J.J. COLLEGE OF ARTS AND SCIENCE (Autonomous)

DEPARTMENT OF MICROBIOLOGY

B.Sc. MICROBIOLOGY

Proposed Course Structure under Autonomous Status
Under Choice Based Credit System
(Applicable for the candidates admitted from academic year 2019-2020 onwards)

SEM	Part	Course code	Course Title	Hrs/ Week	Credit	Exam Hours	Marks Int	Marks Ext	Total Marks
I	I	U1R1TL1/HL1/ FL1/SL1/ABL1	Language Course – I	6	3	3	25	75	100
	II	U1R1EL1	English Language Course - I	6	3	3	25	75	100
	III	U1R1MBCC1	CC - I Fundamentals of Microbiology	5	5	3	25	75	100
		U1R1MBCC2P	Major Practical – I (Covering CC-I)	5	5	3	40	60	100
		U1R1MBAC1	Allied Course Biochemistry	5	3	3	25	75	100
		U1R1MBAC2P	Allied Practical Biochemistry	3	3	3	40	60	100
Total				**30**	**22**	**-**	**-**	**-**	**600**
II	I	U2R1TL2/HL2/ FL2/SL2/ABL2	Language Course – II	5	3	3	25	75	100
	II	U2R1EL2	English Language Course - II	5	3	3	25	75	100
	III	U2R1MBCC3	CC – III Microbial Physiology	5	5	3	25	75	100
		U2R1MBCC4P	Major Practical – II (Covering CC-III)	5	5	3	40	60	100
		U2R1MBAC3	Allied Course - Biotechnology	4	3	3	25	75	100
		U2R1ES	Environmental Science Course	2	2	3	25	75	100
Total				**30**	**21**	**-**	**-**	**-**	**600**

SEM	Part	Course code	Course Title	Hrs/ Week	Credit	Exam Hours	Marks Int	Marks Ext	Total Marks
III	I	U3R1TL3/HL3/ FL3/SL3/ABL3	Language Course – III	5	3	3	25	75	100
	II	U3R1EL3	English language Course - III	5	3	3	25	75	100
	III	U3R1MBCC5	CC – V Microbial Genetics & Molecular Biology	6	5	3	25	75	100
		U3R1MBCC6P	Major Practical – III (Covering CC-V)	6	5	3	40	60	100
		U3R1MBAC4	Allied Course - Biostatistics	6	3	3	25	75	100
		U3R1VE	Value Education Course	2	2	3	25	75	100
Total				**30**	**21**	**-**	**-**	**-**	**600**
IV	I	U4R1TL4/HL4/ FL4/SL4/ABL4	Language Course – IV	5	3	3	25	75	100
	II	U4R1EL4	English Language Course - IV	5	3	3	25	75	100
	III	U4R1MBCC7	CC – VII Environment and Agricultural Microbiology	6	5	3	25	75	100
		U4R1MBCC8P	Major Practical – IV (Covering CC-VII)	5	5	3	40	60	100
		U4R1MBAC5P	Allied Practical - Biostatistics	5	3	3	40	60	100
		U4R1MBAC6	Allied Course - Bioinformatics	4	3	3	25	75	100
	IV	U4R1MBSBE1	Skill Based Elective Course - I	4	2	3	25	75	100
Total				**30**	**24**	**-**	**-**	**-**	**700**

SEM	Part	Course code	Course Title	Hrs/ Week	Credit	Exam Hours	Marks Int	Marks Ext	Total Marks
V	III	U5R1MBCC9	CC – IX Immunology	6	5	3	25	75	100
		U5R1MBCC10	CC – X Virology & Medical Microbiology	6	5	3	25	75	100
		U5R1MBCC11P	Major Practical – V (Covering CC IX & X)	6	5	3	25	75	100
	IV	U5R1MBMBE1	Major Based Elective course – I	5	4	3	25	75	100
		U5R1MBSBE2	Skill Based Elective Course – II	4	2	3	25	75	100
		U5R1MBIDC1	Inter Disciplinary Course - I	3	2	3	25	75	100
			TOTAL	**30**	**23**	**-**	**-**	**-**	**600**
VI	III	U6R1MBCC12	CC – XII Food Microbiology	5	5	3	25	75	100
		U6R1MBCC13	CC – XIII Industrial Microbiology	5	5	3	25	75	100
		U6R1MBCC14P	Major Practical – VI (Covering CC XII & CC XIII)	5	5	3	40	60	100
		U6R1MBMBE2	Major Based Elective Course - II	5	4	3	25	75	100
		U6R1MBMBE3	Major Based Elective Course – III	5	4	3	25	75	100
	IV	U6R1MBSBE3	Skill Based Elective Course - III	2	2	3	25	75	100
		U6R1MBIDC2	Inter Disciplinary Course - II	2	2	3	25	75	100
	V	U6EGS	Gender Studies	1	1	3	25	75	100
			Extension activities	1	1				
			TOTAL	**30**	**29**	**-**	**-**	**-**	**800**
			Grand Total		**140**				**3900**

*Carried over Course – Exam at the end of the next semester

CC-Core Course / AC – Allied Course /MBE – Major based Elective / SBE – Skill based Elective/ IDC – Inter disciplinary course/P – Practical* / T – Theory

Total Credit – 140 / Total Marks – 3900 **CIA Passing Minimum = 10**

Extension activities shall be outside the instruction hours. **Sem. Exam Passing Minimum = 30**

Skill Based Elective papers (Any three from the list) **Aggregate Pass Mark = 40**

1. Vermitechnology
2. Organic Farming
3. Medical Lab Technology
4. Mushroom Technology
5. Biofertilizer Technology
6. Herbs and Drug action

Major Based Elective papers (Any three from the list)

1. Microbial Biotechnology
2. Genetic Engineering
3. Bioinstrumentation
4. Microbiome
5. Microbial Diversity
6. Extremophiles

Inter disciplinary course (offered by the department)

1. Biofertilizer
2. Applied Microbiology
3. Microbes in Human Welfare

CC I: FUNDAMENTALS OF MICROBIOLOGY

Course Code: U1R1MBCC1 **Semester: I**
No. of Credits: 5 **No. of hours per week: 5**
Max marks: 25+75=100 **Total Inst. Hrs: 60**

Objectives

- To know the historical background and the progress of this field to the modern times
- To become familiar with the basics in microbiology
- To learn the sterilization methods
- To know the characteristics of Prokaryotes and Eukaryotes
- To understand the scope of microbiology in various fields, so that students can prepare themselves for the future

Unit I: Introduction **12 hrs**

History and Scope of Microbiology – Spontaneous generation theory – Contribution of Leuvenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Joseph Lister, Winogradsky, Waksman, John Tyndall. Classification of microorganisms - Haeckel's three kingdom concept, Whittaker's Five kingdom concept, Bacterial classification according to Bergey's manual of systemic Bacteriology (9^{th}edition).

Unit II: Microscopy **12 hrs**

Microscopy and staining methods - Principles and application of Microscopes– Bright field, Dark field, Phase contrast, Fluorescence, SEM & TEM - Specimen preparation of electron microscopy –Freeze etching. Staining methods- Stains and staining reactions – Types of staining – Simple, Differential (Grams, Spore, and AFB), Capsule staining, Nuclear and Flagella staining - Albert staining.

Unit III: Sterilization methods **12 hrs**

Sterilization and Disinfection- Principles- Methods of Sterilization – Physical methods – Dry heat- Moist heat, Filtration (Membrane & HEPA) - Radiation – Chemical Sterilization -Chemical agents, Mode of action.

Unit IV: Prokaryotes and Eukaryotes **12 hrs**

Characteristics features of Prokaryotes and Eukaryotes: Prokaryotes – Structure and function of cell wall, Plasma membrane, Flagella, S – Layer, Cytoplasmic inclusion, spore. Eukaryotes – Structure and function. General characteristics of Archaebacteria, Eubacteria, Cyanobacteria, Mycoplasmas, Rickettsiae, Chlamydias, Spirocheates, Actinomycetes, Protozoa, Algae, Fungi and Viruses.

Unit V: Cultivation and preservation of microbes **12 hrs**

Types of culture media – simple, defined, enriched, differential and transport media with specific examples for each type. Methods of maintenance and preservation of microbes. Microbial culture collection centres in India (ITCC, MCC & MTCC) and abroad (ATCC, ECCO & JCM).

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

References:

1. Brock TD, Smith DW and Madigan NT, 1987, Biology of Microorganisms edn, Eniglcwood Cliffs, NJ Prentice Hall K.

2. Dubey RC and Maheswari DK, 2012, A text of Microbiology (Revised edition). S.Chand and Company Ltd., New Delhi.
3. GeetaSumbali and Mehrotra RS, 2009, Principles of Microbiology. First edition, Tata McGraw Hill P.Ltd., New Delhi.
4. John L. Ingraham, Catherine A. Ingraham, 2000, Introduction to Microbiology – Second Edition. Published by Brooks/Cole.
5. Nester EW Roberts CV and Nester N7T, 1995, Microbiology A Human Perspectives Iowa USA.
6. Pelczer J. Chen ECS. Krieg NR, 1986, Microbiology, MC Grow Hill Company.
7. Powar CB and Daginawala H F 2005, General Microbiology volume 1 and 2. Eighth edition, Himalaya publishing house, Mumbai
8. Prescott, Harley, Klein, 2003, Microbiology International Edition, fifth Edition, Published by McGraw-Hill Education.
9. Stainer R Y. Ingraham JL Wheels ML. Painter PR, 1999, General Microbiology MacMillan Educational Ltd, London.
10. Tortora, Funke, Case, Microbiology An Introduction, twelfth Edition, Published by Pearson Education.

Outcome

After completion of this course, students would be able to

- ♣ Get general information about history and scope of Microbiology
- ♣ Perform microscopic and Staining experiment
- ♣ Learn sterilization techniques
- ♣ Get Basic knowledge on characteristic feature of Prokaryotes and Eukaryotes
- ♣ Cultivate and Preserve microbes on their own

CC-II Practical I (Covering CC – I)
Fundamentals of Microbiology
Course Code: UIR1MBCC2P

Fundamentals of Microbiology

1. Safety practices in Microbiological Laboratory
2. Microscope and its Operation
3. Principles and Operations – Autoclave, Hot Air Oven, Laminar air flow, Incubators, Colony counter, Centrifuge, Filtration, pH meter, Colorimeter and Spectrophotometer.
4. Preparation of Culture media, Cleaning of glassware and Sterilization techniques
5. Pure culture techniques – Streak, Spread & Pour plate techniques
6. Test for Motility of bacteria – Hanging drop method
7. Isolation of Bacteria, Actinobacteria, Fungi and Cyanobacteria
8. Staining techniques –
   a. Simple
   b. Gram's
   c. Capsule
   d. Spore staining
   e. LCB mount.
9. Observation of permanent slides to study the structural characteristics of algae, fungi & protozoan. Algae (*Anabena*, *Nostoc*, *Spirullina*, *Oscillatoria*), Fungi (*Pythium*, *Rhizopus*, *Saccharomyces*, *Penicillium*, *Aspergillus*, *Agaricus*) and Protozoa (*Entamoeba hystolytica* and *Plasmodium* spp.).
10. Enumeration of Bacterial numbers by viable count (Plate count) and Total count (Haemocytometer count).

References:

1. Atlas R.M., A.E.Brown and L.C. Parks, Mosby, St. Louis , 1995, Laboratory Manual of Experimental Microbiology
2. Cappuccino J.G. and N. Sherman 2002, Microbiology: A Laboratory Manual, Addison-Wesley.
3. Holt J.G, N.R.Krieg, 2000, Bergey's Manual of Determinative Bacteriology. Ninth edition, Lippincott Williams &Wilkin Publishers.
4. Kannan N, 2002, Laboratory Manual in General Microbiology, Panima Publishers.
5. Sundararaj T, 2003, Microbiology Laboratory Manual, 2nd Edition, A. Sundararj No.5, I cross street, Thirumalai Nagar, Perungudi, Chennai 600 096.

ALLIED COURSE (FIRST) – I– BIOCHEMISTRY

Course Code: U1R1MBAC1 **Semester: I**

No. of Credits: 3 **No. of hours per week: 5**

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

Objectives

- To provide knowledge on bio-molecules
- To know the structural organization of bio-molecules
- To learn the characteristics of nucleic acids.
- To know Types of DNA and RNA
- To acquire knowledge on enzymes.

Unit – I Carbohydrates **12 hrs**

Carbohydrate; Definition; Classification – Monosaccharide (Glucose), Disaccharide (Lactose) and Polysaccharides (Starch), structure of glucose, biological significance, digestion and absorption of carbohydrate.

Unit – II **Proteins** **12 hrs**

Amino acids – Structure - classifications (Essential and non-essential, protein and non-protein amino acids).Proteins – Definition, classification and structure (Primary, secondary, tertiary).

Unit – III Lipids **12 hrs**

Lipids: Definition, classification (Simple, compound and derived lipids), structure, properties and functions. Fatty acids – Definition, classification (Essential, non-essential, saturated and unsaturated fatty acids). Phospholipids, Glycolipids.

Unit – IV Nucleic Acids **12 hrs**

Nucleic acids – Nucleosides, Nucleotides, Watson & Crick Model of DNA structure, forms and its functions – RNA types (tRNA, mRNA, rRNA) structure and functions.

Unit – V Enzymes **12 hrs**

Enzymes –Nomenclature – enzyme activation, properties of enzymes, Classification of enzymes, Mechanism of action. Enzyme inhibition- Overview. Factors affecting enzyme activity. Diagnostic uses of enzymes.

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

References:

1. Sathyanarayana,U and 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. (2008) Molecular Biology, IV Edition, Narosa Publishing House, New Delhi.
6. David E. Metzler and Carol M. Metzler (2001). Biochemistry-The chemical reactions of Living cells- Vol1&2. (2nd edition).Harcourt/Academic press, Newyork.
7. DonaldVoet and Judith G. Voet (1995). Biochemistry – Second Edition. John Willey and

Sons, Inc.
8. Leninger,A.L., Nelson, D.L., Cox, M.M., (1993). Principles of Biochemisry, (2nd Edition).CBS Publishers,
9. Geofferey, L and Zubay (1998). Biochemsitry. (Fourth Edition) Wm. C. Brown Publishers.
10. Stryer, L. (1995). Biochemistry. 4th Ed. W.H. Freeman and Company, New York

Outcome

After completion of this course, students would be able to

- ♣ Knowledge on of bio - molecules
- ♣ General Information about nucleic acids
- ♣ Basic knowledge on lipids
- ♣ Get thorough knowledge on Types of DNA and RNA
- ♣ Clear idea on Enzymes.

Allied Practical – Biochemistry
Course Code: U1R1MBAC2P

Biochemistry

1. Qualitative and quantitative estimation
   a. Carbohydrates
   b. Amino acids
   c. Proteins
   d. Lipids
   e. Nucleic acids.

2. Estimation of ascorbic acid (from biological sample)

References:

1. Keith Wilson and John Walker. (1995). Principles & Techniques of Practical Biochemistry. (4th edition).Cambridge University press, Britain.
2. Oser, B.L.Hawks, (1965). Physiological Chemistry, TATA Mc Graw Hill.
3. Shawn O' Farrell and Ryan T. Ranallo. (2000). Experiments in Biochemistry: A Hands on Approach-A manual for the undergraduate laboratory, Thomson Learning, Inc., Australia.
4. Strolv, B.A. Makavora, V.C. (1989). Laboratory manual in Biochemistry. MIR Publisher.

CC-III MICROBIAL PHYSIOLOGY

Paper Code: U2R1MBCC3 **Semester: II**

No. of Credits: 5 **No. of hours per week: 6**

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

Objectives

- To acquire with basic knowledge in physiology
- To familiarize with the enzymes
- To understand the energy production
- To know the details of biosynthesis
- To know the scope in fermentation industries

Unit I - Nutrition and growth of microorganisms **12 hrs**

Nutrition and growth of microorganisms: Nutitional types of microorganisms, nutritional requirements. Factors influencing the growth of microorganisms – temperature, pH, osmotic pressure, moisture, radiations and chemicals. Physiology of growth – significance of various phases of growth. Growth measurements – batch, continuous and synchronous.

Unit II – Enzymes **12 hrs**

Bacterial enzymes – classification - oxidoreductase, transferase, hydrolase, lyase, isomerase and ligase, properties, coenzymes and cofactors, isozymes. Mechanism of enzyme action, conditions affecting enzyme activity.

Unit III – Energy production **12 hrs**

Metabolism of carbohydrates: Anabolism – photosynthesis: Oxygenic and anoxoygenic, Synthesis of carbohydrate, catabolism of glucose – Embden Meyer Hoff - Parnas pathway, pentose pathway, Kreb's cycle (TCA), electron transport system and ATP production.

Unit IV – Transport system **12 hrs**

Transport across membrane – different types of mechanism – Passive, facilitated transport and active transport. Different types of protein ports – Uniport, Simport and Antiport. Siderophores. Physiological phenomenon involved in membrane transport – biological properties of membrane model.

Unit V – Fermentation **12 hrs**

Anaerobic Respiration – Nitrate, sulphate & methane respiration – Fermentations: alcoholic, mixed acid, lactic acid fermentation – Anabolic and catabolic processes of lipids, gluconeogenesis.

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

References:

1. Albert G. Moat & John W. Foster, 2007, Microbial physiology, A John Wiley and sons, INC publications, New York.
2. Caldwell D.R., 1995, Microbial Physiology and Metabolism, Brown Publishers.
3. Dubey R.C &MaheshwariD.K, 2009, A text book of microbiology, Chand & Company Ltd. New Delhi.
4. GeetaSumbali and Mehrotra RS, 2009, Principles of Microbiology. First edition, Tata McGraw Hill P.Ltd., New Delhi.

5. Geoffrey M. Cooper, 2007, the cell, A molecular approach, 3rd Edition - ASM press, Washington.
6. Millian MeenakumariS, 2006, Microbial physiology, MJP. Publishers, Chennai.
7. Moat G, John W. Foster and Michael P. Spector, 2002. Microbial physiology. Fourth edition, A John Wiley sons, Inc. publication. New Delhi.
8. PelczarJr.M.J,Chan E.C.S.&Kreig N.R, 2007,Microbiology, 5thEditionMc.Graw Hill.
9. Robert F Boyd, 1984, General Microbiology. Times mirror / Mosby college publishers.
10. Rose A.H, Advances in Microbial Physiology. Volumes. Edited by Academic Press, New York.

Outcome

After completion of this course, students would be able to

- ♣ Get information about Nutrition and Growth of Microorganisms
- ♣ Clear idea on Bacterial Enzyme
- ♣ Knowledge on metabolism of Carbohydrate
- ♣ General information about membrane transport system
- ♣ Enable them to work on fermentation industry

CC-IV - Practical II
(Covering CC-III) - Microbial Physiology
Paper Code: U2R1MBCC4P

1. Growth curve – Cell count/viable count/Absorbance (Total count)
2. Carbohydrate Fermentation tests; Glucose, lactose, Sucrose and Mannitol
3. Biochemical test for identification for Bacteria - IMViC tests-TSI Agar test-Urease-Catalase-Oxidase.

References:

1. Atlas R.M., A.E.Brown and L.C. Parks, Mosby, St. Louis, 1995, Laboratory Manual of Experimental Microbiology
2. Cappuccino J.G and N. Sherman, 2002, Microbiology: A Laboratory Manual, Addison-Wesley.
3. Holt J.G, N.R. Krieg, Lippincott, 2000, Bergey's Manual of Determinative Bacteriology. Ninth edition, Williams &Wilkin Publishers.
4. Kannan N, 2002, Laboratory Manual in General Microbiology, Panima Publishers.
5. Sundararaj. T, Microbiology Laboratory Manual, 2003, Published by A. Sundararaj No.5, I cross street, Thirumalai Nagar, Perungudi, Chennai 600 096 2nd Edition

AC-III BIOTECHNOLOGY

Paper Code: U2R1MBAC3 **Semester: II**
No. of Credits: 3 **No. of hours per week: 5**
Max marks: 25+75=100 **Total Inst. Hrs: 48**

Objectives

- To acquire knowledge in the basics of Biotechnology
- To understand the applied areas of Biotechnology
- To inculcate the Pharmaceutical drug formulation and vaccine production
- To equip the students to work in interdisciplinary science industries
- To know the basics of Environmental Biotechnology

Unit I - Basics of Biotechnology **12 hrs**

Introduction to Biotechnology, Definitions of Biotechnology, History of Biotechnology, Biotechnology-multidisciplinary tree, Applications of Biotechnology.

Unit II - Plant Biotechnology **9 hrs**

Introduction of plant tissue culture, composition of media, Micropropagation, organogenesis, somatic embryogenesis, protoplast isolation and fusion, hybirid and cybrid, Plant Transformation, Direct transformation by electroporation and particle gun bombardment, *Agrobacterium*, Ti plasmid vector.

Unit III - Animal Biotechnology **9 hrs**

Cell culture: primary and established culture; organ culture; tissue culture; Disaggregation of tissue and primary culture; cell separation, Slide and coverslip cultures, flask culture, test tube culture techniques, cell synchronization, cryo preservation. Transgenic animals: Production and application; transgenic animals as model for human diseases. Cloning in Animals – Dolly – Ethical and Social issues related to cloning.

Unit IV - Pharmaceutical Biotechnology **9 hrs**

Current status of Pharmaceutical Biotechnology. Biopharmaceuticals – Hormones – Insulin – HGH, Vaccine –Hepatitis B, DNA Vaccines - Interferons.

Unit V - Environmental Biotechnology **9 hrs**

Biodegradation of hydrocarbons, pesticides, xenobiotic. Bioremediation types and applications – Super bug, Bioleaching – Copper, silver and Gold.

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

References:

1. Razdan.M.K., 2011. Plant tissue culture. Oxford and IBH publishing Company Pvt. Ltd, New delhi.
2. Chawla.H.S., 2010. Introduction to plant biotechnology. Oxford and IBH publishing company pvt. Ltd, New delhi.
3. Ian Freshney, 2010. Culture of animal cells. 6th edition. Wiley-Blackwell publishers.
4. Ralf Portner, 2007. Animal cell biotechnology: Methods and protocols. 2nd edition, Humana Press, New Jersey.

5. Harbanslal, 2011. Pharmaceuticals biochemistry. CBS Publishers and distributors Pvt. Ltd, Chennai.34.
6. Carlos A. Guzmán and Giora Z. Feuerstein, 2009. Pharmaceutical Biotechnology, 1st edition, Springer. Daniel Figeys (Ed.). 2005. Industrial Proteomics: Applications for Biotechnology and Pharmaceuticals. Wiley, John & Sons, Incorporated.
7. Kayser, O and Muller R.H... 2004. Pharmaceutical Biotechnology Drug Discovery and Clinical Applications. WILEY-VCH.
8. Leon Shargel, Andrew B. C. Yu, Susanna Wu-Pong, and Yu Andrew B. C. 2004. Applied Biopharmaceutics & Pharmacokinetics. McGraw-Hill Companies·
9. D.I.A. Crommelin, *et al.*, 2002. Pharmaceutical Biology. Amazon prime publications.
10. Werner Kalow, Urs A Meyer and Rachel F. Tyndale. 2001. Pharmacogenomics. CPL press.

Outcome

After completion of this course, students would be able to

- ♣ Learn the techniques in applied areas of Biotechnology
- ♣ Procure knowledge on super bugs
- ♣ Become proficient to get placement in interdisciplinary life science industries
- ♣ Become placed in production Units of pharmaceutical companies
- ♣ Become efficient in bioremediation and monitoring the polluted environment

CC-V MICROBIAL GENETICS & MOLECULAR BIOLOGY

Paper Code: U3R1MBCC5 **Semester: III**

No. of Credits: 5 **No. of hours per week: 5**

Max marks: 25+75=100 **Total Inst. Hrs: 72**

Objectives

- To familiarize with the basic knowledge in genetics
- To understand the gene structure and function
- To know the gene transfer mechanisms
- To get knowledge in Operon concepts
- To apply the gene mechanisms for research and industrial purposes

Unit I – Genetic Material **16 hrs**

History, Structural features of DNA & RNA– experiments of Hershey Chase and Griffith, DNA as the genetic material –discovery of DNA structure – RNA as a genetic material – Genetic code – major features of genetic code, organization and deciphering of genetic code, elucidation of codons.

Unit II – Genome organization and function **14 hrs**

Organization and functioning of genetic material – Bacterial and viral. Details of *E.coli* chromosome. Replication of DNA – rolling circle model – theta model. Replication of RNA – reverse transcriptase. Brief account of plasmid – structure – types

Unit III – Transcription, Translation and Gene Transfer **14 hrs**

Transcription and Translation in prokaryotes and Eukaryotes. Gene transfer mechanisms – conjugation - F^+ x F^- mating, Hfr, F' x F^- conjugation. Transduction: Generalized and specialized transduction, Transformation. Transposable genetic elements: Discovery -Insertion sequences in prokaryotes - Complex transposons (Tn10, Tn5, Tn9 and Tn3), Reteroposans.

Unit IV – Gene expression **14 hrs**

Gene concept - regulation of bacterial gene expression. Lactose system - coordinate regulation, Lac components, positive and negative regulation, catabolite repression. Tryptophan operon - attenuation. Arabinose operon and its regulation.

Unit V – Gene mutation and repair **14 hrs**

Mutagenesis, mutation, mutants; spontaneous and induced mutations, phenotypic mutants – Mechanism of repair: Photo reactivation, excision repair, recombinational repair. The SOS and adaptive responses and their regulation, Heat shock response.

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

References:

1. David Frifelder. (1990). Microbial Genetics, Narosa publishing house, New Delhi.
2. Lansing M. Prescott., John P. Harley and Donald A.Klein. (2003). Microbiology (5^{th} edition) McGraw Hill, New York.
3. MalorSr, Cronan Jr. JE. Freifelds D (1994). Microbial Genetics. Jones and Bartlett Publishers.
4. Daniel L. Hartl and Elizabeth W. Jones. (2001). Genetics-Analysis of Genes and Genomes, Jones and Bartlett publishers, UK.
5. Lewin B. (2000). Genes VII. Oxford University press

6. Gardner E.J., Simmons M.J., Snustad D.P. (1991). Principles of Genetics. John Wiley & sons.
7. Jeremy M. Dale. (1998). Molecular Genetics of Bacteria (3rd edition).John Wiley and sons,NewYork.
8. Larry Synder and Wendy Champness. (2003). Molecular Genetics of Bacteria (2nd edition).American Society for Microbiology, Washington.
9. Lodish, H., Baltimore, D. Berk, A. Zipsury, S.L., Matsudaira, P. Darnell, J. (1995). Molecular Cell Biology. Scientific American Books.

Outcome

After completion of this course, students would be able to

- ♣ Collect knowledge about nucleic acids are genetic material
- ♣ Gain understanding of replication of DNA and RNA
- ♣ Come to know about the gene transfer mechanisms
- ♣ Acquire knowledge on operon concepts
- ♣ Learn mutations and repair systems

CC-VI Practical- III (Covering - CC - V)
MICROBIAL GENETICS & MOLECULAR BIOLOGY
Paper code: U3R1MBCC6P

Microbial Genetics and Molecular Biology

1. Isolation of Auxotrophic mutants
2. Isolation of Chromosomal DNA from bacteria
3. Isolation of Plasmid DNA from bacteria
4. Isolation of Antibiotic resistance mutants by replica plating
5. Estimation of DNA – Diphenyl method
6. Estimation of RNA – Orcinol method
7. Demonstration of bacterial Transformation technique
8. Demonstration of Agarose gel electrophoresis (To study DNA/RNA)
9. Demonstration of SDS – PAGE
10. Demonstration of Gel Documentation system

References:

1. David M. Sylvia, Jeffry J. Fuhrmann, Peter Hastell, David A. Zuberer, 1st Ed. Prentice Hall.
2. James G. Cappuccino and Natalie Sherman. (1996). Microbiology-A Laboratory Manual (4th edition).The Benjamin publishing company, New York.
3. Russell F. Bey. (2001). Microbiology Laboratory Manual, BROOKS/COLE, Australia.

ALLIED COURSE – BIOSTATISTICS

Paper Code: U3R1MBAC4 **Semester: III**
No. of Credits: 3 **No. of hours per week: 5**
Max marks: 25+75=100 **Total Inst. Hrs: 72**

Objectives

- Update and expand the basic knowledge of mathematics.
- To review the basic concepts and knowledge in collection of Data
- To know the graphical representation
- Develop the skills pertinent to practice Measures of central tendency
- The students will collect and analyze data using biological materials

Unit I - Introduction to Biostatistics **16 hrs**

Biostatistics: Definition- Developments - Applications- Role of Statistics - Characteristics -Limitations- Importance.

Unit II - Collection and presentation of data **14 hrs**

Collection of data: Data collection-Primary data - secondary data, Classification

Classification and Tabulation: - Types of classification - Tabulation of data - Parts of a table - types of tabulation.

Diagrammatic representation: Rules, limitations - Bar diagram (Simple, multiple, component / staked, proportional / percentage) - pie diagram.

Graphical representation: rules, limitations - difference between diagram and graphs - histogram - frequency polygon - frequency curve - Ogive curve

Unit III - Measures of Central Tendency **14 hrs**

Measures of central tendency: Introduction - characteristics - Arithmetic mean - Median - Mode - Geometric mean, Harmonic Mean (definition, merits and demerits, problems based on raw, discrete and continuous data) (Direct method only)

Unit IV - Measures of Dispersion **14 hrs**

Measures of dispersion:Definition - Characteristics - Range - Mean derivation - Standard deviation - Coefficient of variation (definition, merits & demerits, problems based on raw data only)

Unit V –Skewness and Kurtosis **14 hrs**

Skewness: Definition, Types, Karl Pearson coefficient of Skewness, Bowley'scoefficient of Skewness - Related problems, Kurtosis & moments (concept only)

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

References:

[1] "**Biostatistics"** - P.N. Arora, P.K.Malhan, Himalaya Publishing House.(2014).
[2] "**Fundamentals of Biostatistics**" - Veer BalaRastogi, Ane Books Pvt. Ltd. (2008).

Unit I : Chapter 1, Sec. 1.1 -1.5, 1.11 – 1.13[1]

Unit II: Chapter 1, Sec. 1.8, 1.9 [1] Chapter 4, Sec. 4.1 - 4.13 [1] Chapter 5, Pg. no. 65-68 [2] Chapter 4, Pg. no. 41 – 43 [2]

Unit III: Chapter 5, Sec. 5.1- 5.3, 5.7 – 5.13, 5.15, 5.17– 5.18 [1]
Unit IV: Chapter 7, Page No. 135 – 138, 146-155 [2]
Unit V : Chapter 7, Sec. 7.1, 7.2, 7.5 - 7.9, 7.11, 7.13 [1]

3. "Introduction to Biostatistics" – SokalandRohlf – Toppan Co. Japan
4. "Primer of Biostatistics" – Stanton A. Clantz – The McGraw Hill Inc. Newyork.

Outcome

After completion of this course, students would be able to

- ♣ Understand the basic concept of statistics, and also apply statistical measures which are used to analyze the data.
- ♣ Procure knowledge on diagrammatic representation
- ♣ Acquire knowledge on measures of central tendency and dispersion.
- ♣ Prepare reports to conclude the findings in data analysis.
- ♣ Understand the concept of Skewness & kurtosis.

CC-VII ENVIRONMENT and AGRICULTURAL MICROBIOLOGY

Paper Code: U4R1MBCC7 **Semester: V**
No. of Credits: 5 **No. of hours per week: 5**
Max marks: 25+75=100 **Total Inst. Hrs: 72**

Objectives

- To know the physico chemical characteristics of soil 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: Introduction to soil microbiology **16 hrs**

Soil microbiology - Introduction – Soil as an environment for microorganisms. Classification of soil, physical and chemical properties of soil, soil stratifications – soil microorganisms – biogeochemical cycles – C, N and P.

Unit II: Microbial interactions **14 hrs**

Microbial interactions definition and types - mutalism, commensalism, amensalism – synergism - parasitism – predation - competition. Brief account of diseases – bacterial (blight of paddy, citrus canker), fungal (late blight of potato, stem rust of wheat), viral (tobacco mosaic virus, cucumber mosaic virus).

Unit III: Aeromicrobiology **14 hrs**

Composition of air, kinds of organisms in air, distribution and sources. Droplets nuclei, aerosol and infectious dust, assessment of air quality. Brief account of air – borne diseases.

Unit IV: Aquatic ecosystems **14 hrs**

Types of aquatic ecosystems: fresh water – ponds, lakes, streams. Marine habitats –estuaries, mangroves, deep sea, saltpan, coral reefs. Zonation – upwelling – eutrophication. Portability of water - microbial assessment of water quality – water purification. Brief account of water borne diseases.

Unit V: Waste management **14 hrs**

Types of wastes – solid and liquid waste treatment. Solid waste treatment – saccharification – gasification – composting. Liquid waste treatment – primary –secondary – tertiary treatment. Utilization of liquid and solid wastes – food (SCP) –fuel (methane).

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 (4nd Edition). Benjamin/Cummings Publishing Company, California (Unit III and IV covered).
2. Subba Rao N .S (1995) Soil microorganisms and plant growth Oxford and IBH publishing co. pvt. Ltd. New Delhi (Unit I and II covered).

3. Joseph, C. Daniel.(1999). Environmental Aspect of Microbiology (2nd Edition).Bright sun publication (Unit V covered).
4. Munn, C.B. (2004). Marine Microbial Ecology and Applications. Bio scientific publishers, New York.
5. Text book of Environmental Microbiology. (2013). Pradipta K.Mohapatra.
6. Blackie. (1998). Plant Molecular Biology. (2nd edition). Chapman Hall, New York.
7. Burns, R.C. and Slater, J.H. (1992).Experimental microbial Ecology- Blackwell Scientific publication, Oxford London.
8. Christon J. Hurst. (2002). Manual of Environmental Microbiology. (2nd edition). American Society for Microbiology, Washington.
9. Marshall, K.C. (1985). Advances in Microbial Ecology. Vol-8.Plenum press.

Outcome

After completion of this course, students would be able to

- ♣ Learn about physico- chemical characteristics and microbes' role imparted
- ♣ Become familiar with Indian crop diseases
- ♣ Become well-known about air- born and water-borne diseases
- ♣ Become knowledgeable in aquatic ecosystem
- ♣ Solid and liquid waste management techniques are imparted

CC-IV Practical - IV (Covering - CC - IV)
Environment and Agricultural Microbiology
Paper code: U4R1MBCC8P

Environment and Agricultural Microbiology

1. Water analysis by MPN technique – presumptive coliform test – confirmed coliform test and completed coliform test.
2. Microbial assessment of air quality – open plate method and air sampler-technique.
3. Isolation and counting of faecal bacteria from water.
4. Soil Analysis – pH, chlorides, nitrate, calcium, magnesium and total phosphorus.
5. Isolation of cyanobacteria from water.
6. Isolation of *Azospirillum, Azotobacter* from soil.
7. Isolation of Rhizobium form legume nodule.
8. Observation of VAM from plant roots.
9. Isolation and enumeration of soil microorganism.
10. Observation of *Anabaene* from *Azolla* plant

References:

1. K.R.Aneja (2010). Experiments in Microbiology, Plant pathology and biotechnology. New Age International Pvt.Ltd.NewDelhi.
2. R.C.Dubey (2002). Microbiology practical manual. S.Chand and Company LTD.
3. Kannan.N (2002) Lab manual in General Microbiology. Panima Publishing Corporation.

ALLIED PRACTICAL – BIOSTATISTICS
Paper code: U4R1MBAC5P

Objectives

- To Update and expand the basic knowledge of mathematics.
- To review the basic concepts and knowledge in Measures of central tendency.
- To develop the skills pertinent to practice of Mathematics.
- To collect and analyze data using biological materials.
- To study about the Test of significance using t- test and chi-square test. This will be very useful to the students for research purpose.

Unit I: Distributions

Construction of discrete frequency distributions - continuous frequency distribution (univariate and bivariate)

Unit II: Graphical Representation

Graphical representation of statistical data - Simple bar diagram, Multiple bar diagram, Component bar diagram, Percentage bar diagram, Rectangle bar diagram and Pie diagram

Unit III: Diagrammatic Representation

Diagrammatic representation of statistical data - Histogram, Frequency polygon, Frequency curve, Ogive curve.(Definitions and simple problems only)

Unit IV: Measures of central tendency

Calculation of arithmetic Mean, Median, Mode, Geometric mean, Harmonic mean and Coefficient of variance using biological materials. (Definition and simple problems only)

Unit V: Test of Significance

Test of significance t-test-single mean and two means, Chi-square test of independence of attributes and goodness of fit. (Definition and simple problems only)

Text Books:

[1] "**Bio Statistics**" - P.N.Arora, P.K.Malhan, Himalaya Publishing House, 2006

[2] "**Business mathematics and statistics**", PA. Navanitham Jai publishers, New no.19 7th cross, Sundar Nagar, Trichy -620 021.

Unit I: Chapter 1- Sec. 1.1-1.5, 1.11-1.13 [1]

Unit II: Chapter 6- Part –II Pg. No. 98-118, 124-137. [2]

Unit III: Chapter 7-Part – II Pg .No. 159-260 [2]

Unit IV: Chapter 8- Part- II Pg No. 305- 368 [2]

Unit V: Chapter 12- Part – II Pg No. 503- 522 [2]

Reference Books:

1. "Fundamentals of Bio statistics" – Veer BalaRastogi, Ane Books Pvt. Ltd. 2009.
2. "Biostatistics" – P. Rama Krishnan – Saras Publications 1995.

Outcome

After completion of this course, students would be able to

- ♣ Understand the basic concept of statistics, and also apply statistical measures which are used to analyze the data
- ♣ Acquire knowledge on measures of central tendency and dispersion.
- ♣ Calculate measures of dispersion.
- ♣ Understand the concept of skewness & Kurtosis.
- ♣ Acquire knowledge of Graphical representation & Diagrammatic representation.

ALLIED COURSE (SECOND) – IV-BIOINFORMATICS

Paper Code: U4R1MBAC6 **Semester: IV**

No. of Credits: 4 **No. of hours per week: 5**

Max marks: 25+75=100 **Total Inst. Hrs: 48**

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: Basic computer **12 hrs**

Introduction to Computers – History of Computers – its developing technology and generation of Computers – Operating Systems – Windows, Unix – Hardware, Software, disc operating systems.

Unit II: Internet **9 hrs**

Working of Internet – Local area and wide area network – Types of files – HTML, TXT, PDF –Search engines and its types and applications.

Unit III: Bioinformatics **9 hrs**

Introduction to bioinformatics – its history and its development - Applications of Bioinformatics. Biological databases – NCBI, EMBL, DDBJ, PDB, Swiss Prot. Data retrieval- Entrez and SRS.

Unit IV: Sequence alignment **9 hrs**

Introduction to Sequence alignment. Sequence analysis – pairwise sequence comparison. Database search for similar sequences using FASTA and BLAST Programs. Multiple sequence alignments.

Unit V: Evolutionary analysis **9 hrs**

Evolutionary analysis: distances, Cladistic and Phenetic Method. Clustering Methods. Rooted and Unrooted tree representation. Bootstrapping strategies, Uses of Clustal W and PHYLIP, MEGA.

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

References:

1. Alexis Leon & Mathews Leon. Fundamentals of Information Technology.VikasPublication.Chenai. (Unit I & II)

2. S.C. Rastogi, NamitaMendiratta, ParagRastogi. Bioinformatics – Concepts, Skills, Applications". (Unit III & IV)
3. DubeyR.C (2007) Text Book of Biotechnology. S.Chand& Company Ltd.(Unit –V)
4. Shanmughavel, P. 2005. Principles of Bioinformatics, Pointer Publishers, Jaipur, India.
5. Teresa. K. Atwood and David J. Parry-Smith Introduction to Bioinformatics.
6. Cynthia Gibas& Per Jambeck (2001). Developing Bioinformatics Computer Skills:Shroff Publishers & Distributors Pvt. Ltd (O'Reilly), Mumbai.
7. HH Rashidi& LK Buehler (2002). Bioinformatics Basics: Applications in Biological Science and Medicine, CRC Press, London
8. Des Higgins & Willie Taylor (2002). Bioinformatics: Sequence, structure and databanks, Oxford University Press
9. Baxevanis AD & Ouellette BEF (2001) Bioinformatics: A practical guide to the analysis of genes and proteins, Wiley Interscience – New York
10. Teresa. K. Atwood and David J. Parry-Smith Introduction to Bioinformatics.10BIIA13C.

Outcome

After completion of this course, students would be able to

- ♣ Gain knowledge on Operating systems
- ♣ 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.
- ♣ To acquire knowledge on FASTA and BLAST programs

CC-IX IMMUNOLOGY

Paper Code: U5R1MBCC9 **Semester: V**
No. of Credits: 5 **No. of hours per week: 5**
Max marks: 25+75=100 **Total Inst. Hrs: 72**

Objectives

- To acquire with basic knowledge in immunology
- To familiarize with the immunity and immune system
- To understand the antigen antibody reactions
- To study the various allergic reactions

Unit – I **16 hrs**

Introduction: – History of Immunology – Immunohematology, Blood groups – ABO and Rh typing, Blood transfusion – Rh – incompatibilities – immunity – types of immunity – Innate – Anatomical, physiological, phagocytic and inflammatory barriers, Acquired – cell mediated and humoral immunity. Hematopoiesis.

Unit – II **14 hrs**

Immune systems: Anatomy of lympho- recticular system – Primary lymphoid organs- bone marrow and thymus; Secondary lymphoid tissue – spleen, lymphnodes, MALT and GALT; cells of the immune system – detailed aspects of T and B lymphocytes – receptors – activation and function.

Unit – III **14 hrs**

Antigens: Types, properties, immunogen, epitope, paratope, haptens – adjuvants – vaccines – types whole organisms vaccine, purified macromolecule vaccine, recombinant vaccine, anti-idiotype vaccine and DNA vaccine – toxoids, antitoxins. Antibody – structure, types and properties. Theories of antibody production. Complement pathway- classical and alternate.

Unit – IV **14 hrs**

Antigen – antibody reactions – in vitro methods; Agglutination – Widal test, Haemagglutination, HAI, and Precipitation – Immunodiffusion and Immunoelectrophoresis, Complement fixation, Immunofluorescence, Enzyme linked immunosorbent assay (ELISA), Radioimmuno assay (RIA) and Fluorescent insitu hybridization (FISH).

Unit – V **14 hrs**

Hypersensitivity reactions – antibody (IgE) mediated - Type I anaphylaxis, Type II – Antibody dependent cellmediated cytotoxicity, Type III – immune complex reactions – respective diseases and immunologic methods of diagnosis – cell mediated immune responses – Lymphokines, Cytokines. Type IV – Hypersensitivity reactions, in vivo methods; Skin tests – immune complex tissue demonstrations, MHC and transplantation.

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

References:

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.Joshi & Osama (1998). Immunology (Serology, Hematology), Agro Botanica.

Outcome

After the completion of this Course work students will be able to

- ♣ Get information immunity and blood grouping
- ♣ Differentiate various lymphoid organs
- ♣ Aquire Knowledge on antigen and antibody
- ♣ Perform antigen antibody reactions *invitro*
- ♣ Learn about allergic reactions and transplantation

CC-X VIROLOGY AND MEDICAL MICROBIOLOGY

Paper Code: U5R1MBCC10 **Semester: V**

No. of Credits: 5 **No. of hours per week: 5**

Max marks: 25+75=100 **Total Inst. Hrs: 72**

Objectives

- To inculcate about the characterization and purification of virus.
- To acquire knowledge about viral diseases.
- To understand about the basic knowledge of medical microbiology.
- Knowledge on clinical lab techniques.
- To make aware of various emerging diseases

Unit I: Introduction to Virology **16 hrs**

History of virology, General properties of viruses, Ultra Structure of viruses. Cultivation of viruses. Purification & Characterization of viruses and enumeration of viruses.

Unit II: Viruses of Plant, Animal and Bacteria **14 hrs**

Plant: Tobacco Mosaic Virus, Cauliflower Mosaic Virus, Bunchy Top of Banana, Satellite virus, Viroids. Animal: Prions, Rinder pest, Raniket Dion, Foot and Mouth disease. Bacteria: T4 Bacteriophage and Lambda Phage.

Unit III: Introduction to Medical Microbiology **14 hrs**

Normal microbial flora of human body, Host microbe interaction, Infections – sources, types and transmission. Collection and transport of specimen for microbiological examination – Pus, Sputum, Urine, Faeces, CSF, and Throat swab.

Unit IV: Bacterial diseases **14 hrs**

Classification, morphology, Cultural characteristics, Pathogenicity, epidemiology, Laboratory diagnosis, treatment, prevention and control of diseases caused by: *Staphylococcus aureus, Streptococcus pyogenes, Bacillus anthracis, Corynebacterium diptheriae, Salmonella typhi, Clostridium tetani, Escherichia coli, Proteus, Mycobcterium tuberculosis, Mycobacterium leprae, Treponema pallidum, Chlamydias, Rickettsiae*

Unit V: Fungal, Parasitic and Viral Diseases **14 hrs**

Clinical symptoms, Epidemiology, pathogenesis, laboratory diagnosis, prevention and treatment of the following fungal, Parasitic and Viral infection (a) superficial infections, subcutaneous infection, cutaneous infection- Opportunistic fungal infections. (b)Parasitic diseases- Amoebiasis, Malaria, Ascarisis, Filariasis. Zoonotic diseases (Rabies), Heamorragic disease – Dengue, Hospital acquired infection.

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 (5thedition) McGraw Hill, New York.
2. Conrat HF, Kimball PC and Levy JA. (1988). Virology. II edition. Prentice Hall,Englewood Cliff, New Jersey.
3. Amitha Biswas (2007). An Introduction to viruses. Vikas Publishers, Delhi.
4. Dimmock N.J. and Primrose S.B. (1994). Introduction to Modern Virology. IV edition. Blackwell scientific Publications, Oxford.
5. Topley and Wilson's (1990). Principles of Bacteriology, Virology and ImmUnity. VIII edition Vol.IV Virology, Edward Arnold, London.
6. Ann GiudiciFettner. (1990). The Science of Viruses.Quill, William Marrow, New York.
7. Flint SJ, Enquist LW, King RM, Racaniell VR and Shalka AM (2000). Principles of Virology - Molecular Biology, pathogenesis and control, ASM Press, Washington DC.
8. Morag, C. Timbury (1994). Medical Virology. X edition. Churchill Livingston.
9. Nicklin, J. Greame-Cook and Killington, R. (2003). Instant Notes I Microbiology. (2ndedition).Viva Books private limited, New Delhi.
10. Robert I. Krasner. (2002). The microbial challenge: Human Microbe Interactions,American society for Microbiology, Washington.
11. Roger Hull.2002.Mathews' Plant Virology.(4thEdition).Academic press-A Harcourt Science and technology company, New York.

Outcome

After completion of this course, students would be able to

- ♣ Get information about the viruses.
- ♣ Describe the viral diseases.
- ♣ Work in clinical labs.
- ♣ Acquire knowledge on control measures of diseases
- ♣ Gain knowledge on emerging diseases and their control measures.

CC-XII Practical - V (Covering - CC – IX & X)
Immunology and Medical Microbiology
Paper code: U5R1MBCC11P

Immunology

1. ABO blood grouping
2. Rh Typing
3. WIDAL test
4. RPR
5. CRP
6. ASO
7. Total Blood cell count by Haemocytometer
8. Differential Blood cell count
9. Double Immunodiffusion
10. Demonstration of ELISA

Virology

1. Isolation on Bacteriophage from Sewage
2. Concentration of Bacteriophages
3. Observation of selected bacterial, Plant and Animal viuses – T4 phage, M13 Phage, TMV, CaMV, HIV, Influenza, HSV, HBV, Rabies and Blue tongue virus.

Medical Microbiology

1. Isolation of Bacteria from Urine, Stool and Sputum
2. Identification of Gram positive organisms (Using laboratory stains); *Streptococcus pneumonia, Staphylococcus aureus and Bacillus* spp. and Gram Negative organisms (Using laboratory stains); *Escherichia coli, Proteus* spp *and Klebsiella pneumonia* on the basis of Microbiological, Cultural and Biochemical characteristics.
3. Saline and iodine wet mount to demonstrate Protozoan parasites
4. Geimsa staining for the demonstration of blood parasites
5. KOH and Lactophenol Cotton blue mount to demonstrate fungi
6. Germ tube technique to identify *Candida albicans*
7. Antibacterial sensitivity test – Kirby – Bauer method
8. Minimal Inhibition Concentration (MIC)

References:

1. K.R.Aneja (2010). Experiments in Microbiology, Plant pathology and biotechnology. New Age International Pvt.Ltd.NewDelhi.
2. Cappuccino J.G. and N. Sherman 2002, Microbiology: A Laboratory Manual, Addison-Wesley.
3. Holt J.G, N.R.Krieg, 2000, Bergey's Manual of Determinative Bacteriology. Ninth edition, Lippincott Williams &Wilkin Publishers.
4. Kannan N, 2002, Laboratory Manual in General Microbiology, Panima Publishers.

CC-XII FOOD MICROBIOLOGY

Paper Code: U6R1MBCC12 **Semester: VI**
No. of Credits: 5 **No. of hours per week: 5**
Max marks: 25+75=100 **Total Inst. Hrs: 60**

Objectives

- To provide knowledge about microbes in food and food spoilage factors
- To learn about the microbial foods.
- To know the preservation methods in foods.
- To make aware of food borne disease
- To learn about the systems in food quality.

Unit I: Introduction **12 hrs**

Importance of food microbiology – Types of microorganisms in food- Factors influencing microbial growth in food - Intrinsic and extrinsic factors – primary sources of microbes in food.Probiotics.

Unit II: Microbial food **12 hrs**

History- mass production- growth requirements- uses of SCP - *Spirulina* - Yeast and Bacteria.Production of fermented dairy products: Cheese, yoghurt, butter milk, sour cream Fermented vegetables; Sauerkraut, Olives and soy sauce.

Unit III: Contamination, spoilage and preservation **12 hrs**

Cereals and cereal products, sugar and sugar products. Vegetables and fruits, meat and meat products, egg and egg products and milk and milk products.

Unit IV: Food borne diseases and food poisoning **12 hrs**

Staphylococcus, Escherichia coli and *Salmonella* infections. Hepatitis, Amoebiosis. Food poisoning (*Clostridium spp.)* and Mycotoxins.

Unit V: Food preservation **12 hrs**

Food preservations-principles, methods of preservations-physical and chemical methods, pasteurization of milk. Food sanitations, Microbiological criteria and food safety, good manufacturing practices, Good Laboratory Practices (GLP), Hazard analysis and critical control points (HACCP), FASSI (Food Safety and Standards Authority of India).

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. 5th Edition. Food Microbiology. 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. 2004.2th EditionBasic 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, 4th edition, CBS Publishers and
    a. Distributers. Jeffrey C.Pommerville.2014.10th Edition. Alcamo's Fundamentals of Microbiology.

6. Andrews AT, Varley J. 1994. Biochemistry of milk products. Royal Society of Chemistry.
7. Robinson RK. 1990. The microbiology of milk. Elsevier Applied Science, London.
8. Ramanathan N. 2009.A Textbook of Food Microbiology, OM Sakthipathipagam
9. Shirly J. VanGarde, Margy Woodburn. 2005. Food Preservation and Safety, Surabhi Publications.
10. PelczarJr,M.J.Chan, E.C.S. and Kreig,N.R. (2016). Microbiology, Mc,GrawHill.Inc,
    a. New York.

Outcome

After completion of this course, students would be able to

- ♣ To become familiar in microbes in food
- ♣ Better understanding of cause of microbes in food spoilage
- ♣ Knowledge on microbial food.
- ♣ Acquire information about food preservation
- ♣ Enable them to work on food industries

CC-XIII INDUSTRIAL MICROBIOLOGY

Paper Code: U6R1MBCC13 **Semester: VI**
No. of Credits: 5 **No. of hours per week: 5**
Max marks: 25+75=100 **Total Inst. Hrs: 60**

Objectives

- To be aware of the historical background of industrial microbiology
- To understand how fermenters are used in the processes of the synthesis of important products
- To know the downstream process
- To understand the production of pharmaceutical products
- To focus on opportUnities to find jobs in such fermentation industries

Unit I – Historical background **12 hrs**

Historical development of Industrial Microbiology, Industrially important microorganisms, Major classes of products, Improvement of industrially important microbial strains-auxotrophic mutants – other genetic improvements.

Unit II – Fermenter design and media **12 hrs**

Design of a fermenter, types of fermenters and basic functions. Fermentation media – Seed culture media. Economic means of providing energy, carbon, nitrogen, vitamin and mineral sources, role of buffers, precursors, inhibitors, inducers and antifoams.

Unit III – Downstream process **12 hrs**

The recovery and purification of fermentation products (intracellular and extracellular), cell disruption, precipitation, filtration, centrifugation, solvent recovery, chromatography, ultracentrifugation, drying, cell immobilization and its applications.

Unit IV – Pharmaceutical products **12 hrs**

Pharmaceutical Microbial products - Microorganism, raw materials, Industrial fermentation and recovery of the products - penicillin, streptomycin, vitamin B12 and rabies vaccine.

Unit V – Industrial products **12 hrs**

Microbial products of industrial value – raw materials, organism and Industrial processes involved in the production of ethanol, vinegar, amylase, protease, glutamic acid.

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

References:

1. Stanbury. P.F. Whitaker. A, Hall. S.J. (1995). Principles of Fermentation Technology, 2nd Edition. Pergamon Press. (Unit IV, V)
2. Patel A.H. (2016). Industrial Microbiology, 2nd Edition. Rajiv Beri for MacMillan India Ltd., New Delhi. (Unit I, II, III)
3. Casida,J.R(2012).Industrial Microbiology. New age international (P) Limited.
4. Kalaichelvan, P T. & Arul Pandi (2007) Bioprocess Technology. MJP Publishers Chennai.
5. Sateesh M.K, (2008).Bioethics and Biosafety .I.K.Internationalpublishing house Pvt .Ltd.
6. Glick, B.R. Pasternak, J.J. (1994) Molecular Biotechnology – ASM Press.

7. Demain A.L. Solomon N.A. (1986) Manual of Industrial Microbiology and Biotechnology ASM Press.
8. Prave, P.Faust, V.Sitting, W.,Sukatsch. D.A. (1987) Fundamentals of Biotechnology ASM Press.
9. Reed. G. (1982) Prescott and Dunn's Industrial Microbiology. Macmillan Publishers.
10. Sikyta. B. (1983) Methods in Industrial Microbiology. Ellis Horwood limited.

Outcome

After completion of this course, students would be able to

- ♣ Get Basic on historical background of industrial microbiology
- ♣ Learn fermentors and fermentation media.
- ♣ perform downstream process
- ♣ produce pharmaceutical products

CC-XIV Practical- VI (Covering Core papers CC XII & CC XIII) – Food Microbiology and Industrial Microbiology
Course code: U6R1MBCC14P

Food and Industrial Microbiology

1. Assessment of milk quality by methylene blue reduction test
2. Performance of Phosphatase test for pasteurized milk
3. Isolation of bacteria from food by standard plate count
4. Isolation of Yeast from grapes
5. Wet mount preparation of spoiled bread, tomato, grapes, potato.
6. Immobilization of yeast cell using Sodium Alginate.
7. Production of Citric acid using *Aspergillus niger*.
8. Alcohol fermentation by *Saccharomyces cerevisae*
9. Estimation of Alcohol using Potassium di-chromate method
10. Starch (Amylase), Casein (Protease) and Lipid (Lipase) Hydrolyses test
11. Mushroom cultivation.
12. Screening of antibiotics producing microbes.
13. Wine production.
14. Isolation of lactic acid producing bacteria from curd
15. Demonstration
    a. Preparation of fermented food – Yoghurt and cheese
    b. Preparation of Wine

References:

1. K.R.Aneja (2010). Experiments in Microbiology, Plant pathology and biotechnology. New Age International Pvt.Ltd.NewDelhi.
2. Cappuccino J.G. and N. Sherman 2002, Microbiology: A Laboratory Manual, Addison-Wesley.
3. Holt J.G, N.R.Krieg, 2000, Bergey's Manual of Determinative Bacteriology. Ninth edition, Lippincott Williams &Wilkin Publishers.
4. Kannan N, 2002, Laboratory Manual in General Microbiology, Panima Publishers.

MBE I - MICROBIAL BIOTECHNOLOGY

Paper Code: U5R1MBMBE1 **Semester: V**
No. of Credits: 4 **No. of hours per week: 5**
Max marks: 25+75=100 **Total Inst. Hrs: 60**

Objectives

- To be aware of the history and scope of biotechnology
- To familiarize with the enzyme technology
- To know the recombinant DNA technology
- To understand the nanotechnology
- To understand the importance of patents in research

Unit I: History and scope **12 hrs**

Biotechnology - Definition – concepts - history, scope and importance, emergence of modern biotechnology - global impact and current excitement of biotechnology (Health care, agriculture, human genome project, environment, genomics and proteomics and bioformatics), biotechnology in India and development.

Unit II: Enzyme technology **12 hrs**

Enzyme production technology through microbes, problems and applications. Enzyme immobilization - definition, advantages of using immobilized enzymes, various methods of immobilization: adsorption, entrapment, ionic bonding, cross linking and encapsulation.

Unit III: rDNA technology **12 hrs**

Principles and application of recombinant DNA technology, production of recombinant vaccine, Insulin, interferon, hormones. Production of Monoclonal antibodies and its applications,Gene therapy – types (somatic cell gene therapy, germ line gene therapy, enhancement and eugenic genetic engineering).

Unit IV: Nanotechnology **12 hrs**

History and development of nanotechnology, introduction, definitions of nanoparticles, nanotubes, nanowires, microbial production of nanoparticles and its applications.

Unit V: Intellectual property rights **12 hrs**

IPR-Tools of IPR (copy rights, patenting, trade mark & trade secret), patenting of biological materials, GATT, WTO, WIPO. Biosafety and Bio ethics – Definitions, principles, Bio safety guide lines for Microbiology Laboratory.

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

References:

1. Text book of Biotechnology. R.C.Dubey (2017).Chand and company (P) Ltd.
2. Glick. B, R and Pasternak J. J (2001) Molecular biotechnology. ASM press,Washington.
3. Kumaresan .V (2009) Biotechnology. Saras Publication.
4. Singh B. D (2006).Biotechnology.KalyaniPublication.
5. Lansing M. Prescott, John P. Harley and Donald A. Klein. (2003). Microbiology. (5th edition).McGraw-Hill company, New York.

6. Helen Kreuzerand Massey (1996).Recombinant DNA and Biotechnology, American society for Microbiology, Washington
7. Trevan,M,D, Boffey,S.CouldingK.HandStanburry.p.(1990)Biotechnology the basic principles-Tata McGraw Hill edition.
8. Nanotechnology Fundamentals and applications I.K.International Publishing House Pvt.Ltd,Neu Delhi.
9. Sathyanarayana, U (2008).Biotechnology.Books and allied (P) Ltd.

Outcome

After completion of this course, students would be able to

- ♣ To become familiar in Genomics and Proteomics
- ♣ Better understanding of immobilization
- ♣ Knowledge on Gene therapy
- ♣ Acquire information about nanotechnology
- ♣ Enable them to know about patents

MBE II - GENETIC ENGINEERING

Paper Code: U6R1MBMBE2 **Semester: VI**
No. of Credits: 4 **No. of hours per week: 5**
Max marks: 25+75=100 **Total Inst. Hrs: 60**

Objectives

- To be aware of the basics about nucleic acid
- To understand the different vectors
- To know the enzymes used in molecular biology
- To familiarize with the gene manipulation
- To understand how these tools are used in research and industries

Unit I: Nucleic acids **12 hrs**

Definition and Functions. Difference between DNA and RNA. Properties of DNA - denaturation, renaturation, melting curve, hyperchromicity.

Unit II: Vectors **12 hrs**

Cloning vectors – plasmids, phage vector, phagemids and cosmids, Ti-plasmid, pBR322, pSC101, pUC, Shuttle vectors and expression vectors – Yeast Artificial Chromosome (YAC), Bacterial Artificial Chromosome (BAC).

Unit III: Enzymes **12 hrs**

Enzymes– Nucleases – Exonucleases and Endonucleases, Concept of restriction and modification – Restriction endonucleases, Ligases, Polymerases, DNA modifying enzymes, Topoisomerases, Methylases – their uses and applications.

Unit IV: Gene manipulation **12 hrs**

Gene and its manipulation techniques; Definition of a gene, structure, cloning techniques, methods of Gene transfer, construction of genomic libraries and c-DNA Libraries. RNA splicing, brief account of DNA sequencing. Site directed mutagenesis.

Unit V: Hybridization techniques **12 hrs**

Nucleic acid and protein hybridization technique – Southern, Northern and Western blotting techniques. DNA amplification using polymerase chain reaction (PCR): types and applications of PCR, DNA fingerprinting and its applications.

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

References:

1. DubeyR.C (2017) Text Book of Biotechnology. S.Chand& Company Ltd.
2. Freifelder D. (2008). Molecular Biology. 4th Edition. Narosa Publishing Home.
3. Brown, T.A., (2006), Gene Cloning, Garland science Publications
4. Joghand, S.N., (2016). Gene Biotechnology (4th Edition).Himalaya Publishing company, India.
5. Richard M. Twyman. (2003). Advanced Molecular Biology (1st edition).Viva Books private Ltd, New Delhi.

6. Veer BalaRastogi (2008).Fundmentals of Molecular Biology. Anne Books, India.(Unit-1)
7. James D. Watson. Michael Gilman. Jan Witkowski and MarkZoller. (2001). Recombinant DNA. Scientific American Books, New York.
8. Lewin, B. (2000). Genes VII. Oxford University press.
9. Lodish, H, Baltimore D, Berk A, Zipursky SL, Matsudaira P, Darnell J. (1995). Molecular Cell Biology. Scientific American Books.
10. Michael Blackburn and Michael J. Gait. (1996). Nucleic acids in chemistry and Biology.(2nd edition).Oxford University press.

Outcome

After completion of this course, students would be able to

- ♣ Get knowledge on structure and properties of nucleic acids
- ♣ Gain insight on vectors and its types
- ♣ Understand about enzymes and their actions
- ♣ Read up gene manipulation techniques
- ♣ Receive information about blotting techniques

MBE- III - BIOINSTRUMENTATION

Paper Code: U6R1MBMBE3 **Semester: VI**
No. of Credits: 4 **No. of hours per week: 5**
Max marks: 25+75=100 **Total Inst. Hrs: 60**

Objectives

- To acquire knowledge in Basic Chemistry
- To understand the basics of centrifugation and colorimeter
- To inculcate the spectroscopy and electrophoretic techniques
- To teach the chromatographic techniques
- To know the basics of Radio-isotopic techniques

Unit I: Basic chemistry **12 hrs**

Acids, bases, buffers; measurements- units of weights and volume; Preparation of solutions; calculation of concentration and methods of expressing concentration of solutions- normality and molarity solutions. Basic instruments- balances, pH meter, Laminar air flow chamber.

Unit II: Centrifugation **12 hrs**

Preparative and Analytical Centrifuges, Sedimentation analysis RCF, Density Gradient Centrifugation. **Colorimetry** – principle, Beer – Lambert's law – Applications.

Unit III: Spectroscopic Techniques **12 hrs**

Theory and Application of UV and Visible Spectroscopy, Fluorescence Spectroscopy, MS, NMR, ESR, Atomic Absorption Spectroscopy, **Electrophoretic Techniques:** Theory and Application of PAGE, Agarose Gel Electrophoresis 2DE, Iso-electric Focusing,.

Unit IV: Chromatography Techniques **12 hrs**

Theory and Application of Paper Chromatography, TLC, Gel Filtration Chromatography, Ion Exchange Chromatography, Affinity Chromatography, GLC, HPLC.

Unit V: Radio-isotopic Techniques **12 hrs**

Introduction to Radioisotopes and their Biological Applications, Radioactive Decay. Types and Measurement, Principles and Applications of GM Counter, Solid and Liquid Scintillation Counter, Autoradiography, Radiation Dosimetry.

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

References:

1. Veerakumari (2005). MJP Publishers.
2. Palaivelu.P(2002) Analytical Biochemistry, MKU University.
3. B.Sivakumar (2005). Bioseperations - Principles and Techniques.Prentice-Hall of India Pvt.ltd.
4. P.Asokan (2002). Analytical Biochemistry. Chinna Publications.
5. Dubey, R.C. (2006). Text book of Biotechnology. Chand and company (P)Ltd.
6. UpadhayayNath, 2001.Biophysical chemistry.

7. 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
8. Glick, B.R. and Pasternak, J.J. (1994). Molecular Biotechnology, ASM Press.
9. John G. Webster. (2004). Bioinstrumentation. University of Wisconsin, John Wiley & Sons, Inc.
10. Wilson, K. and Walker.J (2005). Practical Biochemistry Principles and Techniques,6th edition, CambridgeUniversity/
11. Holme.J and Peck.H (1993). Analytical Biochemistry 2nd edition. Longman Scientific and Technical.
12. ChatwalAnand, 2003. Instrumental methods of chemical analysis

Outcome

After completion of this course, students would be able to

- ♣ Knowledge about basic chemistry in preparation of solution imparted
- ♣ Become proficient in doing analytical techniques
- ♣ Become well-versed in handling all instruments
- ♣ Become skill-fit for Research and Development

MBE - MICROBIAL DIVERSITY

Objectives:

- ♦ To perceive on microbial diversity
- ♦ Get to know about taxonomy of Eubacteria and Actinomycetes
- ♦ Be aware of taxonomy of Photosynthetic bacteria
- ♦ Idea on taxonomy of fungi
- ♦ Learn about taxonomy of algae

UNIT – I

Microbial diversity – siginifcance – microbial evolution – general methods of classifying bacteria - Taxanomy – Principles – Modern approaches – Numerical - Genetic, Serotaxonomy and Chemotaxonomy.

UNIT – II

Taxanomy of Eubacteria and Actinomycetes – Detailed classification upto genus level with general characters of each group – Bergey's Manual and its importance.

UNIT – III

Taxanomy of Photosynthetic Eubacteria and Archaebacteria- General Characteristics.

UNIT – IV

Taxanomy of Fungi (Alexopolous) - General Characteristics - Life Cycles of Mucor, Neurospora ,Agaricus, Dictyostelium.

UNIT – V

Taxanomy of Algae -General Characters and its importance –Cholorophyta- Euglenophyta – Chrysophyta- Phaeophyta - Rhodophyta – Pyrrophyta-Taxonomy of Protozoa – General characters and its importance – Mastigophora, Rhizopoda, Ciliata, Sporozoa.

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

References

1. Prescott, L.M J.P. Harley and C.A. Klein 1995. Microbiology 2nd edition Wm, C. Brown publishers.
2. Michael J. Pelczar, Jr. E.C.S. Chan, Moel : Microbiology McGraw Hill Book R. Krieg, 1986 Company
3. Stainer R.Y. Ingraham J.L. Wheolis H.H and Painter P.R. 1986 The Microbial world, 5th Edition. Eagle Works Cliffs N.J. Prentica Hall.

Outcome

After completion of this course work students would be able to

- ♣ Earned knowledge on Serotaxonomy and Chemotaxonomy
- ♣ Get educated on classification of microorganisms
- ♣ Develop their knowledge on characteristics of archaebacteria
- ♣ Come to know about life cycle of fungi
- ♣ Become proficient with the taxonomy of Protozoa

MBE - EXTREMOPHILES

Objectives:

- ♦ To acquire knowledge on extremophiles.
- ♦ To enable them to know about applications of extremophiles.
- ♦ Learn about physiological adaptations in extremophiles.

Unit I

Extremophiles: Categories of extremophiles and extremotrophs. Distribution of extremophiles and extremotrophs. Extremophiles and the origin of life. Types and diversity of thermophiles, psychrophiles, halophiles, alkaliphiles, acidophiles and barophiles.

Unit II

Alkalophiles: Outline classification, Diversity inalkaline environment, soda lakes and deserts, Anaerobic alkaliphiles and alkaliphilic Poly-Extremophiles. Physiological features of alkaliphiles. Adaptive mechanisms of extreme alkaliphiles. Enzymes from alkaliphiles. Biotechnological applications of alkalophiles.

Unit III

Halophiles: Classification, Dead Sea, discovery basin, cell walls and membranes – Purple membrane. Osmoadaptation/halotolerence. Applications of halophiles and their extremozymes. Barophiles: Classification, high-pressure habitats, life under pressure, barophily, death under pressure.

Unit IV

Thermophile: History of discovery of hyper thermophiles. Carbohydrate-active enzymes from hyper thermophiles. Lignocellulose converting enzymes from thermophiles. Enzymes involved in DNA amplification (e.g.Polymerases) from thermophiles: Evolution of PCR enzymes. Metallo proteins from hyper thermophiles.

Unit V

Psychrophiles: Ecology of psychrophiles: Subglacial and permafrost environments. Taxonomy. Adaptation mechanisms of psychro tolerant bacterial pathogens. Psychrophilic enzymes Acidophiles: Physiological features, adaptation strategies, growth kinetics and enzymes of various extremophilic acidophiles.

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

Reference Books

1. Atlas, R.A. and Bartha, R. 2000. Microbial Ecology, Fundamentals and Application, Benjamin Cummings, New York.

2. Brock, T. D. Thermophilic microorganisms and life at high temperatures, Springer, New York 2. Rainey, F. A. and Oren, A. Extremophile microorganisms and the methods to handle them. In: Extremophiles, Methods in Microbiology, vol. 35, edited by F.A. Rainey and A. Oren, Elsevier, Amsterdam.

3. Glansdorff, Nicolas Gerday, Charles. 2007. Extremophiles- -Physiology and Biochemistry of ASM Press.

4. Horikoshi, K. and W. D. Grant, Extremophiles-microbial life in extreme environments, Wiley, New York.

5. Jean-Claude Bertrand, Pierre Caumette, Philippe Lebaron, Robert Matheron, Philippe Normand, TélesphoreSime-Ngando (eds.) 2011. Environmental Microbiology: Fundamentals and Applications Microbial Ecology. Springer.

6. Johri B.N. 2000. Extremophiles. Springer Verlag. , New York

7. Koki Horikoshi, Garo Antranikian, Alan T. Bull, Frank T. Robb, Karl O. Stetter. 2010. Extremophiles Handbook. Springer.

8. Om V. Singh. 2012. Extremophiles-Sustainable Resources and Biotechnological Implications- -Wiley-Blackwell.

9. Ventosa, A., Nieto, J.J. and Oren, A. (1998) Biology of moderately halophilic aerobic bacteria. Microbiology and Molecular Biology Reviews, 62, 504–544.

10. Madigan, M.T., Martinka, M., Parker, J. and Brock, T.D. 2000. Twelth Edition, Biology Microorganisms, Prentice Hall, New Jerry.

Outcome

After completion of this course work students would be able to

- ♣ Become aware of types of Thermophiles
- ♣ Idea on Acidophiles, Halophiles and Alkalophiles
- ♣ Get educated on Psychrophiles

SBE I - VERMITECHNOLOGY

Course Code: U4R1MBSBE1 **Semester: IV**
No. of Credits: 4 **No. of hours per week: 2**
Max marks: 25+75=100 **Total Inst. Hrs: 48**

Objectives

- To learn the basic principles of biological, chemical and environmental concepts of pertaining to vermitechnnology.
- To create knowledge on Environmental degradation.
- To get the theoretical knowledge on vermicompost bed preparation.
- To create knowledge on Self- EmpolymentOppurtunity.

Unit-I **12 hrs**

Definition, Scope and importance – common species for culture – Environmental requirements – culture methods – Benefits and constraints of vermicomposting.

Unit-II **9 hrs**

Taxonomic position and diversity - Types – morphology and physiology of earthworm – Ecological roles and needs for earthworm culture/wormery breeding techniques – indoor and outdoor cultures – monoculture and polyculture – relative merits and demerits.

Unit-III **9 hrs**

Applications of vermiculture – vermin – composting, use of vermicastings in organic farming/ horticulture – earthworms for management of biomedical solid waste – feed/bait for capture /culture fisheries – forest regeneration.

Unit-IV **9 hrs**

Marketing the products of vermiculture - quality control, market research, marketing techniques – creating the demand by awareness, demonstration and advertisement – packing and transport – direct marketing.

Unit- V **9 hrs**

Future perspectives – Predators/ athogen control in wormeries – Cost – benefit analysis of vermin-composting – potential and constraints for vermiculture in India.

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

References:

1. Sultan Ahmed Ismail, 2005, theEarthworm Book, Second Revised Edition. Mother India Press, Goa.
2. Edward, C.A and Bohlen, P.J 1996, Ecology of Earthworms – 3rd Edition, Chapman and Hall.
3. Jsmail, S.A., 1970,Vermicology, The biology of earthworms, Orient Longman, London.
4. Lee, K.E., 1985. Earthworms-Their ecology and relationship with soil and Land use, Academic Press, Sydney (Unit-II, III).
5. Shukla, G.S 1994. Economic Zoology. Meerut Rastogi Publication.
6.Seethalekshmy .M And Santhi. R, 2014,Vermitechnology, 2nd edition. Saras Publication,

Outcome

After completion of this course work students would be able to

- ♣ Knowledge on vermicompost bed preparation.
- ♣ Knowledge on environmental degradation.
- ♣ Basic idea on Biological, chemical and environmental concept pertaining to vermitechnology.

SBE II - MEDICAL LAB TECHNOLOGY

Course Code: U5R1MBSBE2 **Semester: V**
No. of Credits: 4 **No. of hours per week: 2**
Max marks: 25+75=100 **Total Inst. Hrs: 48**

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 **12 hrs**

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 **9 hrs**

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 **9 hrs**

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 **9 hrs**

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 **9 hrs**

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

References:

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

Outcome

After completion of this course work 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.

SBE III - MUSHROOM TECHNOLOGY

Paper Code: U6R1MBSBE3 **Semester: VI**

No. of Credits: 2 **No. of hours per week: 4**

Max marks: 25+75=100 **Total Inst. Hrs: 24**

Objectives

- To give the basics of mushrooms in human food
- To know mushroom propagation for food industries
- To give an opportunity for future entrepreneurship
- To get knowledge on mushroom cultivation
- To get idea on nutrition availability in mushroom

Unit I: Introduction

Introduction – History – scope of edible mushroom cultivation – Types of edible mushroom available in India – *Calacybe indica, Volvariella volvacea, Pleurotussajor-caju. Agaricus bisporus.*

Unit II: Pure culture

Pure culture – preparation of media (PDA and Oatmeal agar media) sterilization – Preparation of test tube slants to store mother culture – culturing of Pleurotus mycelium on petriplates – Preparation of mother spawn in saline bottle and polypropylene bags and their multiplication.

Unit III: Cultivation Technology

Cultivation Technology: Infra structure, locally available substrates, polythene bags, vessels, inoculation hood, inoculation loop, low cost stove, sieves, Culture rack, Mushroom unit (Thatched house) – Mushroom bed preparation – Paddy straw, sugarcane trash, maize straw, banana leaves.

Unit IV: Storage and nutrition

Storage and nutrition: Short term storage – long term storage (scanning, pickles, papads, drying, and storage in salt solutions) – Nutrition: Proteins, amino acids, mineral elements. Nutrition: Carbohydrates – Crude fiber content, vitamins.

Unit V: Food preparation

Food preparation: Types of foods prepared from mushroom – soup, cutlet, omlette, samosa, pickles, curry. Research centers – National level and Regional level. Cost benefit ratio – Marketing in India and abroad – Export value.

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

References:

1. Nita Bahl (1988) Hand Book of Mushrooms, II edition Vol I & II.
2. Shu Ting Chang, Philip G. Miles, Chang. S.T. (2004). Mushrooms: Cultivation, nutritional value, medicinal effect and environmental impact. 2nd edition, CRC press.
3. Paul Stamets, J.S. and Chittom, J.S. (2004). Mushroom Cultivator: A Practical guide to grow mushrooms at home, Agarikon press.
4. Marimuthu*et al*., (1991) Oyster Mushrooms, Dept. of Plant Pathology, TNAU, Coimbathore.
5. Tewari and Pankaj Kapoor S.C. (1988) Mushroom cultivation, Mittal Publications, Delhi.
6. Swaminathan M. (1990) Food and Nutrition. Bappco. The Bangalore Pritning and Publishing Company Ltd., Bangalore.

Outcome

After completion of this course work students would be able to

- ♣ Gain Knowledge on mushroom cultivation techniques so that they can become employable in agro-based industries.
- ♣ Basic idea on training to go for self-employment
- ♣ Seek information on difference between edible mushroom and poisonous mushroom
- ♣ Get educated on food preparation using mushroom
- ♣ Obtain knowledge on nutrition in mushroom

SBE - ORGANIC FARMING

Objectives

- ♦ To study the principles and practices of organic farming for sustainable crop production.
- ♦ To develop an understanding of the historical, biological and ecological basis organic farming for including crops and livestock management.
- ♦ To learn the basic principles of organic matter management by utilizing cover crops and compost.
- ♦ To develop critical and creative thinking with a system of approach for multiple and diverse farming systems, including vegetables, fruit, field crops and livestock and use the skills for development of a group farming systems plan.
- ♦ To understand and realize the social, economic, political and environmental context for current and future organic agricultural production and sales.

Unit-I

Introduction to organic farming-principles, types, need and development of organic farming - conventional farming v/s organic farming. Biodynamic farming- Scope of organic farming in Tamil Nadu, National and International status-Agencies and Institutions related to organic agriculture.

Unit-II

Organic farming systems: Land preparation- soil tillage - Choice of propagation (Seed and planting materials). Seed treatments – Crop rotations, multiple and relay cropping systems-water management. Manure: Green manure - Composting and factors – Composting methods.

Unit-III

Bio-fertilizers – types – methods of application – advantages and disadvantages. Weed management diseases and insect pest management, bio-pesticides – Vermicomposting – organic manures – Concentrated organic manures-Organic amendments and sludge.

Unit-IV

Organic crop production – methods – Rice –Coconut – Cashew – Okra – Pulses – *Amaranthus* – Solanaceous– Cucurbits – Mango – Banana – Pepper – Ginger – Turmeric – Ornamental Crops – Livestock component in organic farming.

Unit-V

Farmer economy – Basic concept of economics - Demand, supply – Economic viability of a farm – Marketing, Imports and Exports – Farm inspection and certification. Entrepreneurship development – Entrepreneurship – Concept – Characteristics – approaches – need for Entrepreneurship - Agri Enterprises – Stage of Establishing Enterprise – Project Identification.

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

References:

1. Palaniappan SP &Anandurai K.1999.Organic Farming – Theory and Practice. Scientific Publ (Unit I - V).
2. Ananthakrishnan TN, (Ed.).1992.Emerging Trends in Biological Control of Prophageous Insects. Oxford & IBH.
3. Roa BV Venkata .1995.Small Farmer Focused Integrated Rural Development: Socioeconomic Environment and Legal Perspective: Publ.3 Parisaraprajana, Parishtana, and Bangalore.
4. Reddy M. (Ed).1995.Soil Organisms and Litter Decomposition in the Tropics. Oxford & IBH.
5. Sharma A.2002.Hand book of Organic Farming.Agrobios(Unit-V).
6. Veeresh GK, Shivashankar K and Suiglachar MA. 1997. Organic Farming and Sustainable Agriculture.Association for promotion (Unit-I-V).
7. Free – E-book: http:/agridr.in/tnauEAgri/eagri50/GBPR111/index.html.

Outcome

After completion of this course work students would be able to

- ♣ Clear information about Organic farming for sustainable Crop production.
- ♣ Enable them to work on Agricultural industries.
- ♣ Get ideas on bio-pesticides and vermicompost.
- ♣ Basic knowledge on organic crop production including vegetables, fruits, field crops and live stocks.
- ♣ Get clear idea on Organic agricultural production and Sales.

SBE - BIOFERTILIZER TECHNOLOGY

Objectives

- Isolate, identify and screen efficient and effective strains of microbial inoculant
- Find out a suitable carriers for mass production of microbial inoculant
- Develop a suitable techniques of mass production of biofertilizer
- Recommend optimum dose, time and methods of biofertilizers
- Supply of quality liquid biofertilizer on no loss no profit basis

Unit I: Introduction

General account of the microbes used as biofertilizers for crop plants and their advantages. Introduction – definition – advantages. Biocontrol agent – *Pseudomonas.* Green Manure – *Azolla.*

Unit II: Symbiotic N_2 fixers

Rhizobium - Cyanobacteria – Frankia – Isolation, identification, characterization, mass inoculum production and applications.

Unit III: Non - symbiotic N_2 fixer

Azospirillum- Free living – *Azotobacter* - isolation, characterization, mass inoculum production and field application.

Unit IV: Phosphate solubilizers

Phosphate solubilizing microbes – Isolation, characterization, mass inoculum production, field application – Phosphate solubilization mechanism.

Unit V: Mycorrhizae

Mycorrhizae - classification - Taxonomy of mycorrhizae - Isolation of VA mycorrhiza - Mass inoculums production of VAM – field application of Ectomycorrhizae and VAM.

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

References:

1. Kannaiyan,S (2003). Biotechnology of Biofertilizers,CHIPS, Texas.
2. Kumaresan.V (2009). Biotechnology.Saras Publications.
3. Subba Rao N .S (1995) Soil microorganisms and plant growth Oxford and IBH publishing co. pvt. Ltd. New Delhi.
4. Lansing M. Prescott, John P. Harley and Donald A. Klein. (2003). Microbiology.(5th edition).McGraw-Hill company, New York
5. Text book of Microbiology. R.C.Dubey Maheshwari (2006).Chand and company (P) LTD.
6. MahendreK.Rai (2005). Hand book of microbial biofertilizers. The Howorth Press, Inc.New York.
7. Reddy, S.M. *et al* (2002) Bioinoculants for sustainable agriculture and forestry, Scientific Publishers.
8. Subba Rao N.S (1988) Biofertilizers in Agriculture and forestry Oxford and IBH publishing Co...Ltd...New Delhi.

Outcome

After completion of this course work students would be able to

- ♣ Gained knowledge on microbes used as biofertilizers
- ♣ Learned about the mass production of microbial inoculant
- ♣ Knowledge acquired on isolation of *Azospirillum* and *Azotobacter*
- ♣ They have become aware of Phosphate solubilizing microbes
- ♣ Get educated on taxonomy of mycorrhizae

IDC- BIOFERTILIZER

Objectives:

- ♦ To give the basics of bio fertilizers for better soil management
- ♦ To learn importance of symbiotic and non symbiotic N2 fixers
- ♦ To know how microbes are utilized in agriculture
- ♦ To learn the phosphate solubilizers and mycorrhizal

Unit I: Introduction

General account of the microbes used as biofertilizers for crop plants and their advantages. Symbiotic N2 fixers*: Rhizobium* – Isolation, characterization, Identification, Classification, inoculum production and applications.

Unit II: Non - symbiotic N2 fixer

Non - symbiotic N2 fixer - *Azospirillum*- Free living – *Azotobacter, Clostridium, Klebsiella and Anabaena* - free isolation, characterization, mass inoculum production and field application.

Unit III: Symbiotic N2 fixers

Symbiotic N2 fixers - Cyanobacteria, *Azolla*- Isolation, characterization, mass multiplication – Role in rice cultivation- Crop response - field application. Frankia - Isolation, characterization – actinorrhizal nodules – non leguminous crop symbiosis.

Unit IV: Phosphate solubilizers

Phosphate solubilizers - Phosphate solubilizing microbes – Isolation, characterization, mass inoculum production, field application – Phosphate solubilization mechanism.

Unit V: Mycorrhizal

Mycorrhizal - classification - Taxonomy of mycorrhizae - Isolation of VA mycorrhiza - Mass inoculum production of VAM – field application of Ectomycorrhizae and VAM.

References:

1. Kannaiyan,S.(2003). Biotechnology of Biofertilizers,CHIPS, Texas.
2. SubbaRao N .S (1995) Soil microorganisms and plant growth Oxford and IBH publishing co. pvt. Ltd. New Delhi.
3. Lansing M. Prescott, John P. Harley and Donald A. Klein. (2003). Microbiology.(5thedition).McGraw-Hill company, New York
4. Text book of Microbiology. R.C.DubeyMaheshwari(2006).Chand and company (P)LTD
5. MahendreK.Rai(2005). Hand book of microbial biofertilizers. The HoworthPress ,Inc.New York.

6. Reddy, S.M. *et al* (2002) Bioinoculants for sustainable agriculture and forestry, Scientific Publishers.
7. SubbaRao N.S (1988) Biofertilizers in Agriculture and forestry Oxford and IBH publishing Co...Ltd...New Delhi.

Outcome

After completion of this course work students would be able to

- ♣ Gained knowledge on microbes used as biofertilizers
- ♣ Learned about the mass production of microbial inoculant
- ♣ Knowledge acquired on isolation of *Azospirillum* and *Azotobacter*
- ♣ They have become aware of Phosphate solubilizing microbes
- ♣ Get educated on taxonomy of mycorrhizae

IDC- APPLIED MICROBIOLOGY

Objectives:

- ♦ To focus on Contamination and Food spoilage
- ♦ To learn about antibiotic production
- ♦ To know about the cultural characteristics of various microorganisms
- ♦ To gain knowledge on interactions among soil microorganisms
- ♦ To get idea on Marine microorganisms

Unit-I: Food and Dairy

Introduction, History, Occurrence of Microorganisms in food, intrinsic and extrinsic factors influencing microbial growth. Contamination, spoilage and preservation of foods. Fruits, Vegetables, Eggs, Meat, Poultry, Fishes, Milk and Milk Products. Fermented foods: Sauerkraut, Pickles, Buttermilk, Yoghurt, Cheese.

Unit-II: Industrial Microbiology

Industrial product from microorganisms- Antibiotics production of Penicillin, Streptomycin. Enzyme from microbes: Amylase, Protease, Organic acids-Citric acids, aceyic acid. Amino acids – Glutamic acid, Lysine- Production of alcoholic beverages- Beer and wine. Biofuels –Ethanol, Methane, Biogas.

Unit-III: Medical Microbiology

Morphology, Cultural characteristics, Pathogenesis, laboratory diagnosis, prevention, control and treatment of disease caused by the following organisms: *Mycobacterium tuberculosis*, *Clostridum tetani*, *Salmonell typhi*, *Vibrio cholera*, Swine flu, Rota, Ebola, HIV, Dengue virus and Chicken guinea virus and Hepatitis viruses.

Unit-IV: Environmental Microbiology

Soil as dynamic ecosystem, Microbial flora of soil, Interactions among soil microorganisms (Neutralism, Commensalism, Mutualism, Antagonism, Competitions, Parasitism and Predation).Biological Cycles (Carbon, Nitrogen, Sulphur and Phosphorus cycle).Air Microbiology: Sampling of air microflora, Biodiversity in Air. Water Microbiology: Types of water (atmospheric, surface and stored constitutions), Biodiversity of aquatic environments.

Unit-V: Marine Microbiology

Methods of studying microorganisms: Methods of collection, enumeration (total and viable counts), isolation, culture and identification based on morphological, physiological and biochemical characteriistics. Marine microorganisms in food, preservation of marine microbes.

References:

1. A text book of Microbiology-R.C.Dubey,Dr.K.Maheshwari,M.Chand Publishers.Edition.2012.
2. Food Microbiology-William C.Frazier and Dennis C.Westoff,TataMC Graw Hill Education (2013).
3. Industrial Microbiology-l.E. Casida, New age INTERNATIONAL PUBLISHER Ltd.,New Delhi.
4. Marine Microbiology-A. Mitra and Kakoli Banerjee, Narendra Publishing House (2004).

Outcome

After completion of this course work students would be able to

- ♣ Get educated on preservation of various foods
- ♣ Learnt about the production alcoholic beverages
- ♣ Gained knowledge on control and treatment of various diseases
- ♣ Become aware of biodiversity of aquatic environment
- ♣ Knowledge acquired on applications of marine microorganisms