

DEPARTMENT OF MICROBIOLOGY - M.Sc MICROBIOLOGY (2017-18)

SEMESTER	SUB CODE	COURSE TITLE	HOURS	CREDITS
I	17P1RMC1	Microbial taxonomy	6	5
	17P1RMC2	Biochemistry	6	5
	17P1RMC3	Cell & Molecular Biology	6	5
	17P1RMP1	Lab in Biochemistry	6	3
	17P1RMP2	Lab in Molecular Biology	6	3

II	17P2RMC4	Microbial Physiology	6	5
	17P2RMC5	Microbial Genetics	6	5
	17P2RMC6	Medical Microbiology	6	5
	17P2RMP3	Lab in Microbial Genetics	6	3
	17P2RMP4	Lab in Medical Microbiology	6	3

III	17P3RMC7	Applied Microbiology	7	6
	17P3RMC8	Bioinformatics & Biostatistics	7	6
	17P3RNM1	NME – Microbial World	4	4
	17P3RMP5	Lab in Applied Microbiology	6	3
	17P3RMP6	Lab in Bioinformatics	6	3

IV	17P4RMC9	Microbial Biotechnology	6	5
	17P4RMC10	Genomics and Proteomics	6	5
	17P4RMP7	Lab in Genomics & Biotechnology	6	3
	17P4RPR1	Project	12	9

Marks Detail

Theory Paper	-	Internal 25 Marks	-	100 = 11x100 = 1100
	-	External 75 Marks		
Practical	-	Internal 50 Marks	-	100 = 7x100 = 700
	-	External 50 Marks		
Project	-	Internal 100 Marks	-	200 = 200
	-	External 100 Marks		

Total Marks 2000

Course code	Course title	C	H	I	E	T
17P1RMC1	MICROBIAL TAXONOMY	5	6	25	75	100

Unit I

Evolution of life on earth, history and diversity of microorganism. Principles of Classification of Taxonomy of Eubacteria(Bacteria and Archaea): Major characteristics used in taxonomy: Cultural, Morphological, Biochemical, Physiological, Genetic and Molecular Characteristics; Numerical Taxonomy (Taxometrics) and Chemotaxonomy. Assessing Microbial Phylogeny: Chronometers. Phylogenetic trees, r-RNA, DNA and proteins as indicators of phylogeny.

Unit II

Ultra structure of Prokaryotic and Eukaryotic cells, *E.coli*, *Bacillus subtilis*, *Saccharomyces cerevisiae*, *Aspergillus sps*, *Nostoc*, *Chlorella*. Structure and functions of Bacterial cell wall, Gram positive, Gram negative, Mycoplasma, Archaeabacterial cell wall, slime layer, capsule, pili, flagella- ultrastructure, other inclusions bodies. Structure and signification and bacterial endospores. Endospores formation in *Bacillus*.

Unit III

Classification (up to class level), Structure and life cycle of Fungi. Ascomycetes (*Aspergillus*), Deuteromycetes (*Candida*), Zygomycetes (*Mucor*), Basidiomycetes (*Agaricus*).

Unit IV

Structure and classification of Algal cells – reproduction and chacteristics, Chlorophyta (*Chlorella*) Chrysophyta (*Diatoms*), Rhodophyta (*Gracillaria*), *Spirulina*, BGA.

Unit V

Classification of Viruses. Bacteriophage – general characteristics, morphology, classification, reproduction and nomenclature. Structure and architecture of viruses animal(Pox, Adeno, Influenza), Plant (TMV,CMV), Mycophage and Cyanophage.

Text Book (s):

1. Pelczar Jr. M.J. Chan. E.C.S and Kreig. N.R (2006). "Microbiology"- 5th Edition Mc Graw Hill Inc. New York.
2. David, B.D., Delbecco,. R., Eisen, H.N and Ginsburg, H.S (1990) "Microbiology" 5th Edition. Harper & Row, New York.

Reference Books :

1. Lansing M. Prescott., John. P. Harley., Donald A, Klein, (2005)"Microbiology"-Mc Graw Hill Inc. New York.
2. Robert F.Boyd., (1991)"General Microbiology" 2nd Edition., Times MIRROR/Moshy College Publishing Virginia.

Course code	Course title	C	H	I	E	T
17P1RMC2	BIOCHEMISTRY	5	6	25	75	100

Unit I Bioenergetics

Entropy, enthalpy, free energy, ATP – its role in metabolism, other energy rich compounds, oxidation- reduction reactions. Definition, classification and properties of enzymes. Mechanism of enzyme action- Lock and key mechanism, induced fit theory. Factors affecting enzyme activity: pH, temperature and substrate concentration. Michaelis- Menton equation. Enzyme inhibition: competitive, uncompetitive and non competitive. Biological functions of enzymes.

Unit II Carbohydrates

Definition and classification of Carbohydrates, linear and ring forms (Haworth formula) for Monosaccharides for Glucose and Fructose. Disaccharides – Sucrose and Lactose. Physical properties- mutarotation and Kiliani-Fischer synthesis. Chemical properties – Oxidation, reduction, osazone formation. Polysaccharide; Starch and Cellulose- occurrence, structure, physical and chemical properties.

Unit III Aminoacid

Definition and Classification of aminoacids, common properties of aminoacids, amphoteric nature, isoelectric point, isoelectric pH and zwitter ion. Proteins: Classification, physical properties and structure of protein- primary, secondary, tertiary and quaternary.

Unit IV Lipid

Definition, classification, physical, chemical and biological functions- simple lipids, tertiary compound lipids, derived lipids: steroids. Saturated fatty acids: Butyric and Stearic acid. Unsaturated fatty acids: linoleic and palmitic acid. Biosynthesis, β -oxidation of fatty acid.

Unit V Nucleic acid

Definition, nucleoside, nucleotide and polynucleotide. Double helical model of DNA and its biological functions. Structure of tRNA, mRNA and rRNA-occurrence, chemistry and its biological functions. Differences between DNA and RNA properties: cot curve and cot value, T_m , hypo and hyper chromicity.

Text Book (s):

1. Robert K. Murray, Daryl K. Grammer, (1990) -Harper's Biochemistry- McGraw Hill, Lange Medical Books. 25th edition.
2. J.L. Jain, Sanjay Jain, Nitin Jain, (2004)- Biochemistry-S. Chand & Co., Ltd.

Reference Books:

1. Lehninger (1970). Principles of Biochemistry-David L. Nelson, Michael M. Cox, Macmillan Worth Publishers.
2. David, B.D., Delbecco, R., Eisen, H.N and Ginsburg, H.S (1990) "Microbiology" 5th Edition. Harper & Row, New York.

PRACTICALS

1. Colorimetric determination of Complementary colours and its Wavelength.
2. Verification of Beer & Lambert's law
3. pH meter- principle and measurements and preparation of buffers.
4. Titration between strong acid and strong base.
5. Titration between amino acid and strong base.
6. Estimation of Carbohydrates (Glucose) by Anthrone method, Phenol sulphuric acid method.
7. Estimation of Carbohydrates (Glucose) by Phenol sulphuric acid method.
8. Estimation of Carbohydrates (Glucose) by DNS method.
9. Estimation of Proteins (Lowry's method)
10. Estimation of DNA by Diphenyl amine method.
11. Estimation of RNA by Orcinol method.
12. Separation of amino acids by paper chromatography.
13. Separation of amino acids by thin layer chromatography.
14. Separation of pigment by column chromatography.

Course code	Course title	C	H	I	E	T
17P1RMC3	CELL AND MOLECULAR BIOLOGY	5	6	25	75	100

Unit I

Composition of cells – Cell membrane ,Nucleus, Nucleolus, Endoplasmic Reticulum, Golgi apparatus, Lysosomes, Mitochondria, Chloroplast, Peroxisomes, Microtubules. Cell cycle-G1,G2,S and M phase. Meiotic cell division.

Unit II

Different forms of DNA-A, B and Z , Supercoiling of DNA ,DNA synthesis-DNA polymerase I,II and III, topoisomerase I and II. Properties of DNA. DNA replication – mechanism of DNA replication-types of DNA replication-conservative, semiconservative and dispersive-Q mode, D model, rolling circle model, Bi and uni directional , Enzymology of DNA replication.

Unit III

Transcription in prokaryotes-RNA polymerase structure-promoters-initiation, elongation, and termination. Transcription in eukaryotes-RNA polymerase-promoters-enhancers and silencers. Post transcriptional modifications.

Unit IV

Structure of t RNA, r RNA, m RNA-protein synthesis- initiation, elongation and termination. Protein folding, Post modifications .Genetic code, Wobble hypothesis.

Unit V

Mutation: Spontaneous and Induced types of mutation-physical mutagens and chemical mutagens. Light dependent and dark repair mechanism. Molecular Mechanisms: Site Directed Mutagenesis- Methods of directed mutagenesis.

Text Book (s):

1. Old, R.S. and Primrose, S.B. (1995) Principles of Gene manipulation. An introduction to Genetic Engineering. 5th Edition. Blackwell Scientific Publication, London.
2. Click. B.R. and-Pasternat J.J. (1994)Molecular Biotechnology. ASM press. Washington DC.

Reference Books:

1. Benjamin Lewin (1997) Genes VI, Oxford University Press.
2. David, B.D., Delbecco, R., Eisen, H.N and Ginsburg, H.S (1990) "Microbiology" 5th Edition. Harper & Row, New York.

PRACTICALS

1. Sterilization principle and methods-moist heat - dry heat and filtration methods.
2. Media preparation : Liquid media, solid media, Agar deep, Agar slants, Agar plates, Basal, enriched, selective media preparation - quality control of media, growth supporting properties, sterility check of media.
3. Pure culture technique : Streak plate, pour plate, spread plate, decimal dilution.
4. Motility demonstration : Hanging drop preparation, wet mount, dark field microscopy, semisolid agar, Craigies tube method.
5. Staining techniques : Smear preparation, simple staining, Gram's staining, Acid fast staining, Staining for metachromatic granules.
6. Micrometry : Determination of size of Bacteria, yeast. Fungal filaments.
7. Physiological characteristics : IMVic test, MRVP test, H₂S, Oxidase, catalase, urease test, gelatin liquefaction, casein, starch degradation. Carbohydrate fermentation, Maintenance of pure culture, Paraffin method - Stab culture - maintenance of mound culture.
8. Agarose Gel Electrophoresis.
9. Isolation of Chromosomal DNA from *E.coli* culture.
10. Isolation of Plasmid DNA from a Prokaryote culture.
11. Isolation of Chromosomal DNA from Yeast culture.
12. Isolation of Chromosomal DNA from Animal Tissue.

Course code	Course title	C	H	I	E	T
17P2RMC4	MICROBIAL PHYSIOLOGY	5	6	25	75	100

Unit I Microbial Nutrition

The common Nutrient requirements and sources of Carbon, Hydrogen/Energy, Oxygen. Major Nutritional types of Microbes- requirements of Carbon, Hydrogen/Electrons, Energy, Oxygen, Nitrogen, Phosphorus and Sulfur. The flow of carbon and energy. Phosphorylation-types, structure and significance of ATP.

Unit II Metabolism

An overview of Metabolism ATP Production, Anabolism, Catabolism, Phosphorylation, Amphibolic pathway and Anaplerotic pathway. Photosynthesis: Diversity, properties of photosynthetic prokaryotic organisms- Cyanobacteria, Green (sulphur and non- sulphur) Bacteria. Purple (sulphur and non-sulphur) Bacteria. Oxygenic and Anoxygenic photosynthesis. Light reactions: pigment system, carboxysomes, Bacteriochlorophyll. Carboxysomes. light reaction of Cyanobacteria (cyclic and noncyclic). Cyclic light reaction of purple, green and Helicobacteria. Dark reaction: Definition, C₃ cycle of Cyanobacteria. Reductive TCA cycle.

Unit III Catabolism

substrates, significance in Metabolism, Aerobic fermentation and Anaerobic. a) The breakdown of glucose to pyruvate. Glycolytic pathway ,pentose phosphate pathway and ED pathway with examples of microbes. b) significance of pyruvic acid- TCA cycle, ETP system.Fermentation-Alcoholic-Lacticacid fermentation-Homolactic and Heterolactic and Mixed acid fermentation of Enterobacteriaceae with examples. Anaerobic Respiration with examples.

Unit IV The organization of anabolism

Amphibolic nature of TCA cycle, production of biosynthetic products. Glyoxylate cycle, Gluconeogenesis-significance. Metabolism of N₂ fixation, classification of Diazotrophs, Nitrogenase- types, structure and functions. Mechanism of N₂ fixation- role of Ferredoxins, Flavodoxins, Electro proteins and Electron transfer. Role of ATP, over all reactions with NH₃ formation.

Unit V Biosynthetic pathway of aminoacids

Glycine, valine, Isoleucine,Phenylalanine. Biosynthetic pathway of Purine and Pyrimidine. Biosynthetic pathway of Bacterial cell wall synthesis.

Text Book (s):

1. Sale, A.J (1992) "Fundamentals Principles of Bacteriology", 7th Edition. McGraw Hill Publishing Co. Ltd., New York.
2. Dubey, R.C. and Maheswari, D.K. (2005) A Text book of microbiology. S. Chand & Company Ltd. New Delhi.

Reference Book(s):

1. Dall, D.O and Rao, K.K (1995) "Photosynthesis" –Cambridge University press.
2. Stainer, R.Y., Ingraham, J.L., Wheelis, M.L and Painter, P.R. (1986). "General Microbiology" -Mac Milan Education Ltd. London

Course code	Course title	C	H	I	E	T
17P2RMC5	MICROBIAL GENETICS	5	6	25	75	100

Unit I

History of microbial genetics-Mutations and genetic analysis-terms used in genetics-useful phenotypes in bacterial and phage genetics-Experiment of Luria and Delbruck. Newcombe- Isolation of Auxotrophic mutants-positive and negative selection of mutants. Complementation-Allelism and cis/trans tests.

Unit II

Bacterial conjugation: F+, F- Hfr strains. Genetic mapping with Hfr crosses. F- prime factors. Complementation test using F-prime factors-conjugation in *Streptomyces* and role of Pheromones in plasmid transfer in *Enterococcus faecalis*. Transformation : Definition – competence-mechanism of DNA uptake in *E.coli*. *Bacillus sps*, and *Haemophilus sps*. Plasmid-transformation competence induction. Recombination and its mechanisms.

Unit III

Phage biology : virulent and temperate bacteriophages (T7,T4,Lambda, P1) phage crosses,recombination and complementation tests with phages.T4 RII locus mapping. Generalized transduction with P1. Mapping of bacterial markers. Co-transduction. Gene expression during lambda lytic cycle and lysogeny- specialized transduction.

Unit IV

Transposable genetic elements- identification of transposition – IS elements, composite transposons, Tn3, Tn5, Tn9, Tn10 and μ phage-mechanism of transposition. Transposable elements in eukaryotes- maize, AC and DS elements,Spm, dspm. Retro transposons. Population genetics.

Unit V

Regulation of gene expression- negative regulation (*lac* and *gal* operon). Positive regulation (*L-ara* operon) regulation bu attenuation of *trp* operon. Role of RNA molecules in gene regulations. Some regulatory mechanisms in *E.coli*- catabolite regulation. t-RNA and r –RNA regulation(stringent control).

Text Book (s):

1. Lodish, H. Baltimore Daerk . A. Zipsury, S.L. Marsudaisa. P. Darnel. J. (1995)
Molecular cell biology.

2. Gardner- Simon Snustad. (2008). Principles of genetics, 8th Edition. John Wiley & sons. Inc. New York.

Reference Books:

1. Maloy, S.R. Cronan Jr. J.E, Freifelder D (1994), Microbial genetics. Jones and Barlett publishers.
2. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education.

PRACTICALS

1. Isolation of spontaneous mutants Drug resistant mutants by Spread Plate Technique.
2. Isolation of spontaneous mutants Drug resistant mutants by Gradient Plate Technique.
3. Enrichment of auxotrophic mutant by Ampicillin treatment.
4. Isolation of mutants using UV and NTG mutagenesis.
5. Isolation of Petite mutants of Yeast.
6. T7 phage lysate preparation and titration.
7. Transformation of *E.coli* with plasmids(pUC 18/pBR322).
8. Bacterial conjugation (Hfr X F⁻).
9. P₁-lysate preparation and P₁ transduction.

Course code	Course title	C	H	I	E	T
17P2RMC6	MEDICAL MICROBIOLOGY	5	6	25	75	100

Unit I

Components of immunity-Innate immunity, Acquired immunity. Humoral immunity, Cell mediated immunity. Types of antigens- Haptens, Adjuvants: Immunoglobulins- structure and functions: classification and biological activities; Antigenic determinants on immunoglobulins- Iso, Allo and Idiotypic, Monoclonal antibodies. The Complement components, function, complement, activation-(i) Classical, (ii) Alternate and (iii) Lectin pathways(characteristics and functions) Hypersensitivity: definition, types, examples.

Unit II

Transplantation immunology-Types of grafts, allograft rejection. Tumour immunology, tumour antigens. Immune response to tumours. Autoimmunity- concepts of autoimmunity, autoimmune disorders. MHC- types, structure, restriction, HLA typing.

Unit III

Pathogenesis, lab diagnosis, prevention & control of bacterial diseases caused by *E.coli*, *Salmonella*, *Shigella*, *Vibrio*, *Staphylococcus*, *Streptococcus*, *Mycobacterium*. Pathogenesis, clinical features & diagnosis of mycoses. Superficial mycoses- black and white piedra, Cutaneous – *Trichophyton* and *Tinea*. Subcutaneous – *Sporothrix* and *Mycetoma*. Systemic mycoses- Histoplasmosis, Coccidioidosis. Opportunistic mycosis – Aspergillosis, Candidiasis.

Unit IV

Pathogenesis, clinical features & diagnosis of diseases caused by Viruses & Protozoans . Viruses – Influenza, Herpes, Hepatitis, SARS & HIV. Protozoa – Entamoeba, Plasmodium, Trypanosoma, Leishmania and Giardia.

Unit V

General characters of antiseptics, disinfectants , antibiotics – beta lactum , aminoglycoside, polyglycoside, polycyclic alkenes.Mechanism of action. Antibiotic sensitivity test. Minimum inhibitory concentration. Drug resistance. Antiviral and Antiparasitic drugs.

Text Book (s):

1. Roitt, I.M (1998) Essential Immunology Blackwell Scientific Publishers.
2. Kuby, J. (1994) Immunology, 2nd edition, W.H. Freeman and Company. New York.

3. Leffel, Donnenberg, A: and Rose, W.(1997).Hand book of Human Immunology Boca Raton Fla: C.R.C Press.
4. Abbas, A.K. Lichtman, A.M. and Pober, J.S. (1997) Cellular and Molecular immunology 3rd edition Philadelphia : W.B. Saunders
5. Ananthanarayanan R. and Jayaram Panicker C.K. (1994). Text book of Microbiology. Orient Longman.

Reference Books:

1. Baron, E.J. and Finegold S.M. (1995). Scientific Company. Diagnostic Microbiology. Blackwell Scientific Company.
2. Salle, A.J. (1992). Fundamental Principles of Bacteriology. 7th Edition, Mc. Graw Hill Publishing Co. Ltd., New York.

PRACTICALS

- 1.Enumeration of RBC and WBC .
- 2.Total RBC count.
- 3.Total WBC count.
- 4.Detection of blood group.
- 5.Haemagglutination test.
- 6.WIDAL Test.
- 7.Immunoelectrophoresis.
- 8.Rocket Immunoelectrophoresis.
- 9.Single radial immune diffusion.
- 10.Ouchterlony double diffusion method.
- 11.Isolation and Identification of Urinary tract infection pathogens.
- 12.Identification of Microorganism from throat swab sample.
- 13.Determination of Minimum Inhibitory concentration and Minimum lethal concentration.
- 14.Antibiotic Sensitivity test by Kirby-Bauer technique.

Course code	Course title	C	H	I	E	T
17P3RMC7	APPLIED MICROBIOLOGY	6	7	25	75	100

Unit I

Microbiology of milk, Dairy and Food: Microbiology of milk dairy industries – Microbiology of milk – milk products – production of yoghurt, cheese and rennin. Biotechnology of dairy products (plasmid concept in buttermilk starter culture and gene manipulation. Fermented foods – fermented vegetables, sauerkraut and kimchi, fermented meals, fermented fish, soy sauce, Preservation of food – physical and chemical methods – mode of food borne disease Bacterial – *Clostridium perfringens*. Botulism- Mycotoxins- Aflatoxins - protozoa - *Entamoeba histolytica*.

Unit II

Soil microflora, Vermicompost production ,Development of Bacterial and Cyanobacterial biofertilizers - production of biofertilizers, inoculums preparation and mass scale production. Role of mycorrhizae in organic farming. Microbial insecticides-*Bacillus thuringiensis* - insecticidal toxin of *Bt*. Mode of action- various strains of *Bt* and their toxins. Toxin clone isolation and procedure for sub cloning of *Bt*. Toxicity and binding specificity of Cry proteins.Procedure for the development of genetically engineered *Pseudomonas fluorescens*- Baculo virus as biocontrol agent- mode of action –genetic engineering for improved biocontrol.

Unit III

Fermentation of microbial products: SCP, Alcoholic fermentation,Beer and Wine production- Antibiotics-Penicillin, Streptomycin: Organic acid-Citric acid, Acetic acid: Aminoacid- Glutamic acid, L-lysine: Vitamins-B12 and Riboflavin: Hormone- Gibberellic acid: Biogas- Methane: Enzyme production- Protease, Cellulase and Lipase. Mushroom cultivation.

Unit IV

Role of microbes in biogeochemical cycle- nitrogen, sulphur, phosphate solubilizing organisms. Microbial degradation. Organic pollutants, Pesticides, hydrocarbon, Xenobiotic. Biodegradation-the meta effect of biodegradation. Microbial interaction with metal

pollutants- Biomagnification, metal toxicity on microbes. Microbial metal resistance and detoxification, enhanced recovery of metals-Bioleaching with reference to Copper, Uranium. Enhanced recovery of petroleum. Biofiltration, Bioaggregation and Phytoremediation.

Unit V

Production of Insulin. Bacterial production of growth hormone(hGH), Interleukins and Interferons-Stimulatory hormone. Drugs related with AIDS treatment. Vaccine-subunit vaccine *Herpes simplex* and *Tuberculosis*, attenuated vaccines- *Chloera* and *Salmonella*- Vector vaccines-Vaccine against Hepatitis B virus.

Text Book(s):

1. Rangasami G & Bagyaraj D.J.(1993) Agricultural Microbiology 2/e, Prentice-Hall publications.
2. Atlas, R. & Richard, B. (1987). Microbial ecology 2/e, Benjamin-Cummings publications, 1987.
3. Patel A.H(1996) Industrial microbiology Macmillan India limited.

Reference Books:

1. Prescott L.M, Harley J.P. & Klein D.A.,(2010). Microbiology, 6/e, McGraw Hill Publishers, 204. Madigan
2. M.T., Martinko J.M. & Brock P.J.(1997). Biology of Microorganisms 8/e, Prentice-Hall Inc.

PRACTICALS

1. Microbial analysis of Food sample.
2. Examination of coliform in water by MPN method.
3. Milk quality dye reduction test and quality assessment.
4. Isolation of Rhizobium from leguminous plants.
5. Isolation of Siderophore production Rhizobacteria.
6. Isolation of Phosphate solubilizing organism from soil samples.
7. Isolation of Cyanobacteria from soil and water.
8. Isolation of plant bacteria pathogen from infected leaf.
9. Isolation of fungal bacteria pathogen from infected leaf.
10. Immobilization of Yeast cells.
11. Isolation of standard graph for Ethanol.
12. Isolation of Yeast cells from various food sample.
13. Preparation of standard graph for Reducing sugar.
14. Ethanol production by free and immobilized yeast cells.
15. Screening of Microorganisms from soil sample for α amylase production.
16. Isolation of Antibiotic producing microbes from soil sample.
17. Determination of Antimicrobial spectrum.

Course code	Course title	C	H	I	E	T
17P3RMC8	BIOINFORMATICS & BIOSTATISTICS	6	7	25	75	100

Unit I

Computer : Basic components – brief account on processor. Input and output devices. Memory and storage: software -types-applications: operating systems; internet, WAN, LAN. Network software. [WWW.SRS\(NCBI,EBB\)net](http://WWW.SRS(NCBI,EBB)net), Entrez). Introduction to Bioinformatics-basic concepts-DNA and protein sequence, structure and functions and interrelationship-Genome projects-*E.coli* and Human -Role of bioinformatics

Unit II

Databases –Importance – Types –Classification –Sequence format –Database record :DBMS –Nucleicacid sequence databases (Gene Bank,DDBJ, GSTB) . Protein sequence database-Primary,PIR ,Swiss-Prot ,TrEMBL, NRL-30. Structure database-RCSB,MSD: Structure, classification- SCOP,CATH: Secondary databases –PROSITE .PRINT – Composite databases –NDB, CSD, BMRD.Bibliography databases – Pubmet. Virtual library . Medline. Sequence alignment pairwise sequence and multiple alignment. Homology tools BLAST ,FASTA and phylogenetic analysis using CLUSTAL W .PHYLIP. Molecular visualizing tools –ROSMOL.Swiss PDP viewer. Drug design- molecular tagging – Gene finding using Genscan. WebGene Gene Wise.

Unit III

Nature and scope of statistical methods and their limitations- Compilation classification and tabulation of statistical – data. Event and sets – Samples space –Concept of probability – Addition and multiplication theorem on probability –Conditional probability and independence of events.

Unit IV

Standard distributions- Binomial poisson and normal distributions – standard distributions –to test based on normal – t,chi- square and R-non parametric test run median, Sign, Mann,Whitney and Wilcox signed rank test

Unit V

Coefficient of Correlation – scattered diagram – regression lines. Principles of scientific experiment Randomization replication and local control Analysis of Variance – One way and Two way classifications.

Text Book (s):

1. S. Palanisamy and M. Manoharan, (2002). Statistical methods for Biologists. Palani Paramount Publication, Anna Nagar, Palani, T. N.
2. S.C. Gupta and K. Kapoor, (2002). Fundamentals of Applied Statistics. 3rd Edition. Sultan Sons Educational Publisher, N.D.
3. N. Gurumani, (2002). An introduction to Biostatistics. MJP Publishers, Chennai.

Reference Books:

1. Ghosh,Z.and Mallick,V.(2008). Bioinformatics-principles and applications Oxford university press.
2. P.R. Vittal, and V. Malini, (2002). Statistical and Numerical Methods. Margham Publications, Chennai.

PRACTICALS

1. Computer applications in Bioinformatics, genome analysis.
2. Homology sequence search using p-BLAST & n -BLAST.
3. Biostatistical experiment on MS- Excel sheet.

Course code	Course title	C	H	I	E	T
17P3RNM1	MICROBIAL WORLD	4	4	25	75	100

Unit I

Introduction – types, structure and properties. Brief account on microscopic algae, fungi, bacteria, protozoan and viruses.

Unit II

History of Microbiology – Anton Van LeEuwenhock – spontaneous generation of organisms, contribution by Redi, Spallanzani, Liebeg, Louis Pasteur, Robert Koch, Edward Jenner and Alexander Flemming in the field of Microbiology.

Unit III

Role of Microbes in the Environmentg – superbugs, Biogeochemical cycle, Biogas, Biofertilizer, Biological control, Bioremeditation.

Unit IV

Beneficial aspects of Microbes- any four important uses with specific examples form Algae, Fungi and Bacteria.

Unit V

Harmful aspects of Microbes – any four harmful effects of Fungi, Bacteria and viruses with specific examples.

Text Book (s):

1. Anathanarayan, R & Paniker, C.K. (2000). A text book of Microbiology, Orient Longman, New Delhi.
2. Dubey, R.C. (2004), Basic Microbiology, S. Chand Publication, New Delhi.

Reference Books:

1. Christon J. et al, (2002), Manual of Environmental Microbiology, 2nd Edition, ASM Press, New Delhi.
2. Atlas, R.A. (1995), Principles of Microbiology, Mosby Publications, USA.

Course code	Course title	C	H	I	E	T
17P4RMC9	MICROBIAL BIOTECHNOLOGY	5	6	25	75	100

Unit I

Introduction – Definition – interdisciplinary approach-scope and importance –Biotechnology in India- organization and activities.Recombinant DNA technology-Restriction endonuclease-types, nomenclature, recognition sequences. Cleavage patterns. Modification of cut ends. Steps in gene cloning.isolation of desire gene clone.CDNA library, genomic library.

Unit II

Plasmids – basic biology, types, classification and properties of cloning vectors. The origin, restriction map of pBR322, pUC18, Ti plasmids. Lambda phage, M13, Cosmids, Phasmids.

Unit III

Gene transfer in Animal cells-DNA mediated transformation.viral transduction.expression systems for animal cells, role of stem cells. Production and importance of monoclonal antibodies.

Gene transfer in plant cell-Agrobacterium mediated transformation. Role of ti plasmid and cDNA in the field of vectors. Transfer of gene into plant cells with references to TGMV, *Arabidopsis*, *Nicotiana* and *Antirrhinum*.

Unit IV

Applications of recombinant DNA technology for the human welfare-Marshling rDNA to fight against AIDS,DNA based diagnosis of genetic diseases,human gene therapy with reference to HPRT,ADA,PNP,GC,PKU, β -globulin. Role of skin fibroplast in gene therapy.DNA fingerprinting and forensic studies. Concepts of stem cell therapy.

Unit V

Transgenic animals- introduction,objectives,vectors,transfection methods.brief account on transgenic mice-sheep, pigs, cattle and fish.

Transgenic plants- introduction, role of promoter,reportor and terminator genes. Antisense RNA mechanism. Production of transgenic tomato. brief account on the importance of Bt - Bt cotton, Bt brinjal- herbicide resistant,drought resistance plant productions.

Text Book(s):

1. Ratledge C & Kristiansen B.(2008). Basic Biotechnology 3/e, Cambridge University Press.
2. Darnell J. Lodish H. & Baltimore D.(2006). Molecular Cell Biology, Scientific American Books Inc., Iowa.
3. Glick B.R. & Pasternak, J.J., (2006).Molecular Biotechnology- Principles and Applications of Recombinant DNA technology, ASM press, Washington.
4. Mitra S., (2001)Genetic Engineering, Macmillan, India Limited, New Delhi.

Reference Book(s):

1. Winnacker E.L.(1987) From Genes to Clones: Introduction to Gene Technology, VCH Publications, Germany.
2. Winnacker E.L.(1987). From Genes to Clones: Introduction to Gene Technology, VCH Publications, Germany.

Course code	Course title	C	H	I	E	T
17P4RMC10	GENOMIC AND PROTEOMICS	5	6	25	75	100

Unit I

Genome of prokaryotes and eukaryotes-structure and organization of prokaryotic genome and eukaryotic genome- eukaryotic organelle genomes. Repetitive DNA content. Mapping genomes : genetic mapping – RAPD, RFLPs, SSLPs, SNPs detection of SNPs using DNA chip and microarrays. DNA chip and microarrays, physical mapping, restriction mapping. FISH, STS mapping (Radiation hybrid , flow cytometry).

Unit II

PCR technology – gene amplification. PCR primer designing and optimization site directed mutagenesis. DNA foot printing and finger printing. Methods of DNA sequencing .Sangers and Maxam gilbert methods. Automated DNA sequencing with fluorescent labeled ddNTPS. Thermal cycle sequencer, assembly of contigs-DNA sequencer-shotgun approaches.

Unit III

Clone contig approach by chromosome walking and whole genome – shotgun approach. Gene identification, location and computer analysis gene function . molecular phylogenetics – DNA based phylogenetic tree-Tree construction and application of molecular phylogenetics. Transcriptone analysis- Northern blot. RT-PCR . RACE: S1 nuclease mapping. SAGE DNA chips.

Unit IV

Proteomics classification 1 D –SDSPAGE a 2D –SDS PAGE.Detection and quantitation of proteins in gels, pros and cons of various staining methods. Basics of mass spectrometry. MALDITOF and ES1 and their application in proteomics.

Unit V

Tandem MS/MS spectrometry. Peptide sequencing by tandem mass spectrometry. Affinity purification of protein.TAP tag. Gel based proteome profiling

Text Book(s):

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). VIII ed. Principles of Genetics Wiley India.
2. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. XI Edition. Benjamin Cummings.