

**A.V.V.M. SRI PUSHPAM COLLEGE (AUTONOMOUS), POONDI**

**Programme: M. Sc.**

**Department: Microbiology**

**Syllabus Revision 2017-2018**

<b>S.No.</b>	<b>Courses</b>	<b>Number of courses having changes</b>
1.	Core Course	08
2.	Elective Course	01
	<b>TOTAL</b>	09

Total Number of Courses : 23

Total Number of Courses having changes : 09

Percentage of Revision : 39.1 %

**Note:**

The content of the syllabus which has been revised is highlighted.

### M.Sc., MICROBIOLOGY (2017 – 2018)

Sl. No.	SEM	Category	Paper Code	Title of the Paper	Maximum Marks			Minimum Marks of Pass			Hours Week	Credits
					CIA	E.E	Total	CIA	E.E	Total		
1	I	Core I	17P1MBC1	General Microbiology	25	75	100	10	30	50	6	4
2		Core II	17P1MBC2	Biological Macromolecules	25	75	100	10	30	50	6	4
3		Core III	17P1MBC3	Food and Agricultural Microbiology	25	75	100	10	30	50	6	4
4		Core PL	17P1MBCP1	Practical - I	40	60	100	16	24	50	6	5
5		Major Elective -I	17P1MBEL1A 17P1MBEL1B	Bioinoculant Technology Seed Pathology	25	75	100	10	30	50	6	4
6	II	Core I	17P2MBC4	Microbial Physiology	25	75	100	10	30	50	5	4
7		Core II	17P2MBC5	Environmental Microbiology	25	75	100	10	30	50	5	4
8		Core III	17P2MBC6	Recombinant DNA Technology	25	75	100	10	30	50	5	4
9		Core IV	17P2MBC7	Marine Microbiology	25	75	100	10	30	50	5	4
10		Core PL	17P2MBCP2	Practical – II	40	60	100	16	24	50	5	5
11		Major Elective –II	17P2MBEL2A 17P2MBEL2B	Microbial Nanotechnology Soil Biology	25	75	100	10	30	50	5	4
12	III	Core I	17P3MBC8	Medical Microbiology	25	75	100	10	30	50	5	4
13		Core II	17P3MBC9	Immunology	25	75	100	10	30	50	5	4
14		Core III	17P3MBC10	Microbial Genetics and Molecular Biology	25	75	100	10	30	50	5	4
15		Core IV	17P3MBC11	Fundamental of Biological sciences	25	75	100	10	30	50	5	4
16		Core PL	17P3MBCP3	Practical - III	40	60	100	16	24	50	5	5
17		EDC	17P3MBEDC	Mushroom Technology	25	75	100	10	30	50	4	-
			Communicative Skill and Personality Development								1	
18	IV	Core I	17P4MBC12	Research Methodology	25	75	100	10	30	50	6	4
19		Core II	17P4MBC13	Microbial Biotechnology	25	75	100	10	30	50	6	4
20		Core PL	17P4MBCP4	Practical - IV	40	60	100	16	24	50	5	5
21		Major Elective-III	17P4MBEL3A 17P4MBEL3B	Biodiversity and Conservation Management Bioinformatics	25	75	100	10	30	50	6	4
22		Project	17P4MBPR	Project Work	40	60	100	16	24	50	1	4
23		CN	17P4MBCN	Comprehension	-	100	100	-	-	50	5	2
			Communicative Skill and Personality Development			-	-	-	-	-	1	
			<b>Total</b>			<b>2300</b>					<b>120</b>	<b>90</b>

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
I	17P1MBC1	General Microbiology	6	4

**Objectives:**

- ❖ To enable the students to know the general principles of microbiology.
- ❖ To enable the students to know the general characters and classification of microbes.
- ❖ To enable the students to know the important features of cyanobacteria and fungi.
- ❖ To enable the students to know the life cycle of virus.
- ❖ To know about the extremophiles

**Unit I**

History and scope of microbiology – Principles and applications of bright field, dark field, phase contrast, fluorescence, TEM and SEM electron microscope – General features of prokaryotic and eukaryotic microorganisms – bacteria, microalgae, fungi, actinomycetes, protozoa, mycoplasma, Rickettsiae, chlamydiae, prions

**Unit II**

Bergey's Manual of Determinative Bacteriology, 1994 – microbes growing in extreme environments – acidophilic, alkalophilic, thermophilic, barophilic and halophilic – general characters of the following family – Spirochaetaceae, Enterobacteriaceae, Streptococcaceae, Staphylococcaceae and Vibrionaceae.

**Unit III**

Virology – History–General characters, classification. LHT system, multiplication – bacteriophage – structure and its cycles of phage lambda, T4 phage, Ø X 174 phage, virsoids, satellite RNA.

**Unit IV**

Structure and life cycles of the following – Animal virus and DNA virus – Hepatitis – B, Herpes simplex virus – Adeno virus – Pox viruses – RNA virus, Retrovirus, Rhabdo virus, HIV, Influenza – *Chikungunya*, Dengu – Oncogenic viruses – Antiviral therapy – plant virus – TMV, CaMV – Transmission and control.

**Unit V**

Preservation of microbes – culture collection centre – fossil microorganisms. Identification of microbes – physiological characteristics, microbial identification system (MIS)–fatty acid, 16s rRNA sequence homology, RAPD and RFLP.

**Books for Reference**

- Dubey, R.C. and Maheswari, D.K., (2003). A text book by Microbiology. S. Chand and Company Ltd., New Delhi.
- Stanier *et al.*, (1994). General Microbiology, MacMillan Education Ltd., London.
- Prescott, L.M., Harley, J.P. and Klein, B.V., (2007). Microbiology, VI Ed., W.M.C. Brown Publishers IOWA, U.S.A.
- Powar and Dagainawala, (1992). General Microbiology, Vol. I. Himalaya Publishing House, New Delhi.
- Powar and Dagainawala, (1992). General Microbiology, Vol. II. Himalaya Publishing House, New Delhi.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
II	17P2MBC6	r DNA technology	5	4

**Objectives:**

To enable the students

- ❖ To know the modern concepts of microbial biotechnology.
- ❖ To learn genetic engineering, application, cloning strategies, gene libraries DNA cloning, database collection and bioinformatics.
- ❖ To understand the microbes and their applications in enzyme technology.

**Unit I**

Vectors – Plasmids, cosmids, phagemids, phasmids, expression vectors, shuttle vectors and artificial chromosomes (BAC & YAC). Cloning strategies – Isolation of desired gene. Basis steps in gene cloning methods.

**Unit II**

Blotting techniques – Southern, Northern and Western, Dot blotting, Colony and Plaque plating. PCR – Types and Applications. Chromosomes Walking. and jumping. cDNA Libraries and genomic libraries. DNA finger printing. Enzymes involved in genetic engineering properties of enzymes, methods of enzyme production and application. Transgenic animals, transgenic fish, transgenic plants, gene therapy, Gene silencing

**Unit III**

Genomics – definition. Whole genome analysis. Automated sequences – Physical methods of sequencing – Maxam and Gilbert and Sangers method. DNA micro arrays and microchips. Proteomics – definitions, multidimensional protein identification technology.

**Unit IV**

Protein engineering – enhancement of enzymes activity modifying specificity methods of addition of disulphide bonds – amino acid substitutions – substitutions reducing free sulphhydryl residues – site directed, evolutionary mutagenesis and DNA shuffling – uses of engineering proteins advantage of protein engineering .

**Unit V**

Biosafety – Introduction – Containment – physical and Biological, Recognition of facility competent authority – Large scale Experiments and manufacture Biological Produced by r DNA technology. Release to environments & field. Genetic engineering approval committee (GEAC) Good Laboratory Practices (GLPs)

**Books for Reference**

- Old, R.W. and Primose, S.B., (1987). Principles of Gene Manipulation, Blackwell Scientific Publications, Oxford, U.K.
- Satyanarayana, U., (2005). Biotechnology, Books and Allied Private Limited, 1<sup>st</sup> Edition, Kolkata.

Semester	Subject Code	Title of the Paper	Hours of Teaching /Weeks	No. of Credits
<b>II</b>	<b>17P2MBC7</b>	<b>Marine Microbiology</b>	<b>5</b>	<b>4</b>

**Objectives:**

- ❖ To know the various microbes of marine
- ❖ To learn the novel bioactive compounds
- ❖ To know the various metabolic activity of marine microbes.

**Unit I**

Marine Microbial diversity Marine environment – see benthic & littoral zone, salt pan, mangroves and estuarine microbes loop – marine microbial community – planktons, bacteria, fungi, protozoa.

**Unit II**

Marine Microbial Disease Marine food borne pathogens – Aeromonas, Vibrio, Salmonella, Pseudomonas, Corynebacter.

**Unit III**

Marine Microbial biotechnology production and application of marine microbial products – pigments –Astaxanthin B carotene –enzyme – antibiotics – polysaccharide- sea food preservation methods

**Unit IV**

Seafood microbiology – normal general associated with fish food spoilage, fish and human pathogens :Indicator of pollution – faecal coliforme , prevention and control.

**Unit V**

Methods of studying the marine microorganism, methods of collection enumeration (total and viral count Microbial nutrition – influence of environment factors on microbial growth, activity and distribution preservation of marine microbes.

**Books for Reference**

- Prescott, L.M Harley J.P Klein (1999) Microbiology WCB, Mc Grow Hill Publication
- Rain M. Maier Ian
- L. Pepper, Charles P. Gerba (2006) Environmental Micrology, Academic Press.
- James W. Nybakker (2001). Marine Biology Benjamin Cummings
- Shimshon Belkin and Rita
- R. Colwell (2005) Ocean and health : Pathogens in the marine environment. Springer.
- Scheper, T. (2005) Advances in Biochemical Engineering / Biotechnology – Marine Biotechnology
- I. Springer Bhaakuni, D.S. and Rawat D.S. (2005). Bioactive marine natural products.

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
II	17P2MBCP2	Core – PL – Microbial Physiology, Environmental Microbiology, Recombinant DNA Technology and Marine Biotechnology	5	5

**Objectives:**

- ❖ To know about the production of enzymes by microbes.
- ❖ To estimate the various biochemical parameters in microbes.
- ❖ To isolate, plasmids, chromosomal DNA.
- ❖ To know the separation and quantification of nucleic acids.
- ❖ To isolate resistant mutants.
- ❖ To know about water and soil analysis

**Microbial Physiology**

Indole production.  
Methyl red and Voges-Proskauer test.  
Citrate utilization test.  
Casein hydrolysis.  
Urease test.  
Hydrogen sulphide production test.  
Catalase test.  
Triple sugar iron test  
Oxidase test  
Lipid hydrolysis  
Effect of pH on growth  
Effect of temperature on growth  
Carbohydrate fermentation test  
Coagulase test  
Amylase Production test  
Estimation of glycogen.  
Estimation of protein (Lowry's method).  
Estimation of sugar (Anthrone method).

**Environmental microbiology**

Microorganisms in Air.  
MPN technique  
Water Analysis  
a) Alkalinity of Water  
b) Total Carbondioxide  
c) Chloride  
d) Dissolved Oxygen  
e) Biological Oxygen demand  
f) Chemical Oxygen demand  
g) Total hardness  
4. Soil Analysis  
h. Moisture  
i) pH  
j) Estimation of Organic Carbon

**Recombinant DNA Technology**

Plasimd DNA isolation from E.coli.  
Agarose gel electrophoresis technique  
Visualization of protein by SDS PAGE.

**Marine Microbiology**

Isolation and enumeration of microorganisms from marine soils.  
Isolation and microorganisms from salt pan  
Isolation of planktons  
Isolation of microorganisms from polluted environment.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Weeks	No. of Credits
III	17P3MBC11	Fundamental of Biological Sciences	5	4

**Objectives:**

- ❖ To enable the students to understand the basic knowledge in Biological Sciences
- ❖ To understand different life cycle patterns of plants and animals
- ❖ To know the structure and reproductive behaviour of organisms

**Unit I**

Algae and Fungi Thallophytes: Algae-General characteristics- Economic importance- Types of life cycle- Outline of various classifications. Fungi: General characteristics Classifications and Economic importance

**Unit II**

Plant reproduction General characteristics- Economic importance and outline of reproduction methods in Bryophytes, Pteridophytes and Gymnosperms

**Unit III**

Plants Basics of plant cell – Monocot and dicot - Classification of plant diversity – Classes of plant kingdom- Morphology: Inflorescence types -Racemose, cymose, and Mixed –Special types, Cyathium, Hypanthodium, Verticillaster and Thyrsus. Technical description of flower and floral diagram- Microsporangium and structure of Polygonum type embryo sac- Taxonomy: Systems of classification, (Artificial, Phylogenetic and Natural). Outline of Bentham and Hooker's classification.

**Unit IV**

Invertebrates General characteristics and outline classification upto classes in Protozoa, Porifera, coelenterata, Platyhelminthes and Ashelminthes; Economic importance of invertebrates. Classification of Chordata – Characteristic features - protochordata class – Pisces and Amphibia up to orders - General characters - a brief study on Star fish.

**Unit V**

Vertebrates and pests control Salient features of Reptilia, Aves and Mammalia- Economic importance of Vertebrates. Bioluminescence. Insect pests of rice, sugarcane, coconut, cotton, vegetables, fruits and stored products (with an example of each). Principles of insect control: physical, mechanical, chemical, biological and integrated methods of pest control.

**Books for Reference**

- Arumugam N. Invertebrate Zoology, Saras publication, Nagercoil.2002.
- Ekambaranatha Iyar M and Ananthakrishnan TN. Manual of Zoology. Vol. I. part I and II, S. Visvanathan publication, Chennai.1994.
- Ayyar EK and Ananthakrishnan. A Manual of Zoology, Vol. II (Chordata).1992.
- Ekambaranatha Iyar M and Ananthakrishnan TN. Manual of Zoology Vol.II. S. Visvanathan publication, Chennai.1994.
- Ranganathan TN.Chordata Zoology, Rainbow printers, Palayamkottai.1996.
- Ekambaranatha Ayyar. Outlines of Zoology. Vols. I and II S. Viswanathan (Printers and Publishers) Pvt. Ltd., Chennai.1993.
- Kotpal RL. Invertebrata, Rastogi Publication, Meerut.2000.
- Jordan EL and Verma PS. Invertebrate Zoology, 12th Edition, S. Chand and Co.1995.
- Mani MS. General Entomology, Oxford and IBH publishing Co., New Delhi. 1982.
- Nayar KK, Ananthankrishnan TN and David M. General and applied Entomology, Tata McGraw Hill Pub. Co., Ltd., New York. 1995.
- David BV. Pest Management and pesticides Indian Scenario, Namrutha Publications.1992.
- Krishnan NT. Economic Entomology, J.J. Publications, Madurai. 1993.



Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
III	17P3MBCP3	Core – PL – Medical Microbiology, Immunology and Microbial Genetics & Molecular Biology	5	5

**Objectives:**

- ❖ To identify the normal flora of human body.
- ❖ To estimate various properties in urine, blood etc.,
- ❖ To perform various tests for disease confirmation.
- ❖ To learn about mutant and isolation
- ❖ To learn the bacterial transformation

**Medical Microbiology and Immunology**

**Hrs 60**

- Isolation of bacteria from skin
- Isolation of bacteria from urine
- Identification of *E.coli*
- Estimation of urine – bile salt and albumin
- Determination of total count of blood cells – WBC, RBC, Differential count.
- Haemoglobin estimation
- Estimation of glucose in serum (ortho toluidine method)
- Widal test (Typhoid fever)
- Determination of ABO blood group
- Determination of Rh blood group
- ELISA technique
- Immuno diffusion - double
- Antibiotic Sensitivity test

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**Microbial Genetics and Molecular Biology**

- Bacterial conjugation
- Bacterial transformation
- Isolation of mutants by gradient plate techniques
- Separation of protein by SDS-PAGE
- Isolation of lactose (Lac) mutants of *E.coli*
- Separation of Isozymes by native gel electrophoresis.

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
IV	17P4MBC13	Microbial Biotechnology	6	4

**Objectives:**

- ❖ To know the principles of microbial fermentation and screening of industrially important strains.
- ❖ To know the fermentor – its types and their uses in the production of various enzymes and products.
- ❖ To learn about the fermentation products and the role of microbes involved.
- ❖ To understand the IPR and industrial management practices.
- ❖ Industrial visit is compulsory Regional /National / International level for a period of 5 days.

**Unit I**

Principles of Microbial fermentation – Principles and types of Screening. Types of Immobilization and its application. Industrial Management and management practices .

**Unit II**

**Upstream processing-** Fermentors – Types – Design and Operations – continuous parameters, sampling systems – Chemostat, Turbidostat. Containment process – Mechanism of foam fermentations and foam breaking. Computerized control system - Biosensor.

**Unit III**

Downstream processing – Precipitation, filtration, centrifugation, cell disruption, liquid - liquid extraction, chromatography, whole broth processing.

**Unit IV**

Biotechnology products from rDNA technology - Primary and secondary - penicillin, ethanol, vitamin B<sub>12</sub>, citric acid, amylase, rabies vaccine, insulin, Interferon and SCP, **Biofuels, Detergents, Enzymes – protease, lipase.**

**Unit V**

Patent laws and legal protection; Indian and International patent laws - patent microbes and their products. Intellectual Property Rights (IPR). culture collection and maintenance of important industrial strains.

**Books for Reference**

- Agarwal, (2006). Industrial Microbiology: Fundamental and Application, M/S, IBD Publishers and Distributors, New Delhi.
- Patel, A.H., (2003). Industrial Microbiology, Mac Millan.
- Stanley, P.F.A., Whittaker and Hall, S.J., (1995). Principles of Fermentation Technology.
- Alexander, N., Glazer and Hisorshi Nikaido, (1994). Microbial Biotechnology, Fundamentals and Applied Microbiology, W.H. Freeman and Co., New York.
- Rajak, 2005. Microbial Biotechnology for Sustainable Development and Productivity, M/S. IBD Publishers and Distributors, New Delhi.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
IV	17P4MBCP4	Core – PL – Research Methodology and Microbial Biotechnology	5	5

#### **Research Methodology**

- Preparation of Index cards
  - Citations of References in the text and reference section
  - Proof Correction
  - Preparation of Standard graph – Glucose and Protein
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#### **Microbial Biotechnology**

- Immobilization of yeast cells by using sodium alginate
- Isolation of amylase producer and amylase assay.
- Production of citric acid
- Cultivation of edible mushrooms – Preparation of spawn and mushroom bed.
- Isolation of cellulose, production and characterization
- Production of bioethanol and its estimation
- Wine production
- Characterization of wild yeast and test its ethanol producing ability.
- Production and quantification of enzymes – Amylase, cellulase, protease and lipase.

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
IV	17P4MBEL3B	Major Elective – III Bioinformatics	6	4

**Aims and Objectives:**

- ❖ This subject was initiated with an aim to have basic knowledge in computer operating. Nowadays it is necessary to go to the websites and internet for future research work.

**Unit I**

Narration of Computer: Input / Output and Storage Devices – keyboard, Mouse, Scanner, touch screen, Barcode, Microphone, Monitor, Speaker, Printer, RAM, ROM. Hard disk, CD, DVD, Floppy Disk etc. ; Operating System – DOS, Windows, UNIX, LINUX; Internet Perception – Internet Service Providers, WWW, Search Engines, Search Techniques; Finding Scientific articles – Pubmed, Highwire, Press, Plos.

**Unit II**

Biological databases and its types – Sequence, Mapping, Information retrieval from biological databases and Genomic data bases. **Data bank, Information analysis centers ,Referral centers, Translation centers.**

**Unit III**

Sequence alignments pairwise and multiple alignment– local, Global, dot plot, dynamic. Matrix – BLOSUM, PAM, multiple alignment – Clustal W.

**Unit IV**

Analysis of nucleotides–restriction mapping, primer synthesis, ORF prediction. Phylogenetic analysis–Neighbour-Joining, Maximum parsimony, minimum likelihood, rooted and unrooted.

**Unit V**

Analysis of protein level – signature, profiles and motifs, Secondary structure prediction, SWISS Model, Visualization of protein structure: RASMOL, SWISS PDB. **Inferring Data relationships – BLAST services – blastp, blastx, PSI, PHI - FASTA.**

**Books for Reference**

- Cynthia Gibas and Per Jambeck, (2001). Developing Bioinformatics Computer Skills: Shroff Publishers and Distributors Pvt. Ltd (O'Reilly), Mumbai.
- Rashidi, H.H. and Buehier, L.K., (2002). Bioinformatics Basics: Applications in Biological Science and Medicine, CRC Press, London.
- Des Higgins and Willie Taylor (2002). Bioinformatics: Sequence, structure and databanks, Oxford University Press.
- Baxeavains, A.D. and Ouellette, B.E.F., (2001). Bioinformatics: A practical guide to the analysis of genes and protiens, Wiley Interscience – New York.
- Arora, P.N. and Malhon, P.K., (1996). Biostatistics Himalaya Publishing House, Mumbai.
- Sokal and Rohif (1973). Introduction to Biostatistics, Toppan Co. Japan.
- Stanton, A. and Glantz (2012), Primer of Biostatistics - The McGraw Hill Inc., New York.