

Department of Microbiology

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

SEM	SUB CODE	COURSE TITLE	HOURS	CREDITS
I	17U1RMC1	General Microbiology	5	5
	17U1RSM1	Basic Techniques in Microbiology	2	2
		Lab in Microbiology & Basic Techniques	3	*
	17U1RES1	Environmental Studies	2	2
II	17U2RMC2	Microbial Taxonomy	5	5
	17U2RSM2	Cell and Molecular Biology	2	2
	17U2RVE1	Value Education	2	2
	17U2RMP1	Lab in Microbial Taxonomy and Cell and Molecular Biology	3	6
III	17U3RMC3	Biochemistry	4	4
		Lab in Biochemistry & Bioinformatics	2	*
IV	17U4RMC4	Microbial Physiology	2	2
	17U4RSM3	Biostatistics	2	2
	17U4RMP2	Lab in Microbial Physiology and Biostatistics	2	4
V	17U5RE1	Microbial Genetics	5	6
	17U5RMC5	Environmental Microbiology	5	5
	17U5RMC6	Medical Microbiology	5	5
	17U5RMC7	Bioinformatics	3	3
		Lab in Genetics	3	*
		Lab in Environmental and Medical microbiology	3	*
VI	17U6RME2	Dairy & Food Microbiology	6	7
	17U6RME3	Biotechnology	6	7
	17U6RMC8	SBE II-Pharmaceutical & Forensic Microbiology.	4	4
	17U6RSM4	Industrial Microbiology	2	2
	17U6RMP3	Lab in Applied Microbiology	3	6
	17U6RMP4	Lab in Biotechnology	3	6

*Exam will be conducted at the even semester.

B.Sc. Ancillary Microbiology for B.Sc Biotechnology Course structure

Semester	Sub. Code	Title of the paper	Hours	Credits
III	17U3RAC2	General Microbiology	2	1
	17U3RNM1	An Introduction to Microbial world	2	1
		Practical	2	*
IV	17U4RC2	Medical Microbiology	4	2
	174RAP1	Practical III & IV papers	2	2
V	17U5RAC3	Environmental Microbiology	2	2
	17U5RSA1	Mushroom cultivation– Skill Based Elective	2	1
		Practical	2	*
VI	17U6RC4	Applied Microbiology	4	2
	17U6RP2	Practical V and VI papers	2	1

Course code	Course title	C	H	I	E	T
17U1RMC1	GENERAL MICROBIOLOGY	5	5	25	75	100

Unit I

15 Hrs

Definition and scope of Microbiology- Overview of history of Microbiology-Biogenesis and Abiogenesis, Spontaneous generation, Germ theory of diseases, Contribution of Redi, Spallanzani, Needham, Louis Pasteur, Tyndal, Leewenhoek, Joseph Lister, Robert Koch, Edward Jenner, Winogradsky, Flemming, William Beijernick, Emil Christian Hansen, Elie Metchinikoff and Kary Mullis. Impact of Microbiology on future.

Unit II

15 Hrs

Ultra structure and differences of Eukaryotes and Prokaryotes, Archaeobacteria and Eubacteria, Mycoplasma with examples. Growth curve, Growth kinetics, Acidophiles, Alkalophiles Neutrophiles, Thermophiles, aerobes and anaerobes, Halophiles, Osmophiles and Basophiles.

Unit III

15 Hrs

Bacterial cell size, shape, arrangement, gram positive , negative cell wall , glycocalyx, capsule, flagella, fimbriae, pili, cell membrane, cytoplasm. Endospore : structure, formation, stages of sporulation. Ultra structure of *E.coli*, *Bacillus subtilis*. Ultra-structure and reproduction of *Saccharomyces cereviseae* and *Penicillum* sp.

Unit IV

15 Hrs

Ultra structure of HIV, types of Hepatitis. ultra structure and reproduction of Algae – Spirulina, Chlamydomonas and Protozoans. Structure and reproduction of Amoeba and Plasmodium.

Unit V

15 Hrs

General characters of antimicrobial, antiseptics, disinfectants. Antibiotic- Beta lactum and aminoglycosides- mechanism of action. Antiviral, antiparasitic, antifungal antibiotics. Antibiotic sensitivity test & MIC.

Text Book(s):

1. Michael J Pelczar, JR. E.C.S Chan, Noel R. Krieg;(1998). Microbiology, TATA McGraw-Hill publication.
2. Madigah, Martinko, Dunlap; (2010).Brock Biology of Microorganisms; Pearson Publication.

3. P Sharma, (1986).Algae – Series on diversity of Microbes, Tata McGraw Hill Education Private Limited.
4. R.C.Dubey & K.Maheshwari (1999). A Text book of Microbiology, S. Chand & Company.

Reference Books:

1. Prescott, Harley & Klein's,(2008), Microbiology, Mac Graw Hill Higher education.
2. Jacquelyn G.Black, (2008), Microbiology Principles and explorations, JohnWiley& sons Ltd K Rajeshwar Reddy, General Microbiology, New Age Publishers.

Course code	Course title	C	H	I	E	T
17U1RSM1	BASIC TECHNIQUES IN MICROBIOLOGY	2	2	25	75	100

Unit I

6 Hrs

Microscopy- principles and components of Simple, Compound, Dark field, Phase contrast, fluorescent, Electron microscope (TEM & SEM)-Resolution power of microscope. Stains and Staining techniques- Definition of auxochrome, chromophores, dyes, classification of stains, theories of staining, mechanism of Gram staining, Acid fast staining, Negative staining, Capsule staining, Flagellar staining and Endospore staining.

Unit II

6 Hrs

Concept of sterilization and disinfection. Definitions, principles, methods of sterilization- physical methods (heat, filtration), radiation and chemical methods- Pasteurization, Tyndalization, Ultrasonication. Disinfection - sanitization, antiseptics sterilization and fumigation. Determination of phenol co- efficient of disinfectant.

Unit III

6 Hrs

Types of culture media: synthetic, complex, enriched, enrichment, selective, differential, dehydrated solid and liquid. Concept & methods of pure culture technique; Methods: enrichment, streak plate, surface spread, pour plate, colony characters and pigmentation.

Unit IV

6 Hrs

Principle of pH meter, Colorimeter, Centrifuge and its types, Chromatographic techniques – TLC and Column chromatography, Electrophoresis, Spectroscopy – UV spectrophotometer.

Unit V

6 Hrs

Microbiological media, composition and types: Selective and Differential media, growth curve and growth kinetics, influence of environmental factors for microbial growth. Maintenance and preservation of cultures - sub culturing, overlaying cultures with mineral oils, Lyophilization, and culture storage at low temperature.

Text Book(s):

1. Alexopoulos CJ, Mims CW, and Blackwell M. (1996). Introductory Mycology. 4th edition. John and Sons, Inc.
2. Atlas RM. (1997). Principles of Microbiology. 2nd edition. WM.T.Brown Publishers.
3. Kumar HD. (1990). Introductory Phycology. 2nd edition. Affiliated East Western Press.

Reference Book(s):

1. Madigan MT, Martinko JM and Parker J. (2009). Brock Biology of Microorganisms. 12th edition. Pearson/Benjamin Cummings.
2. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education limited.

Course code	Course title	C	H	I	E	T
17U2RMC2	MICROBIAL TAXONOMY	5	5	25	75	100

Unit I

15 Hrs

Bacterial Taxonomy and Classification: position of microorganisms in living world, Whittaker's five kingdom concept. Taxonomic groups, species concept, principles of Binomial nomenclature, criteria used for classification of bacteria.

Unit II

15 Hrs

Methods of Classification: intuitive methods, numerical taxonomy, genetic approach. Introduction to Bergey's manual - salient features, criteria used for classification, past and present status of bacterial taxonomy.

Unit III

15 Hrs

Fungal taxonomy: General criteria for classification, classification by Alexopoulos and Mims, Detail studies on the classes of (a) Slime molds (b) Zygomycetes (c) Deuteromycetes- morphology habitat , reproduction and economic importance of fungi.

Unit IV

15 Hrs

Classification of Algae by Fritsch, Myxophyceae – morphology, habitat and reproduction. Economic importance of algae.

Unit- V

15 Hrs

Principles of Virus taxonomy, characteristics used in nomenclature & classification of bacterial, plant and animal viruses- their major families with suitable examples.

Text Book (s):

1. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company.
2. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005). General Microbiology. 5th edition. McMillan.

3. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education.

4. Vashishta BR and Sinha AK. (2008). Fungi. S. Chand and Company Ltd.

Reference Book(s):

1. Willey JM, Sherwood LM, and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. 7th edition. McGraw Hill Higher Education.

2. Vashishta BR. (2005). Algae. 3rd edition. S. Chand and Company Limited, New Delhi.

Course code	Course title	C	H	I	E	T
17U2RSM2	CELL AND MOLECULAR BIOLOGY	2	2	25	75	100

Unit I

6 Hrs

Overview of Prokaryotic & Eukaryotic cells, cell size, phages, virioids, mycoplasma. Bacterial cell wall- gram positive and gram negative, structure, chemistry & functions, fluid mosaic model of cell membrane, pili, flagella and endospore- structure and functions.

Unit II

6 Hrs

Nucleoid, Nucleus, Endoplasmic reticulum, Golgi apparatus, Lysosomes, Ribosomes, Mitochondria and Chloroplast- structure and functions.

Unit III

6 Hrs

The replication of DNA (Prokaryotes and eukaryotes), DNA replication- Meselson - Stahl experiment (evidence for semi conservative replication). Mechanism of replication-rolling circle model and theta (θ) mode of replication., enzyme involved in DNA replication-DNA polymerase, ligase, primase & telomerase.

Unit IV

6 Hrs

Transcription in prokaryotes – mechanism (initiation, elongation, termination) promoter structure, mechanism of termination, dependent and independent termination.

Unit V

6 Hrs

Mutation-spontaneous & induced, mutagens- physical and chemical. Types of mutations-addition, deletion, inversion, substitution, base analog, frame shift. DNA repair mechanisms, SOS-Photoreactivation, dark repair mechanism.

Text Book(s):

1. Lodish, H. Baltimore Daerk . A. Zipsury, S.L. Marsudaisa. P. Darnel. J. (1995) Molecular cell biology.
2. Gardner- Simon Snustad. (2001) Principles of genetics, 8th Edition. John Wiley & sons. Inc. New York.

Reference Book(s):

1. Maloy, S.R. Cronan Jr. J.E, Freifelder D (1994), Microbial genetics. Jones and Barlett publishers.

2. Willey JM, Sherwood LM, and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. 7th edition. McGraw Hill Higher Education.

Course code	Course title	C	H	I	E	T
17U2RMP1	PRACTICAL -I	2	2	25	75	100

S.No	Experiments
1	Safety measures in laboratory & laboratory techniques.
2	Study of compound microscope. Use of oil immersion objective.
3	Study of apparatus – autoclave, hot air oven, laminar air flow chamber, incubator, centrifuges. pH meter , spectrophotometer.
4	Preparation of media.
5	Pure culture techniques- pour plate, spread plate and streaking.
6	Aseptic transfer techniques.
7	Isolation and identification of bacteria & fungi from soil. (Serial dilution and plating)
8	Staining of bacteria – gram staining, negative, endospore and capsule staining.
9	Study of bacterial motility and hanging drop techniques.
10	Biochemical characterization –IMVIC, TSI.
11	Isolation of mutants by replica plate method.
12	Isolation of genomic DNA from bacterial cells and separation of isolated genomic DNA by agarose gel electrophoresis.
13	Isolation of Plasmid DNA

Books for Reference:

1. S.Shanmugam, T.Sathish kumar and K.Panner selvam, Laboratory Hand Book on Biochemistry, 2010, PHI learning Pvt. Ltd., New Delhi- 1 .
2. Dr.S.Rajan and R.Selvi Christy, Experimental Procedure in Life Science, 1st edition 2011, Anjana publication.
3. Aparana Mathur, Laboratory instrumentation, 2013, Black printers India Inc.,

B.Sc., MICROBIOLOGY COURSE STRUCTURE

SEM	SUB CODE	COURSE TITLE	HOURS / WEEK	CREDITS
I	17U1RMC1	General Microbiology	5	5
	17U1RSM1	Basic Techniques in Microbiology	2	2
	17U1RES1	Environmental Studies	2	2
		Lab in Microbiology and Basic Techniques *	3	
II	17U2RMC2	Microbial Taxonomy	5	5
	17U2RSM2	Cell and Molecular Biology	2	2
	17U2RVE1	Value Education	2	2
		Lab in Microbial Taxonomy , Cell and Molecular Biology	3	
	17U2RMP1	Lab for I & II Semester papers	3	6
III	17U3RMC3	Biochemistry	4	4
		Lab in Biochemistry *	2	
IV	17U4RMC4	Microbial Physiology	2	2
	17U4RSM3	Biostatistics	2	2
		Lab in Biochemistry, Microbial Physiology and Biostatistics	2	
	17U4RMP2	Lab for III & IV Semester papers	3	4
V	17U5RME1	Microbial Genetics	5	6
	17U5RMC5	Environmental Microbiology	5	5
	17U5RMC6	Medical Microbiology	5	5
	17U5RMC7	Bioinformatics	3	3
		Lab in Microbial Genetics and Environmental Microbiology *	3	
		Lab in Medical Microbiology and Bioinformatics*	3	
VI	17U6RME2	Food Microbiology	6	7
	17U6RME3	Biotechnology	6	7
	17U6RMC8	Pharmaceutical & Forensic Microbiology	4	4
	17U6RSM4	Fermentation Technology	2	2
		Lab in Food microbiology and Biotechnology	3	
		Lab in Pharmaceutical , Forensic Microbiology and Fermentation Technology	3	
	17U6RMP3	Lab for V Semester papers	6	6
17U6RMP4	Lab for VI Semester papers	6	6	

***Exam will be conducted at the even semester.**

B.Sc. Ancillary Microbiology for B.Sc Biotechnology Course structure

Semester	Sub. Code	Title of the paper	Hours	Credits
I	18U1RAC1	Basic Microbiology	4	2
		Ancillary Practical I*	2	
II	18U2RAC2	Medical Microbiology	4	2
		Ancillary Practical II		
	18U2RAP1	Practical I & II papers	2	2
III	18U3RAC3	Environmental Microbiology	2	2
	18U3RSA1	Mushroom cultivation (Skill Based Elective)	2	1
		Ancillary Practical III*	2	
IV	18U4RAC4	Applied Microbiology	2	1
	18U4RNM1	Microbes in Human Welfare (NME Paper)	2	1
		Ancillary Practical IV		
	18U4RAP2	Practical III and IV papers	2	1

***Exam will be conducted at the even semester.**

Course Code	Course Title	C	H	I	E	T
17U3RMC3	BIOCHEMISTRY	4	4	25	75	100

Course Objectives:

- To introduce the structure and properties of various biomolecules.
- To learn the concepts involved in the mechanism of enzyme action.

Learning Outcomes:

- Students gathered indepth informations about biomolecules and their mechanisms.
- Students acquire knowledge on role of lipids and vitamins to human population.

Unit I 12 Hrs

Carbohydrates – definitions, biological significance - Classification, Structure, chemical and physical properties of Monosaccharides - Glucose, Disaccharides- lactose, Polysaccharides – starch.

Unit II 12 Hrs

Amino acids -classification, essential and non – essential amino acids, structure and properties. **Proteins** – definitions, classification based on composition, solubility. structural levels of organization – primary, secondary, tertiary and quaternary structure and functions.

Unit III 12 Hrs

Enzymes – definitions, IUB classification with example, Structure, mechanism of enzyme action-lock and key model. Enzyme inhibition-competitive and non competitive, factors affecting enzymes activity.

Unit IV 12 Hrs

Lipids - classifications , physical and chemical properties, saturated and unsaturated fatty acids. Lipid metabolism - β -oxidation, biosynthesis of saturated fatty acid eg. Palmitic acid.

Unit V 12 Hrs

Vitamins- classification, occurrence, deficiency, symptoms and importance of vitamins- water soluble vitamins (Vitamin B and C). Fat soluble vitamins (Vitamin A, D, E and K).

Text Book :

1. Jain, J. L. (2000). Fundamentals of Biochemistry. S. Chand & Co. Ltd., New Delhi

Reference Book(s):

- 1.Nelson, D.L., and M.M.Cox., (2000). Lehninger, Principles of Biochemistry, Third edition, Macmillan Worth publishers
- 2.David, B.D., Delbecco, R., Eisen, H.N and Ginsburg, H.S (1990). "Microbiology" 5th Edition. Harper & Row, New York.
- 3.Stryer. L. (1995). Biochemistry, 4th Edn , W.H. Freeman &Co. NY.
- 4.Rober K. Murray, Daryl K. Grammer, (1990) -Harper's Biochemistry- McGraw Hill, Lange Medical Books. 25th edition.
- 5.Satyanarayana, U (2005). Essentials of Biochemistry, Books and Allied (P) Ltd., Kolkata.
- 6.Veerakumari, L (2004). Biochemistry. MJP Pubilshers, A Unit of Tamil Nadu Book House, Chennai.

Web reference(s):

- 1.www.biochemistry.org/
2. [www. bookboon.com/en/biology-biochemistry](http://www.bookboon.com/en/biology-biochemistry)
- 3.www.ncbi.nlm.nih.gov/books/NBK21154

You tube reference(s):

1. [www. Biochemistry Introductory Lecture for Kevin Ahern's BB 450/550 youtube.com](http://www.Biochemistry Introductory Lecture for Kevin Ahern's BB 450/550 youtube.com)
2. [www .Biochemistry Lecture \(Introduction\) from Kevin Ahern's BB 350 youtube.com](http://www .Biochemistry Lecture (Introduction) from Kevin Ahern's BB 350 youtube.com)

Course Code	Course Title	C	H	I	E	T
17U4RMC4	MICROBIAL PHYSIOLOGY	2	2	25	75	100

Course Objectives:

- To study the various physiological phenomena involved within microbes.
- To study different types of extremophilic organisms.

Learning Outcomes:

- The learners acquire knowledge about various physiological activities of the microbes and their survival under extreme atmospheric conditions.
- Students learn the concepts of physiological cycles mainly the importance of gluconeogenesis.

Unit I

6 Hrs

Nutritional requirements of microorganisms -autotrophs, heterotrophs, phototrophs and chemotrophs. Energy production- Phosphorylation - types. Structure of ATP and its significance.

Unit II

6 Hrs

Metabolism- Types, Aerobic, anaerobic respiration and fermentation. Catabolism – Glycolysis, Krebs cycle and ED pathway. Fermentation – alcoholic and lactic acid .Homo and heterolactic fermentation.

Unit III

6 Hrs

Anabolism - Photosynthesis- Classification and properties of prokaryotic photosynthetic microbes. Light reaction of Cyanobacteria, Purple and green bacteria. Dark reaction - C3 cycle and reductive TCA cycle.

Unit IV

6 Hrs

Biosynthetic Pathway of Aminoacids – leucine, valine, isoleucine, methionine, lysine. Biosynthesis of Peptidoglycan.

Unit V

6 Hrs

Biosynthetic Pathway - Purine and Pyrimidine pathways. Glyoxylate Pathway and Gluconeogenesis and their significance.

Text Book :

1. Moat G, John E. Foster and Michael P.Spector (2002). Microbial physiology. Fourth edition, A John Wiley sons, Inc publication. 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.
- 3.Dubey, R.C. and Maheswari, D.K. (2005). A Text book of microbiology. S. Chand & Company Ltd. New Delhi.
- 4.Sale, A.J (1992). "Fundamentals Principles of Bacteriology", 7th Edition. McGraw Hill Publishing Co. Ltd., New York.
- 5.Stanier, R.Y., J.L.Ingraham, M.L.Whellis and P.R.Painter, (1986). The Microbial World, Fifth edition, Prentice Hall of India, New Delhi.
- 6.Sundara Rajan ,S. (2003). Microbial Physiology, Anmol Publication ,NewDelhi

Web reference(s):

- 1.[www.omicsonline.org/microbial-physiology/..](http://www.omicsonline.org/microbial-physiology/)
- 2.www.omicsonline.org/scholarly/microbial..
3. [www mib.uga.edu/research/content/microbial-physiology](http://www.mib.uga.edu/research/content/microbial-physiology)

You tube reference(s):

1. [www Microbial Physiology youtube.com](http://www.MicrobialPhysiologyyoutube.com).
2. [www .Dr. S. R. Dave's lecture on Microbial Physiology and Growth youtube.com](http://www.Dr.S.R.Dave'slectureonMicrobialPhysiologyandGrowthyoutube.com)

Course Code	Course Title	C	H	I	E	T
17U4RSM3	BIOSTATISTICS	2	2	25	75	100

Course Objectives:

- To train the students to collect, organize and analyze data.
- Learn to apply different statistical tools in presenting biological data.

Learning Outcomes:

- The students obtain analytical knowledge to apply various statistical tools in their higher studies.
- Students have the methods of sampling, collection of data.
- Students know the methods of data presentation.

Unit I

6 Hrs

Biostatistics - definitions , types of data, sources of data in life science – Limitations and uses of statistics – collection of data – Primary data – Secondary data – classification of data – Tabulation and presentation of data.

Unit II

6 Hrs

Theory of sampling – Introduction, types of sampling- random and non random sampling methods.

Unit III

6 Hrs

Measures of central tendency – Mean, Median and Mode – Measures of dispersion – range, quartile deviation, standard deviation.

Unit IV

6 Hrs

Data presentation - introduction, presentation of three forms - textual form, tabular form and graphical form. Frequency – types of diagram – bar, pie, histogram and line diagram.

Unit V

6 Hrs

Chi square distribution - F and T test. Analysis of Variance - One way and two way classifications.

Text Book :

1. Gurumani, N. (2004). An Introduction to Biostatistics. MJP publishers, Chennai.

Reference Book(s):

1. Arora, P.N and P.K.Malhan (2008). Biostatistics. Himalaya Publications, Mumbai.
2. Daniel, W.W (2006) Biostatistics-A foundation for analysis in health sciences, John Wiley (Asia) & sons, Singapore.
3. Gupta S.P. (1987). Statistical Methods. Sultan Chand & Sons Publishers, New Delhi
4. Sokal, R.R. and Rohif, F.J. (1987). Introduction to Biostatistics. W.H. Freeman and company, New York.
5. Sundar Rao, P.S.S. and Righard, J. (2002). An Introduction to Biostatistics. III edn. Prentice Hall of India, New Delhi.
6. Misra, B.N. and Misra, B. K. (1998). Introductory Practical Biostatistics. Naya Prakash, Calcutta.

Web reference(s):

1. www.researchgate.net/publication/2
2. www.stat.ufl.edu/~winner/sta6934/st4170
3. www.sanfoundry.com/-biostatistics

You tube reference(s):

1. [www Biostatistics introduction youtube.com](http://www.Biostatisticsintroductionyoutube.com).
2. [www Biostatistics SUMMARY STEP 1 - The Basics USMLE youtube.com](http://www.BiostatisticsSUMMARYSTEP1-TheBasicsUSMLEyoutube.com)

Course code	Course title	C	H	I	E	T
17U4RMP2	PRACTICAL –II LAB IN BIOCHEMISTRY, MICROBIAL PHYSIOLOGY AND BIOSTATISTICS	4	3	50	50	100

S.No	Experiments
1	Measurement of pH of various samples using pH meter
2	Verification of Beer's Law
3	Buffer preparation (Verification of Henderson-Hasselbalch equation)
4	Separation of amino acids by paper chromatography
5	Separation of leaf pigments by Column chromatography
6	Separation of amino acids by TLC
7	Quantitative estimation of glucose by anthrone method.
8	Quantitative estimation of DNA by Diphenylamine method
9	Quantitative Estimation of Protein by Lowry's Method
10	Qualitative analysis of carbohydrate (mono, di and polysaccharides).
11	Biochemical characterization of bacterium--IMVIC, oxidase and catalase
12	Starch, casein and lipid hydrolysis
13	Diagrammatic and graphical representation of data.
14	Problems in Mean, Median, Mode.
15	Problems in Chi square Test/ SD

Text Manual:

1. Aneja KR (2005). Experiments in Microbiology, Plant pathology and Biotechnology. 4th Edition, New Age International Publishers, Chennai.

2. Palanivel, P. (2000). Laboratory Manual for Analytical Biochemistry & Separation Techniques, School of Biotechnology, Madurai Kamaraj University, Madurai

Reference Book(s):

1. James G Cappuccino & Natalie Sherman (2004). Microbiology: A Laboratory Manual. 6th Edition, Published by Pearson Education.

2. Bajpai, P.K. (2010). Biological Instrumentation and Methodology. S.Chand & Company. New Delhi.

3. Jeyaraman, J., (1985), Laboratory Manual in Biochemistry, Wiley Eastern Limited, New Delhi.
4. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas (2000). Vogel's Textbook of quantitative chemical analysis. 6th edition. Pearson Education. New Delhi.
5. Bailey, N.J.J. (1994). Statistical methods in Biology. Cambridge University Press. Cambridge.
6. P. Mariappan, (2013). Biostatistics an introduction. Pearson.
7. Sawhney, S.K. and Nandhir Singh, (2000). Introductory practical Biochemistry, Narosa Publishing house, New Delhi.
8. Veerakumari, L. (2009). Bioinstrumentation. MJP Publishers, Chennai.

Web reference(s):

1. www.jaypeedigital.com
2. www.biolympiads.com
3. www.elearningbiostatistics.com/

You tube reference(s):

1. www.appliedbiostatistics.youtube.com
2. www.practicalbiochemistry.youtube.com

Course Code	Course Title	C	H	I	E	T
17U5RME1	MICROBIAL GENETICS	6	5	25	75	100

Course Objectives:

- To learn the fundamentals of Microbial genetics.
- To expose the students to the structure and functions of genetic material and gene transfer methods.

Learning Outcomes:

- Enables the students to understand the relevance of microbial genetics with day today life.
- Students gathered the information regarding the structure and chemistry of genetic molecule.
- They learn the types and functions of various forms of DNA and RNA.
- Students can understand the gene transfer mechanisms and gene regulation.

Unit I 15 Hrs

Cell cycle –G₁ phase, S phase (synthesis), G₂ phase (interphase), mitosis, amitosis and meiosis - significance.

Unit II 15 Hrs

DNA - structure, types and chemical composition , replication- semiconservative- Meselson stahl experiment. Replication of double strand DNA, synthesis of Okazaki fragment and enzymes involved. RNA – types and significance.

Unit III 15 Hrs

Translation in prokaryotes- Genetic Code, wobble hypothesis, Ribosome. tRNA, Initiation, Elongation and Termination of polypeptide biosynthesis. Post transcriptional and post translational modifications of proteins.

Unit IV 15 Hrs

Prokaryotic gene transfer mechanism - Bacterial conjugation –F Factor, Hfr Transfer. Gene mapping. Bacterial Transformation- *E.coli* Transduction- Generalized and specialized transduction.

Unit V 15 Hrs

Gene Regulation – introduction, Operon concept , types – positive and negative regulations, Lac operon and Trp operon concept.

Text Book :

1. David Frifielder (2005). Molecular Biology. 2nd Edition. Narosa Publishers, New Delhi.

Reference Book(s):

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.
3. Lodish, H. Baltimore Daerk . A. Zipsury, S.L. Marsudaisa. P. Darnel. J. (1995). Molecular cell biology.
4. Gardner- Simon Snustad. (2008). Principles of genetics, 8th Edition. John Wiley & sons. Inc. New York.
5. Hayes.W. (1968). Genetics of Bacteria and their viruses, Black Well Publication, London.
6. Allison, L.A., (2007). Fundamental Molecular Biology, Blackwell Publishing, USA.

Web reference(s):

1. www.omicsonline.org/scholarly/microbial-genetics.
2. www.lamission.edu/lifesciences/Steven/Micro20
3. www.indiabix.com Microbiology

You tube reference(s):

1. www.MicrobialGeneticsyoutube.com
2. www.MicrobialGeneticsPart2youtube.com

Course Code	Course Title	C	H	I	E	T
17U5RMC5	ENVIRONMENTAL MICROBIOLOGY	5	5	25	75	100

Course Objectives:

- To understand the role of microbes in different spheres of life.
- Make them to learn analytical techniques of Quality control sector in microbiological industry.

Learning Outcomes:

- Students acquire the concept of omnipotence of microorganisms.
- Students will be able to know the role and interaction of microbes in biogeochemical cycle.
- They are able to analyze the role of microbes in the air and their sampling.
- They will know the various biochemical characteristics and treatment of sewage.

Unit I

15 Hrs

Introduction to soil Microbiology – Types and significance of soil microbes – Bacteria, fungi, actinomycetes and algae . Factors affecting microbial population.

Unit II

15 Hrs

Biochemical cycle – carbon, phosphorus, nitrogen – Biological nitrogen fixation. Biofertilizer – *Rhizobium* and *Azotobacter*, Cyanobacteria – Mass multiplication.

Unit III

15 Hrs

Microbial interaction – neutralism, comensalism, synergism, mutualism, ammensalism, competition, parasitism and predation. Interaction of microbes with plants – Rhizosphere.

Unit IV

15 Hrs

Microbiology of air – Aeromicrobial pathways – Enumeration of bacteria from air – Air sampling devices – Air sanitation. Microbiology of water- Potability of water quality – Indicator organisms – Water purification – Waterborne diseases – Typhoid and Amoebic dysentery and their control measures.

Unit V

15 Hrs

Microbiology of sewage – chemical and biochemical characteristics of sewage. Sewage treatment – physical, chemical and biological treatment -trickling filter, activated sludge and oxidation pond.

Text Book :

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

Reference Book(s):

1. Rangasami G & Bagyaraj D.J(1993). Agricultural Microbiology , Prentice-Hall publications.
2. Alexander. (1997). Introduction to soil Microbiology. John Wiley and Sons. N.Y.
3. Subba Rao, N.S. (1995) .Soil Micro organisms and plant growth, Oxford and IBH publishing Co. Pvt. Ltd.
4. Prescott L.M, Harley J.P. & Klein D.A.,(2006). Microbiology , McGraw Hill Publishers.
5. Madigan M.T., Martinko J.M. & Brock P.J.(1997). Biology of Microorganisms , Prentice-Hall Inc.
6. Kanika Sharma, (2011). Textbook of Microbiology – Tools and Techniques. 1st Edition, Ane Books Pvt. Ltd., New Delhi.

Web reference(s):

1. www.highveld.com/microbiology/environmental-microbiology.
2. www.sfam.org.uk/en/journals/environmental-microbiology.cfm
3. www.sciencedirect.com/science

You tube reference(s):

1. [www.EnvironmentalMicrobiology youtube.com](http://www.EnvironmentalMicrobiology.youtube.com)
2. [www .BI280 Chapter 26 Environmental Microbiology - Part 1 of 2youtube.com](http://www.BI280Chapter26EnvironmentalMicrobiology-Part1of2youtube.com)

Course Code	Course Title	C	H	I	E	T
17U5RMC6	MEDICAL MICROBIOLOGY	5	5	25	75	100

Course Objectives:

- To recognize the significance of immune system and vaccines for maintaining human health.
- To understand the pathogenesis mechanism of different pathogens.

Learning Outcomes:

- Students acquire various basic concepts of medical microbiology.
- The paper presents an overview of the organization and function of clinical microbiology laboratory
- The students have analyzed the mechanism of pathogenicity and vaccines.

Unit I

15 Hrs

History of Immunology – Host-parasite relationship – Immunity – Innate and acquired immunity – Humoral and Cell-mediated immunity.

Unit II

15 Hrs

Cells and organs of immune system - Structure and functions of Cells and organs involved in immune system. Primary and secondary lymphoid organs. Antigens – Types, properties – Immunoglobulins – Structure, types and properties . Monoclonal antibodies – production and applications.

Unit III

15 Hrs

Antigen – Antibody reactions – Agglutination – Precipitation – Complement fixation – Immunofluorescence – ELISA-RIA. Hypersensitivity reactions – Type I and Type II.

Unit IV

15 Hrs

Mechanism of microbial Pathogenicity -Morphology, cultural characteristics, biochemical, pathogenicity, lab diagnosis and prevention of bacterial diseases - *Mycobacterium tuberculosis*, *Salmonella typhi* and *Escherichia coli*. Viral diseases- *Pox*, *Herpes*, *Hepatitis* and *HIV*. Fungal diseases -systemic mycoses- Histoplasmosis. Protozoan diseases- *Plasmodium*.

Unit V

15 Hrs

Vaccines – Historical background, types of vaccine- live , inactivated vaccines , recombinant vaccines and edible vaccines . Immunization schedule for infants, children and teens.

Text Book :

1. Ananthanarayanan R. and Jayaram Panicker C.K. (1994). Text book of Microbiology. Orient Longman.

Reference Book(s):

1. Baron, E.J. and Tenenbaum 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.

3. Rajesh Bhatia & Rattan Lal Ichhpujani (2004). Essentials of Medical Microbiology. 3rd Edition, Jaypee Brothers Medical Publishers (P) Ltd., New Delhi

4. Roitt, I.M (1998) Essential Immunology Blackwell Scientific Publishers.

5. Kubly, J. (1994). Immunology, 2nd edition, W.H. Freeman and Company. New York.

6. Rajan, S. 2009. Medical Microbiology, MJP Publishers, Chennai.

Web reference(s):

1. www.immunology.org/.

2. www.omicsonline.org/clinical-cellular-immunology.php

3. www.omicsonline.org/medical-microbiology

You tube reference(s):

1. www.immunology101.com: The Basics and Introduction to our Patient- youtube.com

2. www.immunologyandmedicalmicrobiology.com Lecture Mini. youtube.com

Course Code	Course Title	C	H	I	E	T
17U5RMC7	BIOINFORMATICS	3	3	25	75	100

Course Objective

- Learn “from sequence to structure prediction” –concept.
- To familiarize students in applying bioinformatic tools in biomedical research.

Learning Outcomes:

- Students acquire knowledge on computers and various programmes.
- Students have collection of biological database and know how to use it.
- Students get familiarize with sequence analysis and information retrieval systems.

Unit I

9 Hrs

Introduction to Computers - Characteristics and Classification of Computers – Input and Output Devices, Storage devices. Operating system : MS,DOS & Windows . Intranet , Internet, World Wide Web, Browsers, Search Engines – Google, Yahoo. Information access, LAN, WAN.

Unit II

9 Hrs

Introduction to Bioinformatics- History and scope of Bioinformatics. Bioinformatics in India- the flourishing future.. General Introduction of Biological data bases- Nucleic acid databases - Gen Bank, DDBJ and EMBL.

Unit III

9 Hrs

Biological Sequence Databases- Protein data bases- eg. SWISS PROT, primary, composite and secondary. Applications of Bioinformatics

Unit IV

9 Hrs

Sequence analysis- Sequence alignment, pairwise and multiple sequence alignment, local and global alignment, BLAST, FASTA.

Unit V

9 Hrs

Information retrieval systems- Medline, NCBI, Pubmed, OMIM. Genomics and proteomics (Basic concepts), Data mining, ENTREZ and SRS.

Text Book :

1. Ignacimuthu, S.J., (2001). Basic bioinformatics, Phoenix Publishing House Pvt., Ltd., New Delhi.

Reference Book(s):

1. Murthy, C.S.V, (2003). Bioinformatics, Himalaya publishing house.
2. Rastogi, S.C Mendiratta, N and Rastogi, P (2003). Bioinformatics – Concepts, Skills & Applications, CBS Publishers & Distributors.
3. Arthur M. Lesk, (2003). Introduction to Bioinformatics, Oxford University Press, New Delhi.
4. Higgins, D and Taylor, W (Eds), (2000) Bioinformatics- Sequence, structure and databanks, Oxford University Press, New Delhi .
5. Attwood, T.K and Parry-Smith, D.J (2004) Introduction to Bioinformatics, Pearson Education Ltd., New Delhi.
6. Lesk, M.A. (2008). Introduction to Bioinformatics. Oxford Univ. Publishers Ltd., New Delhi.

Web reference(s):

1. www.bioinformatics.org/wiki/...to_Bioinformatics.
2. www.goodreads.com/shelf/show/bioinformatics.
3. www.biostars.org/

You tube reference(s):

1. Introduction to Bioinformatics - Week 1 - Lecture 1 youtube.com
2. Bioinformatics part 3 Sequence alignment introduction youtube.com

Course Code	Course Title	C	H	I	E	T
17U6RME2	FOOD MICROBIOLOGY	7	6	25	75	100

Course Objectives :

- To learn the role of microbes in food preparation, preservation and spoilage
- To understand the quality of food and dairy products.

Learning Outcomes:

- Students understand the role of microbes in food microbiology.
- They get adequate information regarding food preservation and food spoilage.
- Students have gathered information regarding dairy technology.
- Students are able to classify the food borne diseases and food sanitation.

Unit I 18 Hrs

Food as a substrate for microbes – Microbes involved in food microbiology – Mould, Yeast, Bacteria – Factors affecting the growth of Microorganisms in food.

Unit II 18 Hrs

Food preservation – Asepsis – Removal of microorganisms, anaerobic conditions – high and low temperatures – drying – radiation – chemical preservatives – food additives.

Unit III 18 Hrs

Food spoilage – General principles – underlying food spoilage and contamination – Cereals, vegetables, fruits, and poultry products, meat, fish and sea foods.

Unit IV 18 Hrs

Microorganisms in milk and milk products – Yoghurt, butter milk, butter and cheese – Quality control of Milk – Methylene blue reductase test , Standard plate count and Phosphatase tests.

Unit V 18 Hrs

Food-borne diseases – Food poisoning – infective and toxic bacterial food borne diseases- *Staphylococcus aureus* -Staphylococcal food poisoning , *Clostridium botulinum* - Botulism and their diagnosis – Food sanitation and its control measures eg Hazard analysis & critical control points (HACCP).

Text Book :

1. Frazier WC and Westhoff DC (1988). Food Microbiology, 4th Edition, Mc Graw Hill, New York.

Reference Book(s):

1. Garbutt, J., (1997). Essentials of Food Microbiology, Arnold-International Students' edition, London.

2. Atlas, R.M., (1997). Principles of Microbiology, Second edition, WCB/McGraw Hill, U.S.A.,

3. Deak, T, and L.R. Beuchat, (1996). Hand Book of Food Spoilage Yeasts, CRC Press, New York.

4. Adams MR & MO Moss (2005). Food Microbiology. 1st Edition. Reprinted, Published by New Age International (P) Limited. Publishers, New Delhi

5. James M Jay (2004). Modern Food Microbiology. 4th Edition, CBS Publishers & Distributors, New Delhi.

6. Banwart, G.J., (1987). Basic Food Microbiology, CBS Publishers & Distributors, New Delhi.

Web reference(s):

1. www.highveld.com/microbiology

2. www.sciencedirect.com/food-microbiology

3. www.omicsonline.org/scholarly/food-microbiology.

You tube reference(s):

1. www.Food Microbiology youtube.com

2. www. introduction to food microbiology-youtube.com

Course Code	Course title	C	H	I	E	T
17U6RME3	BIOTECHNOLOGY	7	6	25	75	100

Course Objectives:

- To introduce the basic principles of genetic engineering.
- To learn various methods of gene transfer and manipulation.

Learning Outcomes:

- Students are able to trace the development of biotechnological field.
- They are able to classify the plasmids.
- Students gain knowledge about GATT, IPR and patenting of biological material.
- They get information regarding transgenic plants and animals.

Unit I - History and Scope of Biotechnology

18 Hrs

Biotechnological organizations in India. Significance, types of cloning vectors. Plasmids - pBR322, pUC18, Ti plasmids, Lambda phage, cosmids & their applications.

Unit II - Gene manipulation techniques

18 Hrs

Restriction enzymes - Types & properties - *EcoRI*, *HindIII*, *AluI*, *ScaI*. DNA ligation- methods of gene transfer- gene gun method, electroporation and microinjection methods. Ti plasmids- *Agrobacterium* mediated gene transfer.

Unit III -Microbial production of recombinant protein

18 Hrs

Expression vectors–Constitutive and inducible promoters - Production of recombinant DNA proteins using microbial hosts – Production of Insulin.

Unit IV - Intellectual property rights

18 Hrs

GATT & IPR, different forms of IPR, IPR in India, patent co operation treaty, forms of patent, process of patenting, patenting of biological material – A case study of turmeric and basmati rice.

Unit V – Applications of Biotechnology

18 Hrs

Transgenic plant- Bt cotton, Bt brinjal, Basmati rice. Transgenic animals- Dolly, Mice, Fishes. Biosafety aspects.

Text Book :

1.Gupta, P.K., (2004). Biotechnology and Genomics, Rastogi & Co., Meerut

Reference Book(s):

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

2.Glick B.R. & Pasternak, J.J., (2006).Molecular Biotechnology- Principles and Applications of Recombinant DNA technology, ASM press, Washington.

3.Ratledge C & Kristiansen B.,(2008). Basic Biotechnology 3/e, Cambridge University Press.

4.Old, R.W. and S.B. Primrose, (2003). Principles of Gene Manipulation, Blackwell Scientific, London.

5.Mitra S., (2001). Genetic Engineering, Macmillan, India Limited, New Delhi.

6.Satyanarayana V. (2010). Biotechnology, Books and Allied (P) Ltd. Kolkata, India

Web reference(s):

1.www.bio.org/what-biotechnology

2.www.nature.com › subjects

3.www.khanacademy.org/science/biology/biotech-dna-technology

You tube reference(s):

1.[www. Applications of Biotechnology -youtube.com/watch](http://www.youtube.com/watch)

2.[www. Introduction to Biotechnology youtube.com/watch](http://www.youtube.com/watch)

Course Code	Course Title	C	H	I	E	T
17U6RMC8	PHARMACEUTICAL & FORENSIC MICROBIOLOGY	4	4	25	75	100

Course Objectives:

- Students achieve a detailed knowledge and understanding of the sciences underpinning the forensic, pharmaceutical and analytical fields.
- Experience in pharmaceutical and forensic science combined with a range of analytical techniques.

Learning Outcomes:

- After completing the students get placement in Pharma industry and in forensic department.
- They obtain information regarding discovery and designing of drugs.
- They are able to identify microbial contamination of drugs.
- Students will gather information regarding the role of microbes in forensic study and gather various case study.
- They get information regarding bioterrorism i.e., biological warfare.

Unit I

12 Hrs

Aim and Scope of Microbial Pharmacology- Definitions, Pharmacology, Pharmacognosy, Pharmacodynamic and Pharmacogenomics. Microbial drugs and edible vaccines. Biopharmaceuticals- source, production methods, cytokines, haemopoetic growth factors, hormones and therapeutic enzymes.

Unit II

12 Hrs

Drug discovery and developments – Role of molecular recognition in drug design, enzymes and receptors as drug targets, pro drug design and applications.

Unit III

12 Hrs

Microbial contamination of drugs - preventive measures and practices. Concepts of quality control in Biopharmaceuticals, testing the quality of drug, validation and certification of drugs- ISO, WHO and USFDA.

Unit IV

12 Hrs

Microbes in forensic –Principles, characteristics, opportunities and challenges. Guidelines to legal proceeding of forensic biology and sub-disciplines. Microbial ethics, superbug- strain escape, case studies and examples.

Unit V

12 Hrs

Bi terrorism- biological warfare, Biocrime, Bioweapons, new disease outbreak, national and international dimensions, diagnostic methods, sampling methods, sample preservations and analysis. Tools for forensic microbiology. Scientific working group in forensic microbiology.

Text Book :

1. Parikh C. K. (1999). Parikh's Textbook of Medical Jurisprudence, Forensic Medicine and Toxicology. Sixth Ed., CBS Publishers & Distributors Pvt. Ltd., India.

Reference Book(s):

1. Hugo, W.B., Russell, A.D,(1999). Pharmaceutical Microbiology 4th edition. Blackwell scientific publications / Oxford.
2. Russell and Ayliffe, G.A.J(1982) Principles and practice of Disinfection, preservation and sterilization Oxford:
3. Ashutosh Kar, (2008).Pharmaceutical Microbiology, New Age International Publishers, New Delhi.
4. Microbiology in Pharmaceutical Manufacturing – II edition – Richard Prince.
5. The United States Pharmacopoeia (USP 32) NF 27 – Volume 1 (General Chapters)
6. Nanda, B.B. and Tewari, R.K. (2001): Forensic Science in India: A vision for the twenty first century Select Publisher, New Delhi.

Web reference(s):

1. www.pharmacy.umich.edu/pharmsci
2. www.scientiaricerca.com/cops.php
3. www.crimesceneinvestigatoredu.org/what-is-forensic-science/

You tube reference(s):

1. [www. The Real Science of Forensics - YouTube.com](http://www.TheRealScienceofForensics-YouTube.com)
2. [www. The Pharmaceutical world - youtube.com](http://www.ThePharmaceuticalworld-youtube.com)

Course Code	Course title	C	H	I	E	T
17U6RSM4	FERMENTATION TECHNOLOGY	2	2	25	75	100

Course objectives:

- To learn the process involved in the industrial production of microbial products
- To learn processing and recovery of the product.

Learning Outcomes:

- Students understand the concepts of fermentation and role of microbes.
- They get idea regarding media formulation and fermentors.
- Students acquire knowledge on industrial production of various products like Wine , Citric acid, Penicillin, Vitamin B12 and α amylase.
- Students can develop small scale industries with self employment.

Unit I

6 Hrs

Industrially important microorganisms – screening techniques – primary and secondary. Preservation of cultures – Strain improvement .

Unit II

6 Hrs

Aerobic respiration-sulphur, nitrogenous compounds and CO₂ as a final electron acceptor. Fermentation – Alcoholic fermentation.

Unit III

6 Hrs

Media for industrial fermentation – Submerged and solid state fermentation – Down stream processing – Recovery and purification of intracellular and extracellular products

Unit IV

6 Hrs

Fermentors –Components of fermentor – Types of bioreactors – Heat production – heat transfer – Oxygen transfer – Stirring and mixing – Scale up – control of temperature – p^H , Foam pressure – computer applications in fermentation technology.

Unit V

6 Hrs

Industrial production methods - wine, organic acids – citric acid, Antibiotics – penicillin, vitamin – B12, Enzyme - α amylase.

Text Book :

1. Patel, A.H., (1996). Text Book of Industrial Microbiology, MacMillan India Ltd., New Delhi

Reference Book(s):

1. Atlas, R.M., (2000). Microbiology Fundamentals and Applications, MacMillan Pub. Co., New York.
2. Crueger, W. and Crueger, A. (2000). Biotechnology: A Test Book of Industrial Microbiology, Second Edition, Panima Publishing corporation, New Delhi.
3. Demain A.L. and Davies, J.E. (1999). Manual of Industrial Microbiology & Biotechnology. ASM press.
4. Kalaichelvan, P.T. and Arul Pandi, I. (2007). Bioprocess Technology, MJP publishers, Chennai.
5. Casida, J.F. (2010). Industrial Microbiology, New Age International India Pvt. Ltd., New Delhi.
6. Waites, M.J., Morgan, N.L., Rockey, J.S. and Higton, G. (2001). Industrial Microbiology: An Introduction, Blackwell Science, London.

Web reference(s):

1. www.sciencedirect.com/topics/agricultural-and.../industrial-microbiology
2. www.contentextra.com/lifesciences/unit2/unit2home.aspx
3. www.crcpress.com/Modern-Industrial-Microbiology

You tube reference(s):

1. www.IndustrialMicrobiologyintroductionyoutube.com
2. www.IndustrialMicrobiologyyoutube.com

Course code	Course title	C	H	I	E	T
17U6RMP3	PRACTICAL III LAB IN MICROBIAL GENETICS, ENVIRONMENTAL MICROBIOLOGY, MEDICAL MICROBIOLOGY AND BIOINFORMATICS	6	6	50	50	100

S.No	Experiments
1	Isolation of petite mutants
2	Isolation of auxotrophic mutants
3	Isolation of streptomycin resistant mutants using gradient plate technique.
4	Agarose gel electrophoresis of DNA
5	Isolation of <i>Rhizobium</i> sps. from root nodules of legumes
6	Isolation of Phosphate solubilizing Microorganisms from soil.
7	Potability analysis of drinking water. (MPN test)
8	Isolation and Enumeration of RBC from human blood.
9	Isolation and Enumeration of WBC from human blood.
10	Direct agglutination to determine ABO blood grouping
11	Agar gel Ouchterlony double immunodiffusion.
12	Mancini single radial immunodiffusion.
13	Isolation & identification of <i>Streptococci</i> – α , β and γ haemolysis
14	Isolation & identification of UTI infection – <i>E.coli</i> , <i>Proteus</i> , <i>Pseudomonas</i> .
15	Serodiagnosis of Bacterial Infection - Widal Test
16	Kirby – Bauer disc diffusion technique.
17	Qualitative analysis for carbohydrates – Fehling's test & Benedict's test
18	Qualitative analysis for proteins – Biuret test
19	Pairwise sequence alignment (BLAST)
20	Multiple sequence alignment (CLUSTAL –W)

Text Manual:

1. Aneja KR (2005). Experiments in Microbiology, Plant pathology and Biotechnology. 4th Edition, New Age International Publishers, Chennai.
2. James G Cappuccino & Natalie Sherman (2004). Microbiology: A Laboratory Manual. 6th Edition, Published by Pearson Education.

Reference Book(s):

1. Ashok, R. (2000). Antimicrobials in Laboratory Medicine, B.I. Churchill Livingstone. New Delhi.
2. Collee, J.G., A.G. Fraser, B.P. Marmion and A. Simmons (2007). Mackie and McCartney Practical medical Microbiology. Elsevier, New York.
3. Ranjan Kumar De, (2007). Diagnostic Microbiology, Jaypee Brothers publishing, New Delhi.
4. Garvey J.S., Cremer N.E., Sussdorf D.H., (1983). Methods in Immunology, 3rd ed., Benjamin / Cummins Publishing, London.
5. Gunasekaran, P. (1995). Laboratory Manual in Microbiology, New Age International (P) Ltd. Publishers, New Delhi.
6. Kannan, N. (1996). Laboratory Manual in General Microbiology, Palani Paramount Publication, Palani.

Web reference(s):

1. www.juliantrubin.com
2. www.uvi.eu.com
3. www.academia.edu.com

You tube reference(s):

1. www.bacterialgenetics.m.youtube.com
2. www.medicalmicrobiology.m.youtube.com

Course code	Course title	C	H	I	E	T
17U6RMP4	PRACTICAL IV LAB IN FOOD MICROBIOLOGY, BIOTECHNOLOGY, PHARMACEUTICAL & FORENSIC MICROBIOLOGY AND FERMENTATION TECHNOLOGY	6	6	50	50	100

S.No	Experiments
1	Isolation and enumeration of micro – organisms from food sample by the serial dilution agar plating method.
2	Determination of total bacterial population by standard plate count technique
3	Resazurin dye reduction test.
4	Methylene blue test-milk quality determination
5	Vitamin C assay
6	Isolation of bacterial Genomic DNA
7	Isolation of Plasmid DNA
8	Restriction digestion analysis
9	Detection of proteins by S D S - P A G E method
10	Western blotting - demonstration
11	Replica plating method for identifying antibiotic resistant mutants
12	Production of Citric acid by <i>Aspergillus niger</i> by Solid State fermentation.
13	Yeast cell immobilization
14	Alcohol fermentation by <i>Saccharomyces cerevisiae</i> .
15	Estimation of alcohol using Potassium Di-chromate method.
16	Screening of antibiotic producing microbes
17	Screening of bacterial strains for enzyme production.
18	Production and estimation of alcohol
19	Screening of bacterial strains for enzyme alpha amylase production.
20	Yeast biomass estimation by turbidity method

Text Manual:

1. Aneja KR (2005). Experiments in Microbiology, Plant pathology and Biotechnology. 4th Edition, New Age International Publishers, Chennai.
2. James G Cappuccino & Natalie Sherman (2004). Microbiology: A Laboratory Manual. 6th Edition, Published by Pearson Education.

Reference Book(s):

1. Anuj Kumar Rana, (2012). Downstream Processing Techniques in Biotechnology. Global Academic Publishers, New Delhi.
2. Kulanthaivel, S and S. Janarthanan (2012). Practical Manual on Fermentation Technology. I.K. International publishing house. New Delhi 3.
3. Swami, P.M. (2009). Lab Manual of Biotechnology. Rastogi Publications, Meerut.
4. Janarthanan, S. and Vincent, S. (2007). Practical Biotechnology: Methods and protocols, University Press.
5. Gunasekaran, P. (1995). Laboratory Manual in Microbiology, New Age International (P) Ltd. Publishers, New Delhi.
6. Kannan, N. (1996). Laboratory Manual in General Microbiology, Palani Paramount Publication, Palani.

Web reference(s):

1. www.academic.oup.com
2. www.lincoln.ac.com
3. www.microbeonline.com

You tube reference(s):

1. www.microbialfermentation.m.youtube.com
2. www.foodmicro.procedure.m.youtube.com

COMPONENTS OF C.I.A AND QUESTION PATTERN FOR
END SEMESTER EXAMINATIONS

Components of C.I.A

- | | | | |
|------|-------------------------|---|----------|
| i) | Test | - | 15 marks |
| ii) | Assignment/Quiz/Seminar | - | 5 marks |
| iii) | Attendance | - | 5 marks |

Total 25 marks

End Semester Exam Components for U.G.

Time: 3 Hrs

Maximum Marks: 75

Part –A (10 x 1 = 10 Marks)

(Answer ALL questions)

- Objective type Questions.
- Two questions from each unit.

Part –B (5 x 7 = 35 Marks)

(Answer ALL questions)

- Either or pattern.
- Two question from each unit.

Part –C (3 x 10= 30 Marks)
(Answer any THREE questions)

- Out of FIVE questions, THREE questions to be answered
- One question from each unit.

B.Sc. Ancillary Microbiology for B.Sc Biotechnology Course structure

Semester	Sub. Code	Title of the paper	Hours	Credits
I	18U1RAC1	Basic Microbiology	4	2
		Ancillary Practical I*	2	
II	18U2RAC2	Medical Microbiology	4	2
		Ancillary Practical II		
	18U2RAP1	Practical I and II papers	2	2
III	18U3RAC3	Environmental Microbiology	2	2
	18U3RSA1	Mushroom cultivation– Skill Based Elective	2	1
		Ancillary Practical III*	2	
IV	18U4RAC4	Applied Microbiology	2	1
	18U4RNM1	Microbes in Human Welfare (NME)	2	1
		Ancillary Practical IV		
	18U4RAP2	Practical III and IV papers	2	1

***Exam will be conducted at the even semester.**

Course Code	Course Title	C	H	I	E	T
18UIRAC1	BASIC MICROBIOLOGY	2	4	25	75	100

Course Objectives:

- To learn the fundamentals of microbiology.
- To understand the morphology, structural organization of microbes.

Learning Outcomes:

- This paper introduce the foundation of Microbiology. Students traced the history and contribution of various microbiologists. This is a motivation to the students in the field of Microbiology.
- Students are able to isolate the microbes in the lab and note their morphology and staining of bacteria of various types.
- Students properly understood the techniques, types and importance of sterilization in the field of microbiology.
- Students get the information about various antibiotics, biofertilizers and their significance.

Unit I

12 Hrs

Introduction and History of Microbiology – History and recent developments – Spontaneous generation – Biogenesis Contributions of Leeuwenhoek, Louis Pasteur, Robert Koch, Elie Metchinkoff and Fleming.

Unit II

12 Hrs

Morphology and structure of bacteria – types of bacteria based on morphology and flagella, Ultrastructure of bacteria eg. *E.coli* , flagella, fimbriae and Pili. Endospore – Structure, formation and significance.

Unit III

12 Hrs

Cell wall structure and staining of bacteria – Gram positive and Gram negative bacteria. Staining techniques – Simple, differential and special staining. Fungal staining.

Unit IV

12 Hrs

Sterilization and its methods – Principles – dry heat – moist heat – Radiation – Filtration. Disinfection- sanitization , antiseptis and fumigation..

Antibiotics and Biofertilizer - Antibiotics – mode of actions – antimicrobial resistance – Tests for sensitivity to antimicrobial agents. Biofertilizers -*Mycorrhizae* , Biopesticides- *Bacillus thuringiensis*.

Text Book :

1. Dubey RC & Maheswari DK (2005). A text book of Microbiology, Revised Multicolour Edition, Published by S. Chand & Company Limited, New Delhi.

Reference Book(s):

1. Prescott M (2005). Microbiology. 6th Edition, Tata McGraw – Hill, New Delhi.
2. Albert G Moat & John W Foster (2004). Microbial Physiology. 4th Edition, John Wiley & Sons, New York.
3. Robert F Boyd (1984). General Microbiology. Times Mirror / Mosby College Publishers.
4. Purohit SS (2005). Microbiology – Fundamentals and Applications. Reprinted & Published by Student Edition, Behind Nasrani Cinema, Chopasani Road, Jodhpur.
5. Pelczar TR, Chan ECS & Kreig NR (2006) Microbiology. 5th Edition, Tata McGraw – Hill, New Delhi.
6. Schlegel, H.G., (1993). General Microbiology, Seventh edition, Cambridge University Press.

Web reference(s):

1. www.periobasics.com/basic-microbiology.
2. www.microbiologynutsandbolts.co.basic-concepts.
3. www.microbiologyinfo.com/category/basic-microbiology

You tube reference(s):

1. [www. Microbiology - Overview -youtube.com](http://www.Microbiology-Overview-youtube.com)
2. [www. Introduction to microbiology. youtube.com](http://www.Introduction-to-microbiology-youtube.com)

Course Code	Course Title	C	H	I	E	T
18U2RAC2	MEDICAL MICROBIOLOGY	2	4	25	75	100

Course Objectives:

- To know about morphology and pathogenesis of different bacteria, fungi & parasites.
- To understand the pathogenesis mechanism.
- To learn the technique of prevention, control and therapy.

Learning Outcomes:

- This field emphasize in response to dreadful disease such as Cholera, Typhoid, Tuberculosis, Pneumonia, Smallpox.
- This paper helps the students to classify various types of diseases i.e., bacterial, fungal, protozoan, viral etc.
- Students able to know the method of transmission, prevention and control of diseases.

Unit – I Micro flora of human body

12 Hrs

General features of normal flora. Microflora of human body, germ theory of diseases, Contribution of Robert Koch and his postulates and Edward Jenner. Non specific defense mechanisms- general factors- physical, mechanical and chemical barriers.

Unit – II Bacterial disease

12 Hrs

Morphology, Culture, biochemical, pathogenicity, Lab diagnosis and prevention of bacterial diseases – *Staphylococcus aureus*, *Streptococcus pyogenes*, *Salmonella typhi*, *Vibrio cholera* and *Escherichia coli*.

Unit – III Fungal disease

12 Hrs

Superficial Mycosis – black and white piedra, Cutaneous mycosis – Trichophyton, Subcutaneous mycosis – sporothrix, Systemic mycosis – Histoplasmosis, Opportunistic mycosis-Aspergillosis, Candidiasis.

Unit – IV Parasitology

12 Hrs

Life cycle of *Entamoeba histolytica*, *Giardia intestinalis*, *Plasmodium vivax*, *Toxoplasma gondii*, & *Wuchereria bancrofti*.

Unit - V Viral Disease

12 Hrs

DNA viruses – Pox, Adeno, Herpes, Hepatitis. RNA viruses – Picorna, Rhabdo, Retero, Orthomyxo .

Text Book :

1. Ananthanarayan R & Jayaram Paniker CK (2005). Text Book of Microbiology. 7th Edition, Orient Longman Private Limited.

Reference Book(s):

1. Baron EJ, Peterson LR and Tenenbaum SM (1994). Bailey and Scott's – Diagnostic Microbiology. 9th Edition, Mosby Publications.
2. Morag C & Timbury MC (1994). Medical virology. 10th Edition, Churchill Livingstone, London.
3. Patric R Murray (1990). Medical Microbiology. Mosby Publications.
4. Satish Gupte (2006). The Short Text books of Medical Microbiology. 9th Edition, Jaypee Brothers, Medical Publishers (P) Ltd., New Delhi.
5. Chakraborty P. (1995). A Text Book of Microbiology, New Central Book Agency (P) Ltd., Kolkata.
6. Rajan, S. (2009). Medical Microbiology, MJP Publishers, Chennai.

Web reference(s):

1. www.microbiologynutsandbolts.co.uk/medical-students.html
2. www.takealot.com/lecture-notes-medical-microbiology-
3. www.microbiologybytes.wordpress.com/.../instant-notes-in-medical-microbiology

You tube reference(s):

1. [www. Introduction to Medical Microbiology - youtube.com](http://www.youtube.com)
2. [www. Staphylococcus - Medical Microbiology- youtube.com](http://www.youtube.com)

Course code	Course title	C	H	I	E	T
18U2RAP1	PRACTICAL –I & II LAB IN BASIC MICROBIOLOGY AND MEDICAL MICROBIOLOGY	2	2	50	50	100

S.No	Experiments
1.	Microscopic observation of bacteria –Simple and Differential staining
2.	Sterilization methods – moist heat, dry heat, filtration and radiation.
3.	Aseptic transfer of microorganisms.
4.	Preparation of culture media –solid (Selected and differential)and liquid
5.	Isolation of single colonies on solid media – Slant, Streak –Simple and Quadrant
6.	Isolation and identification of pathogenic bacteria from clinical specimens using selection plate methods
7.	Isolation & identification of UTI infection
8.	Kirby – Bauer disc diffusion technique.

Text Manual:

- 1.Aneja KR (2005). Experiments in Microbiology, Plant pathology and Biotechnology. 4th Edition, New Age International Publishers, Chennai.
- 2.James G Cappuccino & Natalie Sherman (2004). Microbiology: A Laboratory Manual. 6th Edition, Published by Pearson Education.

Books for Reference:

1. Ashok, R. (2000). Antimicrobials in Laboratory Medicine, B.I. Churchill Livingstone. New Delhi.
2. Collee, J.G., A.G.Fraser, B.P.Marmion and A.Simmons (2007). Mackie and McCartney Practical medical Microbiology. Elsevier, New York.
3. Ranjan Kumar De, (2007). Diagnostic Microbiology, (For DMLT Students) Jaypee Brothers publishing, New Delhi.
4. Gunasekaran, P. (2008). Laboratory Manual in Microbiology, New Age International (P) Ltd. Publishers, New Delhi

5. Harry W. Seeley, J.R., Paul, J.VanDemark and John J.Lee. (1997). *Microbes in Action – A Laboratory Manual of Microbiology*. W.H.Freeman and Company, New York.
6. Kanika Sharma, (2009). *Manual of Microbiology – Tools and Techniques*. 2nd Edition, Ane Books Pvt. Ltd., New Delhi.

Web reference(s):

- 1.www.biocourseware.com
- 2.www.microbiologyonline.com
- 3.www.ncbionetwork.com

You tube reference(s):

- 1.[www.introduction to microbiology culture.m.youtube.com](http://www.introduction%20to%20microbiology%20culture.m.youtube.com)
- 2.[www.practical microbiology.m.youtube.com](http://www.practical%20microbiology.m.youtube.com)

Course Code	Course Title	C	H	I	E	T
18U3RAC3	ENVIRONMENTAL MICROBIOLOGY	2	2	25	75	100

Course Objectives:

- To understand the role of microbes in different spheres of life.
- Make them to learn analytical techniques of quality control sector in microbiological industry.

Learning Outcomes:

- Students are able to isolate and observe the soil micro flora. They will be able to measure bacterial content of air and identify the airborne diseases.
- Students gather knowledge to analyze the nature of microorganisms and potability of water.
- Students familiarize with specific test for water analysis and sewage water treatment.
- Students are able to analyze the role of microbes in the field of biodegradation.

Unit I

6 Hrs

Microbiology of soil – Rhizosphere, soil microflora, significance of soil microbes. Role of microbes in Biogeochemical cycle- Carbon , Nitrogen and Phosphorus .

Unit II

6 Hrs

Microbiology of air – Enumeration of bacteria from air – Air sampling devices – Air sanitation- Air borne diseases –Tuberculosis , Influenza.

Unit III

6 Hrs

Microbiology of water – Potability of water quality -MPN test – Indicator organisms -IMVIC test – water purification – waterborne diseases and their control measures – Amoebic dysentery, Cholera & Typhoid.

Unit IV

6 Hrs

Microbiology of sewage – chemical and biochemical characteristics of sewage – Sewage treatment – Physical, chemical and biological methods -trickling filter, activated sludge, Lagoon and sewage farming.

Unit V

6 Hrs

Role of microbes in biodegradation – Xenobiotics –Biomining eg. (copper). Biodegradation of paper, oil, pesticide, dyes and heavy metals. Phytoremediation.

Text Book :

1. Vijaya Ramesh K (2004). Environmental Microbiology. 1st Edition, MJP Publishers (A unit of Tamil Nadu Book house), Chennai.

Reference Book(s):

1.Mithell R (1974). Introduction to Environmental Microbiology. Prantice Hall. Inc., Englewood Cliffs, New Jersey.

2.Atlas, RN and Bartha R (1992). Microbial Ecology: Fundamentals and applications. 3rd Edition, Redwood city, Benjamin/Cummings.

3.Joseph C Daniel (1999). Environment Aspects of Microbiology. 1st Edition, Bright sun Publications, Chennai.

4.Subba Rao, N.S., (2000). Advances in Agricultural Microbiology, Oxford & IBH Publ. Co. Pvt. Ltd., New Delhi.

5.Metting, Jr. F.B., (1993). Soil Microbial Ecology, Harcel Dekker Inc., New York.

6.Atlas, M., (2000).Microbiology-Fundamentals and Applications, Collier MacMillan Publication, London

Web reference(s):

1.www.highveld.com/microbiology/environmental-microbiology.

2.www.sfam.org.uk/en/journals/environmental-microbiology.cfm

3.www.sciencedirect.com/science

You tube reference(s):

1.[www.EnvironmentalMicrobiology youtube.com](http://www.EnvironmentalMicrobiology.youtube.com)

2.[www .BI280 Chapter 26 Environmental Microbiology - Part 1 of 2youtube.com](http://www.BI280Chapter26EnvironmentalMicrobiology-Part1of2youtube.com)

Course Code	Course Title	C	H	I	E	T
18U3RSA1	MUSHROOM CULTIVATION	1	2	25	75	100

Course Objectives:

- To acquire the basic knowledge and develop suitable skills involved in mushroom cultivation.
- To study the common cultivation methods for mushrooms and to realize the nutritive and medicinal value of mushrooms.

Learning Outcomes:

- This paper aims to develop students to acquire skills in mushroom cultivation.
- Students are able to develop their mushroom cultivation farm as a self employment.
- Students learn to differentiate edible from poisonous mushroom.
- Students acquire knowledge on storage, marketing of mushroom and trained themselves to prepare various mushroom recipes.
- This paper mainly makes the students to acquire self employment.

Unit I

6 Hrs

Introduction- History- Scope and importance of mushroom cultivation. Present status of mushroom industry in India.

Unit II

6 Hrs

Breeding conditions of mushroom strains -Pure Culture- Media- Preparation and maintenance of mother culture in test tube slants -Petriplates- saline bottle - poly propylene bags.

Unit III

6 Hrs

Cultivation Technology - Infrastructure - culture rack - thatched house - substrates - vessels- inoculation methods. Mushroom bed preparation. Mother spawn and commercial spawn preparation- types , methods of storage. Preservation technology- long term storage - short term storage.

Unit IV

6 Hrs

Cultivation and importance of edible mushroom in India. *Pleurotus species* & *Volvariella species* . Mushroom contamination - disease caused by viruses and fungi. Poisonous Mushrooms.

Unit V

6 Hrs

Significance and applications - Nutritional and Medicinal values of Mushroom - protein - carbohydrates - vitamins - minerals - fibre content. Preparation of mushroom recipes – Pickles and soup.

Text Book :

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991). Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.

Reference Books(s):

1. Aneja, K.R. (1993). Experiments in Microbiology, Plant pathology, Tissue culture and mushroom cultivation, Wishwa Prakashan, New Age International (P) Ltd., New Delhi.

2. Chang, S. and Miles, P.G. (2004). Mushrooms: Cultivation, Nutritional Value, Medicinal Effect, and Environmental Impact, CRC Press online.

3. Swaminathan, M. (1990). Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore.

4. Nita Bahl. (1996). Hand Book on Mushrooms. Oxford and IBH Publishing Company Ltd., New Delhi. 2.

5. Kapoor, J.N. (1989). Mushroom Cultivation, ICAR, New Delhi.

6. Banwari George, J. (1998). Basic food microbiology, 2nd Edition. CBS publishers and distributors, New Delhi.

Web reference(s):

1. www.mushroomcouncil.com/...mushrooms/six-steps-to-mushroom-farming

2. www.krishisewa.com/articles/.../46-technology-for-mushroom-cultivation.

3. www.indiamart.com › Vocational Education and Training

You tube reference(s):

1. [www. Mushroom Production Technology -youtube.com](http://www.MushroomProductionTechnology-youtube.com)

2. [www.mushroom cultivation- youtube.com](http://www.mushroomcultivation-youtube.com)

Course Code	Course Title	C	H	I	E	T
18U4RAC4	APPLIED MICROBIOLOGY	1	2	25	75	100

Course Objectives:

- To learn the role of microbes in food preparation, preservation, spoilage and control.
- To learn the process involved in the industrial production of microbial products.

Learning Outcomes:

- Students know the applications of microbes in various fields i.e., microbes in food industry and they have gathered more information regarding prevention of food borne disease.
- Students familiarize with prevention and control of food spoilage.
- Students get information regarding biofertilizers and their significance.

Unit I

6Hrs

Microorganisms in food –Food preservation – Principles, Asepsis-anaerobic condition, high temperature, low temperature & drying, Food additives, Canning.

Unit II

6Hrs

Fermented foods – Dairy products –(Cheese, Bread) Vegetable –Sauerkraut. Food borne disease – Bacterial disease -*Bacillus*, *Clostridium* and fungal disease- *Candida* and *Aspergillus*.

Unit III

6Hrs

Contamination & spoilage – Meat & meat products, milk & milk products. Spoilage of canned foods. Detection of spoilage, Characterization, prevention and control.

Unit IV

6Hrs

Biofertilizer –Introduction and significance- Bacterial biofertilizer - *Rhizobium* –Algal biofertilizer- *Azolla* - *Cyanobacteria* and its Mass multiplication.

Unit V

6Hrs

Microbial production - Organic acid – (Citric acid), Antibiotics – (Penicillin), Enzyme – (α amylase), Alcohol- (Wine).

Text Book :

1. Pelczar, M.J., E.C.S. Chan and N.R. Kreig. (2009). Microbiology, fifth edition. McGrawHill. Book Co. Singapore

Reference Book(s):

1. Adams MR & MO Moss (2005). Food Microbiology. 1st Edition. Reprinted, Published by New Age International (P) Limited. Publishers, New Delhi.
2. James M Jay (2004). Modern Food Microbiology. 4th Edition, CBS Publishers & Distributors, New Delhi.
3. Singh DP & SK Dwivedi (2005). Environmental Microbiology and Biotechnology. 1st Edition, New Age International (P) Ltd., Publishers, New Delhi.
4. Vijaya Ramesh K (2004). Environmental Microbiology. 1st Edition, MJP Publishers (A Unit of Tamil Nadu Book House) Chennai.
5. Patel A.H . (1996). Industrial microbiology .2nd edition ,Macillan India Ltd.
6. Kulshreshtha, S.K. 1994, Food Preservation, Vikas Publishing House Pvt. Ltd., New Delhi

Web reference(s):

1. www.highveld.com/microbiology
2. www.sciencedirect.com/food-microbiology
3. www.omicsonline.org/scholarly/food-microbiology.

You tube reference(s):

1. www.Food Microbiology youtube.com
2. www. introduction to food microbiology-youtube.com

Course Code	Course Title	C	H	I	E	T
18U4RNM1	MICROBES IN HUMAN WELFARE (NME Paper)	1	2	25	75	100

Course Objectives:

- To get a fundamental knowledge about microbial world for other major students.
- To motivate the non microbiology students to appreciate the role and importance of microbes in day today life.

Learning Outcomes:

- This paper gives a basic and elementary aspects of microbiology to non major / non microbiology students.
- Students acquire knowledge on history and development of microbiological world.
- The students have a clear idea about the beneficial and harmful aspects of microbes in a lucid manner.

Unit I

6 Hrs

History and scope of Microbiology- Spontaneous generation of organism. Contributions of Louis Pasteur, Robert Koch and Edward Jenner.

Unit II

6 Hrs

Role and applications of microorganisms - in food and dairy industries- *Saccharomyces* - *Lactobacillus*, *Agaricus* and *Spirulina* .

Unit III

6 Hrs

Role of microbes in Pharma field- Industrial production of Insulin. Antibiotics – industrial production of Penicillin. Immunization- Vaccines, immunization schedule for children, role of vaccines for Small pox, Rabies and Polio.

Unit IV

6 Hrs

Role of microbes in Agriculture- Soil microflora, Rhizosphere, organic manure. Biofertilizer - *Blue green algae*. Bioinsecticides – *Bacillus thuringiensis*,.

Unit V

6 Hrs

Role of microbes in sewage treatment -Trickling filter, activated sludge, oxidation pond, oxidation ditch. Microbes in the production of biogas. Industrial production of alcohol.

Text Book :

1. Dubey RC and Maheswari DK (2005). A Text book of Microbiology. S.Chand &Company Ltd., New Delhi.

Reference Book(s):

1. Adams, M.R.and Moss. M.O. (1995) .Food Microbiology. New International (P) Ltd. Publishers.
2. Frazies ,W.C. and Westhoff, D.C. (1988) .Food microbiology. 4th Edition. McGraw Hill NY .
3. Alexander. (1997). Introduction to soil Microbiology. John Wiley and Sons. N.Y.
4. Subba Rao, N.S. (1995) .Soil Micro organisms and plant growth, Oxford and IBH publishing Co. Pvt. Ltd.
5. Sundara Rajan S (2003). College Microbiology. Volume 1 & 2. Revised Edition, Vardhana Publications, Bangalore.
6. Powar CB and Daginawala HF (2005). General Microbiology, Volume I & II, 8th Edition, Himalaya Publishing House, Mumbai.

Web reference(s):

- 1.www.periobasics.com/basic-microbiology.
- 2.www.microbiologynutsandbolts.co.basic-concepts.
- 3.www.microbiologyinfo.com/category/basic-microbiology

You tube reference(s):

- 1.[www. Microbiology - Overview -youtube.com](http://www.Microbiology-Overview-youtube.com)
- 2.[www. Introduction to microbiology youtube.com](http://www.Introduction-to-microbiology-youtube.com)

Course code	Course title	C	H	I	E	T
18U4RAP2	PRACTICAL –III & IV LAB IN ENVIRONMENTAL MICROBIOLOGY, MUSHROOM CULTIVATION AND APPLIED MICROBIOLOGY	1	2	50	50	100

S.No	Experiments
1.	Examination of plant diseases – Blast disease in paddy, Blight of rice.
2.	Isolation of Nitrogen fixing bacteria from root nodules of legumes
3.	Study of morphology of cyanobacteria.
4.	Enumeration of bacteria from soil.
5.	Standard plate count technique (SPC)
6.	MPN test.
7.	Methylene Blue Reductase Test
8.	Resazurin dye reduction test.
9.	Yeast cell immobilization
10.	Cultivation of oyster mushroom (<i>Pleurotus spp.</i>) (Demonstration)

Text Manual:

1. Aneja KR (2005). Experiments in Microbiology, Plant pathology and Biotechnology. 4th Edition, New Age International Publishers, Chennai.
2. James G Cappuccino & Natalie Sherman (2004). Microbiology: A Laboratory Manual. 6th Edition, Published by Pearson Education.

Books for Reference:

1. Dubey RC and Maheswari DK (2004). Practical Microbiology 1st Edition, S.Chand & Company Ltd., New Delhi.
2. Kannan N (2003). Handbook of Laboratory Culture Media, Reagents, Stains and Buffers. Panima Publishing Corporation, New Delhi.
3. Kanika Sharma, (2009). Manual of Microbiology – Tools and Techniques. 2nd Edition, Ane Books Pvt. Ltd., New Delhi.

4. Kulanthaivel,S and S. Janarthanan (2012). Practical Manual on Fermentation Technology. I.K. International Publishing house. New Delhi.
5. Gunasekaran, P. (1995). Laboratory Manual in Microbiology, New Age International (P) Ltd. Publishers, New Delhi.
6. Harry W. Seeley, J.R., Paul, J.VanDemark and John J.Lee. (1997). Microbes in Action – A Laboratory Manual of Microbiology. W.H.Freeman and Company, New York.

Web reference(s):

- 1.www.jmm.microresearch.com
- 2.www.environmentalmicro.weebly.com
- 3.www.sciencedirect.com

You tube reference(s):

- 1.www.appliedmicro.m.youtube.com
- 2.www.foodmicro.m.youtube.com

COMPONENTS OF C.I.A AND QUESTION PATTERN FOR
END SEMESTER EXAMINATIONS

Components of C.I.A

i)	Test	-	15 marks
ii)	Assignment/Quiz/Seminar	-	5 marks
iii)	Attendance	-	5 marks

	Total		25 marks

End Semester Exam Components for U.G.

Time: 3 Hrs

Maximum Marks: 75

Part –A (10 x 1 = 10 Marks)

(Answer ALL questions)

- Objective type Questions.
- Two questions from each unit.

Part –B (5 x 7 = 35 Marks)

(Answer ALL questions)

- Either or pattern.
- Two question from each unit.

Part –C (3 x 10= 30 Marks)

(Answer any THREE questions)

- Out of FIVE questions, THREE questions to be answered
- One question from each unit.