MANONMANIAM SUNDARANAR UNIVERSITY
TIRUNELVELI
PG - COURSES – AFFILIATED COLLEGES
Course Structure for M.Sc. Microbiology
(Choice Based Credit System)
(with effect from the academic year 2017- 2018 onwards)

Sem	Subject No	Status	Subject title	Contact hours/ week	Credits (98)
III	13	Theory /Core	Bioinformatics and Biostatistics	4	4
	14	Theory /Core	Medical &Pharmaceutical Microbiology	4	4
	15	Theory /Core	Environmental & Agricultural Microbiology	4	4
	16	Theory /Core	Research Methodology	4	4
	17	Practical	Practical – V	7	4
	18	Practical	Practical – VI	7	4
				30	24
IV	19	Theory /Core	Food Microbiology	4	4
	20	Theory /Core	Fermentation &Industrial Microbiology	4	4
	21	Theory /Core	Biotechnology	4	4
	22	Project	Project	4	4
	23	Practical	Practical – VII	7	4
	24	Practical	Practical – VIII	7	4
				30	24

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BIOINFORMATICS AND BIOSTATISTICS

Objectives: Making students with basic knowledge in computers and mathematics to acquire comprehensive knowledge about the role of computers and applications of statistics for understanding the developments in the fields of life science and to make further advancements in the field of biological research.

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Unit: IBiology in computer

Biology in the computer age: Computational Approaches in Biology. Basics of computers – servers, workstations, operating systems, Unix, Linux. World Wide Web. Search engines, finding scientific articles – Pubmed – public biological databases.

(12 L)

Unit: II Sequencing and applications

Genomics Sequence analysis – Sequencing genomes – sequence assembly – pairwise sequence comparison – geneome on the web – annotating and analysing genome sequences.Genbank – sequence queries against biological databases – BLAST and FASTA – multifunctional tools for sequence analysis. Multiple sequence alignments, Phylogenetic alignment – profiles and motifs.

(14 L)

Unit: IIIProteomics

Proteomics Protein Data Bank, Swiss-prot – biochemical pathway databases – Predicting Protein structure and function from sequence – Determination of structure – feature detection – secondary structure prediction – predicting 3 D structure – protein modeling.

(12 L)

Unit: IV Basics of Biostat

Biostatistics Introduction – Population and sample – Variables – Collection and presentation of data – Descriptive statistics – Measures of Central tendency – mean (arithmetic, harmonic & geometric) median and mode – Measures of dispersion – range, mean deviation, variance & standard deviation, Skewness and Kurtosis.

(12 L)

Unit: VBiostatistic applications

Biostatistics Inferential statistics – Probability and distributions – Poisson, Binomial and Normal distribution – Chi-square test – Hypothesis test – Student's t-test – Correlation and Regression – ANOVA.

(10 L)

TEXTBOOKS RECOMMENDED:

1. W.J. Ewens, Gregory Grant,(2005). Statistical Methods in Bioinformatics: An Introduction (Statistics for Biology & Health), Springer
2. Bryan Bergeron,(2003).Bioinformatics Computing First Indian Edition, Prentice Hall,
3. Cynthia Gibas& Per Jambeck (2001). Developing Bioinformatics Computer Skills: Shroff Publishers & Distributors Pvt. Ltd (O'Reilly), Mumbai
4. HH Rashidi& LK Buehler (2002). Bioinformatics Basics: Applications in Biological Science and Medicine, CRC Press, London
5. Des Higgins & Willie Taylor (2002). Bioinformatics: Sequence, structure and databanks, Oxford University Press

REFERENCES

6. Baxevanis AD & Ouellette BEF (2001) Bioinformatics: A practical guide to the analysis of genes and proteins, Wiley Interscience – New York
7. Arora PN &Malhon PK (1996). Biostatistics Imalaya Publishing House, Mumbai.
8. Sokal&Rohif (1973). Introduction to Biostatistics, Toppan Co. Japan.
9. Stanton A &Clantz, Primer of Biostatistics — The McGraw Hill Inc., New York.
10. Gurumani.N. (2006). Research Methodology for Biological Sciences. MJP Publishers, Chennai.

MEDICAL AND PHARMACEUTICAL MICROBIOLOGY

Preamble: Strengthening the desire of students in the field of medical microbiology by inculcating advanced knowledge on diverse microbial diseases and the techniques of diagnostic and pharmaceutical microbiology essential for making them as a tool to create a joyful society

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Unit: ISystamatic Diseases and its transmission

Etiology, transmission, pathogenesis, clinical manifestation, lab diagnosis, chemotherapy and prophylaxis of respiratory tract infections :**upper respiratory tract infections** (*Streptococcal pharynghgitis*, Diphtheria) and **lower respiratory tract infections.** (Tuberculosis and bacterial pneumonia) – **Urinary tract infections** – **Sexually transmitted infections.** (Syphillis, Gonorrhea) – **Gastro intestinal infections** – (Bacteria-*Escherchia coli*, *Salmonella sp*, *Shigellasp*, *Vibrio sp*, Protozoan – *Enatamoebahistolytica*– Viral-Rotaviruses). (15 L)

Unit: II Infection and diagnosis

Studies on **central nervous system infections** (Bacterial: meningitis and tetanus) –**Skin infections** (Bacterial: PyogenicStaphylococcal and Streptococcal) – Mycobacterial disease (leprosy) – **Vector borne infections** (Ricketsial infections) – **Protozoa infections** (Malaria) – **Fungal infections** (Dermatophytosis, Candidiasis) – **Viral infections** (Rabies, Poliomyelitis). (14 L)

Unit: IIIEmerging infectious diseases

Emerging infectious diseases: Emerging bacterial and viral infections – SARS – Avian – H1N1 influenza – Chikungunya, Dengue, Ebola – Zika. (10 L)

Unit: IVPharmacheuticle tests

Pyrogentesting - Sterility and toxicity test – Antimicrobial testing (Kirby- Bauer method) – MIC and MBC – Types of disinfectants, antiseptics and sanitizers – Factors influencing the selection of drugs. (Dose, route, toxicity and combined therapy) – Drug resistance in microbes. (11 L)

Unit: VPharmacopia

Standards of drugs: BP, EP, IP and USP – sterility testing of parental products (solid and liquid products) – Sterility testing of pharmaceutical products – Sterility testing of sterile surgical device, dressings absorbable, hemostats, surgical ligatures, suture and surgical catgut. (10 L)

TEXTBOOKS RECOMMENDED:

1. Ananthanarayanan, R., and Panicker, J. (2000). Text Book of Microbiology. Orient Longmans.
2. Rajan, S. (2007). Medical microbiology. MJP Publisher, Chennai
3. Bernard D. Davis, Renato Dulbecco, Herman N. Eisen and Herold, S. Ginberg, (1990), Microbiology (4th Edition), J.B. Lippincott Company, New York.
4. Prescott L.M. Harley J.P., and Klein D.A (2008). Microbiology (7th Edition). McGraw Hill, New York.
5. Larry MO Kane and Judy Kandel (1996), Microbiology – Essentials and Applications. (2nd Edition).

REFERENCES:

6. Madigan M.T., (Martinko, J.M., and Parker J., Brock TD. (1997). Biology of Micoorganisms. (8th Edition). Prentice Hall international Inc, London.
7. Mariappan C. and Murugesan A.G., (2010), Pharmaceutical microbiology and quality control theory and techniques. Nalini Publishers, India.
8. Nester, E.W., Roberts, C.V., and Nester, M.T. (1995). Microbiology, A Human Perspective. IWOA, U.S.A.
9. Salle, A.J. (1996). Fundamental Principles of Bacteriology. (7th Edition). Tata MoGraw Hill, Publishing Company Ltd, New Delhi.
10. Pelczer Jr., M.J. Chan E.C.S., and Kreig N.R. (1993). Microbiology. McGraw Hill, Inc., New Delhi.

ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY

Preamble: Transforming student society caring nature as an eco-friendly one by introducing the relationship between microbes and nature, its roles and its utilization for the creation sustainable environment.

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Unit I: Soil microbiology

Soil microbiology: soil structure and profile – Classification of soil – Physical and Chemical characteristics – Micro flora of various soil types – Quantification of soil micro flora – Factors affecting microbial community in soil – Biogeochemical cycles – Carbon, nitrogen, phosphorus and sulphur cycles. (12 L)

Unit II:Aero microbiology

Aero microbiology: Droplet nuclei – aerosol – Assessment of air quality – Solid and liquid impingement method – Airborne transmission of microbes – Diseases and preventive measures (Bacteria, fungi and viruses). (12 L)

Unit III: Aquatic Microbiology

Aquatic environment – Freshwater habitats (ponds – lakes) marine habitats (mangroves, deep sea, hydrothermal vent –Potability of water, microbial assessment of water quality – waterborne diseases and control measures – water pollution Eutrophication. (12 L)

Unit IV:Rhizosphere effects

Rhizosphere effects – R/S ratio – Rhizoplane – Biofertilizers and role in agriculture – Bacteria (Rhizobium, Azotobacter, Azospirillum and Phosphobacteria). Algae (Blue green Algae) – and Fungi (VAM). (12 L)

Unit V: Important diseases of horticultural crops

Important diseases of horticultural crops – Symptoms – Etiology, lifecycle and management – Bacterial leaf blight of Paddy, Late blight of Potato – Apple scab – stem rust of wheat – Transgenic plants for crop improvement – Bio-control agents of bacteria, fungi and virus. (12 L)

TEXTBOOKS RECOMMENDED:

1. Rangasamy. G., and Bagyaraj. D.J. (1996). Agricultural Microbiology. Prentice – Hall of India Pvt Ltd., New Delhi.
2. Atlas, R.M., and Bartha.M. (2003). Microbial Ecology – Fundamentals and applications. Benjamin – Cummings, Menlo Park,California.
3. Talaro, K.P. and Talaro. A (1999). Foundations in Microbiology. WCB McGraw Hill New York.
4. Dirk, J. Elasas, V., Trevors, J.T., and Wellington, E.M.H (1997). Modern Soil Microbiology. Marcel Dekker INC, New York, Hong Kong.
5. Grant W.D. and Long, P.L. (1981). Environmental Microbiology. Blackie Glasgow and, London.

REFERENCES:

6. Mitchel, R. (1992). Environmental Microbiology Wiley – John Wiley and Sons. Inc. Publications, New York.
7. Vijaya Ramesh, K. (2004). Environmental Microbiology. MJP Publishers, Chennai.
8. MoshrafucidinAhamed and Basumatary, S.K. (2006). Applied Microbiology MJP Publishers, Chennai.
9. Rajednran. P., and Gunasekaran. P, (2006) Microbial Biormediation. MJP Publishers Chennai.
10. Kalaiselvan, P.T. Arul Pandi. I. (2007). Bioprocess Technology. MJP Publishers, Chennai.

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RESEARCH METHDOLOGY

Preamble: Providing opportunity for students with a thirst in research to get well acquainted with research methodology which includes different skill developments in scientific writing, data handling and processing, development of research ideas and planning / designing of research projects.

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Unit: 1 Basics of Research Methodology

Objectives – principles – types of research approaches – Research process – Criteria of good research – Research and Scientific method – Defining the Research problem – Selecting the problem – Techniques in defining the problem. (12 L)

Unit: II Formula and hypothesis

Importance and need for research ethics and scientific research - Formulation of hypothesis – Types and characteristics – Hypothesis testing – Procedures. (12 L)

Unit: III Designing of research work

Designing a research work – Need of research design – Features of a good design – Concepts and different research design – Basic principles of experimental design. (12 L)

Unit: IV Interpretation and report writing

Interpretation and report writing.Meaning – Techniques and significance of report writing – Steps - Types of report – Oral presentation. (10 L)

Unit: VScientific writing

Scientific writing – Characteristics – Logical format for writing thesis and papers – Essential features of abstract, introduction, review of literature, materials and methods, results and discussion. Effective illustration – Tables and figures – Plates – Conclusion and Bibliography – Application of computer in research. (14 L)

TEXTBOOKS RECOMMENDED:

1. Vijayalekshmi, G. and C. Sivapragasam (2008). Research Methods (Tips and techniques). MJP Publishers, Chennai.
2. Gurumani, N. (2006). Research methodology for Biological Sciences. MJP Publishers, Chennai.
3. Cappuccino. J.G., and Sherman. N. (1996). Microbiology – Laboratory Manual. Benjamin Cummins. New York.
4. Kannan. N (1996), Laboratory Manual in General Microbiology. Palani Paramount Publication, Palani.
5. Gunasekaran. P. (1996). Laboratory Manual in Microbiology. New Age International Ltd., Publishers, New Delhi

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PRACTICAL-V

Preamble: Exposing students exhibiting passion over teaching, research and jobs in industries to basics and routine experiments carried out in diverse areas pertaining to their theory background so as to improve their experimental skills, reliability and effectiveness needed for effective research and employment.

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1. Perform pairwise sequence alignment for a set of two analogous protein **(DEMO)**.
2. Sequence similarity search using NCBI – BLAST tool **(DEMO).**
3. Construction of graph and bar diagram.
4. Calculation of mean, median, mode,
5. Calculation of standard deviation and standard error
6. Basics of Chi-Square test.
7. Collection and transport of clinical specimens-methodology and media.
8. Determination of MIC **(DEMO)** *
9. Determination of MBC **(DEMO)** *
10. Determination of LD_{50} **(DEMO)** *
11. Testing the efficacy of antiseptics by Phenol Coefficient test **(DEMO)**
12. Bacteriological analysis of throat
13. Bacteriological analysis of sputum
14. Bacteriological analysis of ear
15. Bacteriological analysis of wound
16. Bacteriological analysis of pus
17. Bacteriological analysis of urine sample
18. Bacteriological analysis of faeces
19. WIDAL test: Qualitative and quantitative.
20. Detection of endotoxin – LAL Test **(DEMO)** *
21. **A**ntibiotic sensitivity test – Kirby – Bauer disc diffusion method.

* Effective learning could be made possible by arranging Field / Industrial visits and Training programmes.

LABORATORY MANUALS RECOMMENDED:

1 Cappuccino. J.G., and Sherman. N. (1996). Microbiology – Laboratory Manual. Benjamin Cummins. New York.
2. Kannan. N (1996), Laboratory Manual in General Microbiology. Palani Paramount Publication, Palani.
3. Gunasekaran. P. (1996). Laboratory Manual in Microbiology. New Age International Ltd., Publishers, New Delhi.
4. Sundararaj, T. (2005), Microbiology – Laboratory Manual. (1st Edition), PubinSundararaj. A, Chennai.
5. Jayaraman, J. (1985) Laboratory Manual in Biochemistry. Willey Eastern Ltd., New Delhi.
6. Plummer D.T. (1998). An introduction to Practical Biochemistry Tata McGraw Hill, NewDelhi.
7. Palanivelu.P. Analytical. Biochemistry and Separation Techniques.
8. Benson (2002). Microbiological Applications – Laboratory Manual in General Microbiology. International Edition, McGraw Hill Higher Education.
9. Collins, C.R. and Lyne. P.M. (1976). Microbiological Methods (4th edition), Butterworths, London.
10. Dubey. R.C. and Maheswari O.K. (2002). Practical Microbiology. S.Chand and Co Ltd., New Delhi.

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PRACTICAL – VI

SUB CODE:

Preamble: Exposing students exhibiting passion over teaching, research and jobs in industries to basics and routine experiments carried out in diverse areas pertaining to their theory background so as to improve their experimental skills, reliability and effectiveness needed for effective research and employment.

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1. Determination of PH in packaged water / River water*.
2. Determination of TDS packaged water / River water*.
3. Determination of conductivity packaged water / River water*.
4. Determination of Salinity packaged water / River water*.
5. Determination of alkalinity packaged water / River water*.
6. Estimation of dissolved oxygen*.
7. Determination of BOD*.
8. Determination of COD*.
9. Screening Aerobic Bacterial Count in packaged water / River water*.
10. Screening of *Pseudomonas sp*in packaged water / River water*.
11. Collection and observation of plankton in freshwater*.
12. Microbiological examination of water portability by (i) MPN method (ii) Membrane filter method – **(DEMO)** *.
13. Microbial sampling of air– **(DEMO)** *.
14. Population assay of extra cellular enzyme activities (amylase, cellulose and lipase).
15. Microbial flora from different soil types – population study*.
16. Isolation of *Rhizobium* from root nodules*.
17. Study of Mycorrhizae in roots of crop plants*.
18. Isolation of *Azotobacter* and *Azospirilium*from soil samples*.
19. AzollaProduction –**(DEMO).***
20. VermicompostProduciton **-(DEMO).***

21. Plant diseases: Tobacco mosaic, bacterial blight, powdery mildew and citrus canker*.
22. Isolation and testing of antagonistic microorganisms from soil.

* Effective learning could be made possible by arranging Field / Industrial visits and Training programmes.

LABORATORY MANUALS RECOMMENDED:

1. Cappuccino. J.G., and Sherman. N. (1996). Microbiology – Laboratory Manual. Benjamin Cummins. New York.
2. Kannan. N (1996), Laboratory Manual in General Microbiology. Palani Paramount Publication, Palani.
3. Gunasekaran. P. (1996). Laboratory Manual in Microbiology. New Age International Ltd., Publishers, New Delhi.
4. Sundararaj, T. (2005), Microbiology – Laboratory Manual. (1st Edition), PubinSundararaj. A, Chennai.
5. Jayaraman, J. (1985) Laboratory Manual in Biochemistry. Willey Eastern Ltd., New Delhi.
6. Plummer D.T. (1998). An introduction to Practical Biochemistry Tata McGraw Hill, NewDelhi.
7. Palanivelu.P. Analytical. Biochemistry and Separation Techniques.
8. Benson (2002). Microbiological Applications – Laboratory Manual in General Microbiology. International Edition, McGraw Hill Higher Education.
9. Collins, C.R. and Lyne. P.M. (1976). Microbiological Methods (4th edition), Butterworths, London.
10. Dubey. R.C. and Maheswari O.K. (2002). Practical Microbiology. S.Chand and Co Ltd., New Delhi.

FOOD MICROBIOLOGY

Preamble: Educating students about the relationship of foods with microbes and its positive and negative roles in food processing, production and preservation in order to keep/ produce safe foods needed for a healthy society.

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Unit: I Concept and scope of food microbiology

Concept and scope of food microbiology – Food composition – Types and microorganisms in food materials. (Bacteria, Mold, and Yeasts) – Factors influencing microbial growth in food. Extrinsic and intrinsic factors.(Nutrient content, p^H, buffering capacity, redox potential, relative humidity). (14 L)

Unit: II Contamination and its sources

Contamination and its sources.Spoilage of foods and its classification Principles of food preservation.(Temperature – Dehydration – Osmotic pressure – Chemicals – Radiation). Contamination, spoilage and preservation of Cereals – Vegetables – Fruits – Seafood's – Meat – Milk and poultry products. Canning and food additives. (14 L)

Unit: III Food borne infections

Food borne infections and intoxications of *Brucella*, *Bacillus*, *Clostridium*, *E. coli*, *Listeria*, *Salmonella*, *Shigella*, *Staphylococcus*, *Vibrio*, *Yersinia* – Fungal toxins. (10 L)

Unit: IV Fermented foods

Fermented foods – bread – Cheese – Vinegar – Dairy products – Oriental fermented foods – fermented beverages (Beer and Wine) –Genetically engineered foods. (10 L)

Unit: V Food produced by microbes

Food produced by microbes – Microbial cells as food – SCP (*Spirulina*and *Chlorella*) – Mushroom cultivation – Laboratory testing procedures – Food controlling agencies and its regulations (AGMARK, BIS, FDA, HACCP, ISO). Plant sanitations – Employees health and preventive measures. (12 L)

Textbooks recommended:

1. Adams, M.R. and Moses, M.O. (1995). Food Microbiology. The Royal Society of Chemistry, Cambridge.
2. Frazier, W.C. and Westhoff, D.C. (2008). Food Microbiology. (4th edition). Tata McGraw Hill Publishing Co Ltd., New Delhi.
3. Jay, J.M. (1987), Modern Food Microbiology. CBS Publishers and Distributors, New Delhi.
4. Atlas, R.M (1989). Microbiology. Fundamentals and Applications Macmillian Publishing Company.
5. Banwart, G.J. (1989). Basic Food Microbiology. Chapman & Hall New York.

REFERENCES:

1. Bernard D. Davis, Renato Dulbecco, Herman N. Eisen and Harold, S. Ginsberg. (1990). Microbiology. (4th Edition). J.B. Lippincott Company, New York.
2. Prescott LM., Harley J.P., and Klein D.A., (2008). Microbiology. (7th Edition). McGraw Hill, New York.
3. Larry Mc Kane and Judy Kandel (1996). Microbiology Essentials and Applications. (2nd Edition). McGraw – Hill Inc, New York.
4. Madigan M., T., (Martinko. J.M., and Parker J., Brock TO. (1997) Biology of Microorganisms. (8th Edition). Prentice Hall International Inc, London.
5. Nester, E.W., Roberts, C.V., and Nester, M.T. (1995). Microbiology – A Human Perspective. IWOA, U.S.A.

FERMENTATION AND INDUSTRIAL MICROBIOLOGY

Preamble: Displaying concepts, regular affairs, techniques involved in the production of microbial based industrial products among the interested students and to make them employable in industries or to convert them as an entrepreneur.

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Unit: I History and Scope

Concepts and historical development of Industrial microbiology.Industrial microbes & products.Growth and product formation in industrial process. Types of processing: upstream and down stream. Screening: primary and secondary. Preservation of microbes and its types. Strain improvement. Culture collection. Media: significance, types & components. Raw materials in industrial fermentation and its role: molasses, cellulose, corn steep liquor, soybean meal and malt extract. Industrial sterilization of equipment, production media and air. (14 L)

Unit: II Microbial growth kinetics

Microbial growth kinetics.Stages of fermentation. Scale up of fermentation. Inoculum development for large scale.Inoculum development and production media. Fermenter and bioreactor: Principle and factors involved in fermentor design. Basic components and functions of fermenter. (10 L)

Unit: III Fermenter types

Fermenter types: size: Lab, pilot scale & industrial fermentor, process: submerged and solid state. Nature: Continuous reactor, plug flow reactor, air-driven column reactors, bubble column , air lift bioreactor, fluidized bed reactor, tower fermentor and shake flask fermentor. Process control in fermentation: aeration, oxygen delivery system, foam control, temperature, pH, agitation and operation. Role of computer in process control.

(12 L)

Unit: IV Down stream processing

Down stream processing: Stages: Removal of insoluble, product isolation, purification and polishing technologies involved. An overview on the process, types limitations and applications of filtration, flocculation, sedimentation, gravity settling, cell disruption, centrifugation, solvent extraction, precipitation, membrane processing, whole broth processing, chromatography, drying, crystallization and lyophilization. (12 L)

Unit: V Industrial products produced by microorganisms

Industrial products produced by microorganisms. Enzymes (Amylase, protease), Organic acids (Vinegar). Solvent (Ethyl alcohol, butane diol). Amino acids (L- Lysine, L – Glutamic acid).Production of antibiotics (Penicillin, streptomycin).Vitamins (B_{12}).Beverages (Beer, wine). Yeast (Baker's, brewer and food and feed yeast production). Immobilization: principle, types, significance and applications. (12 L)

TEXTBOOKS RECOMMENDED:

1. Reed.G. (Editor), Industrial Microbiology, CBS Publishers, AVI Publishing Company.
2. Demain. A.L., and Soloman N.A. (1986). Manual of IndustrialMicrobiology and Biotechnology.
3. Hershnergy. CL.Queener. S.W. and Hegeman. Q Genetics and Biotechnology of Industrial Micoorganisms. ASM Press. USA.
4. Stanbury, P.F.A., Whitaker and .Hal. S.J. (1995). Principles of Fermentation Technology. (2^{nd} Edition). Pergamon, U.K.
5. Casida. L.E (1989). Industrial Microbiology. Willey Eastern Limited, New Delhi.

REFERENCES:

1. Prescott L.M., Harley J.P., and Klein D.A (2008). Microbiology. (7^{th} Edition). McGraw Hill, New York.
2. Larry Mc Kane and Judy Kandel (1996). Microbiology – Essentials and Applications. (2^{nd} Edition). McGraw-Hill Inc, New York.
3. Madigan M., T martinko. J.M., and Parker J., Brock T.D. (1997). Biology of Microorganisms. (8^{th} Edition). Prentice Hall International Inc, London.
4. Nester, E.W., Roberts, C.V., and Nester, M.T.(1995). Microbiology -A Human Perspective. IWOA, U.S.A.
5. Salle, A.J. (1996). Fundamental Principles of Bacteriology. (7^{th} Edition). Tata McGraw Hill Publishing Company Ltd, New Delhi.

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BIOTECHNOLOGY

Preamble: Portraying history, tools, techniques and applications of biotechnology among interested students to understand their importance and its scope in research and generation of employment.

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Unit: I Basic tools

Definition, Concepts – History of biotechnology – Basic tools and techniques of rDNA Technology – Restriction enzymes Types I, II, and III – Modifying enzymes – Ligases – Isoshizomers – Isolation of fragments with cohesive end and blunt end – Homopolymer tailing – Isolation of nucleic acids, DNA sequencing – Maxmam Gilbert – Dideoxy and automation methods – PCR-Southern and northern blotting – DNA finger printing – RFLP – RAPD – AFLP and QTLS. (14 L)

Unit: II Cloning vectors

Cloning vectors – Derived bacterial plasmid vectors – Properties – Isolation – Special Vectors – Phage vectors – Cosmids, phasmids, M_{13} and Mu phage – Yeast cloning vectors. (10 L)

Unit: IIIScreening procedures

Screening procedures – Cloning strategies – DNA hybridization, immunological assay, protein activity –Isolation of cloned genes – Gene libraries – Identification of recombinants, structural and functional analysis of recombinants in bacteria and yeast. (12 L)

Unit: IV Transgenic plants

Application of recombinant DNA technology – Genetic engineering of plants – Plant transformation, Ti plasmids, derived vectors. Physical methods of gene transfer in plants – Reporter genes in transformed cells. Developing plant strains by genetic

engineering – insecticide – herbicide – viral resistant plants – Stress and senescence tolerance – flower pigmentation – plant products. (12 L)

Unit: V Transgenic animals

Transgenic animals – Transgenic mice, methodology – Direct gene transfer – Retroviral vector transfer – EEE method and application – Development and use of transgenic cattle sheep, goat, pigs, birds and fish. (12 L)

TEXTBOOKS RECOMMENDED:

1. Brown. T.A (1999). Gene Cloning. (3rd Edition). Chapman and Hall publications, USA.
2. Mariappan C. A text book of molecular biotechnology. Pooja Publishers India .
3. Gerhardt, P., Murray, R.G., Wood W.A., and Kreig, N.R. (1994)Methods for General and Molecular Bacteriology. ASM Press, Washington D.C.
4. Glick, B.R. and Pasternak, J.J. (1998) – Molecular BiotechnologyPrinciples and applications of Recombinant DNA. ASM Press, Washington D.C.
5. Murray Moo Young (1992). Plant Biotechnology. Pergamon Press.

REFERENCES:

1. Desmona.S.T.,Nicholl. (19.94). An Introduction to Genetic Engineering Cambridge Press.
2. Anand Solomon. K.(2008). Molecular Modeling' and Drug. Design. MJP Publishers, Chennai.
3. Susa R. Barnum (2002) Monoclonal Antibodies. MJP Publishers, Chennai.
4. Nisonoff.A(1985). Introduction to Molecular (1) munology. (2nd Edition Sundarland, Mass.)
5. Zaltin. M., Day. P and Hollaender A. (1983). Biotechnology in Plant Sciences Relevant to Agriculture, Academic Press. London.

MSU / 2017-18 / PG –Colleges / M.Sc.(Microbiology / Semester -IV / Ppr.no.22 / Project

PROJECT

Preamble: To address and assess the diverse problems associated with various fields relevant to microbes through the techniques learnt to design managerial measures for a healthy environment.

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To plan and design an appropriate viable project and statistically apply the data wherever possible and process it accordingly after the correct retrieval of relevant literature and fixation of an organized plan of work. The research project should be supported with figures, tabulations, plates and photographs along with necessitated bibliography.

The project work may be done either in the department itself or in collaboration with any other organization of advanced learning including educational institutions, research centres, Industries, NGO's with research background, etc., without affecting their regular academic affairs.

The final project report should be submitted to the head of the course department 15 days before the university prescribed date. The project report shall contain atleast 35 pages excluding bibliography and appendices. Each student will have to submit THREE copies of his / her project for evaluation in the fourth semester itself.

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PRACTICAL – VII

Preamble: Exposing students exhibiting passion over teaching, research and jobs in industries to basics and routine experiments carried out in diverse areas pertaining to their theory background so as to improve their experimental skills, reliability and effectiveness needed for effective research and employment.

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1. Basic aspects of AGMARK, BIS, FSSAI and HACCP.
2. Basics aspects of Microbial Culture Collection Centers.
3. Standard plate count of milk*.
4. Microbiological examination of milk*.
   i) Methylene blue reduction test
   ii) Rezaurin test
   iii) Phosphatase test
5. Microbiology of fermented milk products*.
   i) Curd*
6. Microbiological analysis of foods*.
   i) Soft drinks
   ii) Meat and fish
   iii) Fruits and Vegetables
   iv) Salted and dried foods
   v) Bread
7. Production of enzymes by batch fermentation (Protease and Amylase).
8. Purification of extracellular enzymes.

I. Enzyme precipitation – Ammonium sulphate and Acetone.

II. Dialysis of crude enzymes.

III. Ion-exchange chromatography – **(DEMO)**.

9. Enzymes and Whole cell Immobilization*.
10. Fermentative production of ethyl alcohol by yeast*.
11. Wine production – **(DEMO)***.
12. Solid-state fermentation – Mushroom Production – **(DEMO)***.
13. Spirulina Production – **(DEMO)***.
14. Production – extraction and purification of any antibiotic **(DEMO)***.
15. Preparation of fermented product-yogurt from milk*.

*Effective learning could be made possible by arranging Field / Industrial visits and Training programmes.

LABORATORY MANUALS RECOMMENDED:

1. Cappuccino.J.C:7 and Sherman. N. (196). Microbiology – Laboratory Manual. Benjamin Cummins, New York
2. Kannan. N. (1996). Laboratory manual in General Microbiology. Palani Paramount Publication, Palani.
3. Gunasekharan. P. (1996). Laboratory manual in Microbiology, New Age International Ltd., Publishers, New Delhi.
4. Sundararaj, T. (2005). Microbiology – laboratory manual. (1^{st} edition). Pubinj. Sundararaj. T, Chennai
5. Jayaraman, J. (1985). Laboratory manual in Biochemistry. Wiley Eastern Ltd, New Delhi.
6. Plummer, D.T. (1998). An Introduction to practical Biochemistry. Tata McGraw Hill, New Delhi.
7. Palanivelu P. (2001). Analytical Biochemistry and Separation techniques – A Laboratory Manual.
8. Benson (2002). Microbiological applications – Laboratory Manual in General Microbiology. International edition. McGraw Hill Higher education.
9. Collins, C.R. and Lyne P.M. (1976). Microbiological methods (4^{th}- edition). Butterwoths, London.
10. Dubey, R.C. and Maheshwari, O.K., (2002). Practical Microbiology. S. Chand and Co Ltd., New Delhi.

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PRACTICAL – VIII

Preamble: Exposing students exhibiting passion over teaching, research and jobs in industries to basics and routine experiments carried out in diverse areas pertaining to their theory background so as to improve their experimental skills, reliability and effectiveness needed for effective research and employment.

L T P C

0 0 7 4

1. Restriction enzyme Digestion with Labeled DNA – Lambda phage DNA **(DEMO)**.
2. PCR **(DEMO)**.*.
3. Primer Designing**(DEMO)**.*.
4. Blue white selection with IPTG – **(DEMO)***
5. Cloning by desired vector – pBR_{322} – **(DEMO)***
6. Preparation of plant tissue culture media **(DEMO)**
7. Callus induction **(DEMO)***
8. Shoot tip culture **(DEMO)***
9. Isolation of protoplast
10. Isolation of protoplast by enzymatic method
11. Preparation of media for animal cell culture**(DEMO)***
12. Preparation of serum.

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3. Gunasekharan. P. (1996). Laboratory manual in Microbiology, New Age International Ltd., Publishers, New Delhi.
4. Sundararaj, T. (2005). Microbiology – laboratory manual. (1st edition). Pubinj. Sundararaj. T, Chennai
5. Jayaraman, J. (1985). Laboratory manual in Biochemistry. Wiley Eastern Ltd, New Delhi.
6. Plummer, D.T. (1998). An Introduction to practical Biochemistry. Tata McGraw Hill, New Delhi.
7. Palanivelu P. (2001). Analytical Biochemistry and Separation techniques – A Laboratory Manual.
8. Benson (2002). Microbiological applications – Laboratory Manual in General Microbiology. International edition. McGraw Hill Higher education.
9. Collins, C.R. and Lyne P.M. (1976). Microbiological methods (4th- edition). Butterwoths, London.
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