sep 1, 2003).
6. Brendan Wren (Editor), Nick Dorrell (2002) Functional Microbial Genomics (Volume33) (Methods in Microbiology), Academic Press, UK.
7. Sandy B. Primrose Richard M. Twyman (2005) Principles of Genome Analysis and Genomics, Blackwell Publishing, USA.
8. Roderic D. M. Page, Edward C. Holmes (1998). Molecular Evolution: A Phylogenetic Approach. Blackwell publishing, USA.
9. Principles of Genome Analysis: A Guide to Mapping and Sequencing DNA from Different Organisms by S. B. Primrose (Paperback - Jan 1998)

Outcome

After completion of this course, students would be able to

- ♣ Learned about basic concepts of taxonomy
- ♣ Become aware of DNA finger printing methods
- ♣ Obtained knowledge on types of rRNA
- ♣ Get educated on Gen bank submission
- ♣ Knowledge acquisition on constructing Phylogenetic tree

EC - MARINE MICROBIOLOGY

Objectives

- To focus on marine microbial community
- To be aware of extremophiles
- To understand Microbe-microbe interaction
- To learn about the marine pathogens
- To realize the applications of marine products

Unit: I Marine Microbial Disserts

Marine environment – benthic & littoral zone, saltpan, mangroves and estuarine microbes, microbial loop – marine microbial community – plankton, bacteria, fungi and protozoa.

Unit II: Marine Extremophiles

Survival at extreme environments – starvation – adaptive mechanisms in thermophilic, alkalophilic, asmophilic and barophilic, psychrophilic microorganisms – hyper thermophiles and halophiles – importance of extremophiles in biotechnology.

Unit III: Symbiotic Microbes

Microbe-microbe interactions – Lichens, antagonistic interactions – amensalism, mycoparasitism – Animal-microbe interaction – Ectosymbiosis of Protozoa, Ruminant symbiosis – sponge.

Unit IV: Marine Microbial Disease

Marine food borne pathogens & Water borne pathogens – *Aeromonas, Vibrio, Salmonella, Pseudomonas, Corneybacter, black band disease in corals.*

Unit V: Marine Microbial Biotechnology

Production and applications of marine microbial products – pigments – Astaxanthin, β carotene – enzyme – antibiotics – polysaccharide – sea food preservation methods.

Unit VI: Latest Learning (for Continuous Internal Assessment only) Latest developments related to the course during the Semester

References:

1. Prescott, L.M., Harley J.P. Klein (1999). Microbiology, WCB, Mc Grow Hill Publications
2. Raina M. Maier, Ian L. Pepper, Charles, P. Gerba (2006). Environmental Micrology, Academic press.
3. Jamesh W. Nybakker (2001). Marine Biology, Benjamin Cummings
4. Shimshon Belkin and Rita R. Colwell (2005). Ocean and Health: Pathogens in the marineenvironment. Springer.
5. Scheper, T. (2005). Advances in Biochemical Engineering/Biotechnology-Marine Biotechnology I. Springer
6. Bhakuni, D.S. and Rawat, D.S. (2005). Bioactive marine natural products. Anamaya Publishers, New Delhi

Outcome

After completion of this course, students would be able to

- ♣ Get knowledge on Marine environment
- ♣ Acquire the skills on types of extremophiles
- ♣ Gather learning on Animal – microbes interaction
- ♣ Become aware of marine microbial diseases
- ♣ Gain understanding of production and applications of marine microbial products

EC - BIOETHICS, BIOSAFETY & IPR

Objectives:

- ♦ To be aware of Bioethics, Biosafety and IPR
- ♦ To focus on Quality control
- ♦ To get knowledge on Global scenario of patents

Unit - I: Bioethics

Legalty, morality and ethics, the principles of bioethics, autonomy, human rights, beneficience, privacy justice equalit .

Unit - II: Biosafety

Concept and issues, rational and subjective perceptions of risks and benefits – relationship between risk hazard, exposure, and safe gaurds – biosafety concerns at the level of individuals, institutions, society, region, country and the world – Lab associated infections.

Unit - III: Biosafety Assessment

Biosafety assessment in biotechnology – biosafety during industrial production of GMOs – microbes, plants and animals. Planned introduction of genetically modified organisms and pharmaceutical products fromGMOs such as drug-vaccines – biomolecules. Biosafety guidelines in India.

Unit - IV: Quality control

Quality control in food process technology – WHO standards – Quality control in dairy products, drugs and beverages – Quality control for potable water.

Unit V: IPR

GATT and IPR, forms of IPR, IPR in India, WTO Act, Convention on Biodiversity (CBD), Patent Co-operation Treaty (PCT), forms of patents and patentability, process of patenting, Indian and international agencies involved in IPR & patenting, Global scenario of patents and India’s position, patenting of biological material, GLP, GMP.

Unit VI: Latest Learning (for Continuous Internal Assessment only) Latest developments related to the course during the Semester

References:

1. Ignacimuthu. S (2009).Bioethics. Narosa Publishinghouse
2. Singh B. D (2006).Biotechnology.KalyaniPublication.
3. Shaleesha .A (2008).Bioethics. Wisdom Biotechnology
4. Sateesh M.K, (2008).Bioethics and Biosafety .I.K.International Publishing house (P) Ltd

5. Sathyanarayana, U (2008).Biotechnology.Books and allied (P) Ltd
6. Frederic H. Erbisch, Karim M. Maredia (2004). Intellectual Property Rights in Agricultural Biotechnology, CABI Publisher.
7. Mittal D.P. (1999). Indian Patents Law. Taxmann Allied Services (p) Ltd.
8. Christian Lenk, Nils Hoppe, Roberto Andorno (2007). Ethics and Law of Intellectual Property: Current Problems in Politics, Science and Technology, Ashgate Publisher (p) Ltd.
9. Felix Thiele, Richard E. Ashcroft (2005). Bioethics in a Small World. Springer.
10. John Bryant (2002) Bioethics for Scientists. John Wiley and Sons Publisher.

Outcome

After completion of this course, students would be able to

- ♣ Get insight on risks and benefits of Biosafety
- ♣ Gained knowledge on Quality control in food process technology
- ♣ Learnt about International agencies involved in IPR & Patenting

EC - MEDICAL LAB TECHNOLOGY

Objectives

- To learn about the Blood system and their functions.
- To get Knowledge on Cardiovascular system.
- Clear ideas about diagnostic pathology and laboratory safety.

Unit-I Hematology

Composition of Blood and their functions-Collections of blood-types of Anemia-Mechanism of blood coagulation-Bleeding time, Clotting time, Determination of Hemoglobin, Erythrocyte Sedimentation Rate(ESR),Packed Cell Volume(PCV)-Total count of RBC and WBC-Differential Count of WBC, Platelet count, Reticulate Count-Absolute Eosinophil count. Estimation of Blood Cholesterol.

Unit-II Physiology

Cardiovascular system- Cardiac cycle - Blood Pressure and Pulse - Regulation of heart rate, Cardiac Shock. Heart sounds, Electro Cardiogram-Significance, Ultra Sonography-Ultrasonic Diagnostic methods-Computer Tomography.

Unit-III Diagnostic Pathology

Handling and labeling of histology specimens, tissue processing of histological tissues for paraffin embedding, block preparation. Microtome-type of microtome, sectioning-Staining-staining methods-Mounting – problems encountered during section cutting and remedies-Frozen section technique-freezing microtome.

Unit-IV Laboratory Safety

Laboratory Safety – Toxic chemicals-Biohazard Waste- biosafety levels-Good Laboratory Practices (GMP), Laboratory Symbols, Cleaning and Sterilization of lab ware and reagents. Handling and Care of Laboratory animals.

Unit-V Clinical Biochemistry

Liver function test-Serum bilirubin -SGPT-SGOT- Alkaline phosphatase and Urine analysis- Bile salts- Bile pigments and Urobilinogen. Kidney Function Test- Urea, uric acid and Creatinine.

Unit VI: Latest Learning (for Continuous Internal Assessment only) Latest developments related to the course during the Semester

Referred Books: Mukkerjee K.L. (1999).Medical laboratory Technology. Vol I, II, III.Tata McGrawHill Publications.

Outcome

After completion of this course, students would be able to

- Acquire Knowledge on Blood System And Their Functions.
- Gain Knowledge on Cardiovascular System and Diagnostic Pathology.
- Enable Them To Work On Clinical Labs.