

**HINDUSTHAN COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)**  
**COIMBATORE-641 028**  
**M.Sc., MICROBIOLOGY**  
**SCHEME OF EXAMINATIONS – CBCS PATTERN**

*(For the students admitted from the Academic year 2018- 2019 and onwards)*

CODE NO.	SUBJECT	LECTURE HRS /WEEK	EXAM DURATION HRS	MAXIMUM MARKS			CREDIT POINTS
				IE	EE	TOTAL	
<b>First Semester</b>							
16MBP01	Principles of Microbiology	5	3	25	75	100	4
16MBP02	Biomolecules	5	3	25	75	100	4
16MBP03	Microbial physiology and metabolism	5	3	25	75	100	4
16MBP04	Applied Biotechniques	5	3	25	75	100	4
16MBP05	Practical I - Principles of Microbiology	5	6	40	60	100	4
16MBP06	Practical II - Microbial Physiology and Metabolism	5	6	40	60	100	4
<b>Second Semester</b>							
18MBP07	Immunobiology	5	3	25	75	100	4
18MBP08	Molecular Genetics	5	3	25	75	100	4
16MBP09	Medical Microbiology	5	3	25	75	100	4
18MBP10	Virology and Nanotechnology	5	3	25	75	100	4
16MBP11	Practical III - Immunobiology and Medical Microbiology	4	6	40	60	100	4
16MBP12	Practical IV - Microbial genetics and Virology	4	6	40	60	100	4
-	*Institutional/Industrial training	-	-	-	-	-	-
16GSP01	<b><u>Skill Based</u></b> Cyber Security	2	-	100	-	100	2

Third Semester							
16MBP13	Environmental and Agricultural Microbiology	5	3	25	75	100	4
16MBP14	Food and Dairy Microbiology	5	3	25	75	100	4
16MBP15	Fermentation technology	5	3	25	75	100	4
16MBP16	<b>Elective-I</b> a) Recombinant DNA technology (OR) b)Pharmaceutical Microbiology	5	3	25	75	100	3
16MBP17	Practical V – Food Microbiology and Fermentation technology	5	6	40	60	100	4
16MBP18	Practical VI - Recombinant DNA technology, Environmental and Pharmaceutical Microbiology	5	6	40	60	100	4
16MBP19	*Institutional/Industrial training	-	-	100	-	100	2
Fourth Semester							
16MBP20	Research Methodology & Bioinformatics	6	3	25	75	100	4
16MBP21	<b>Elective-II</b> a)Corporate Microbiology (OR) b)Commercial Microbiology	6	3	25	75	100	3
16MBP22	Practical VII - Biostatistics and Bioinformatics	6	3	40	60	100	4
16MBP23	Project work	-	-	50	150	200	4
							<b>90</b>

\* Students should undergo an institutional/industrial training relevant to any one of theory paper for a period of 15 days before semester III and submit report along with attendance certificate.

**REGULATIONS****1. Breakup Marks for IE (Theory papers)**

One Test	- 5 Marks
Model Exam	- 10 Marks
Assignments	- 5 Marks
Seminar	- 5 Marks
-----	
Total	- 25 Marks
-----	

**Question Paper Pattern for IE test I  
(for 50 Marks) (2 hours)****Section-A (18 Marks)****3 x 6=18 Marks**

Answer ALL Questions

**Either or Type****ALL questions carry EQUAL Marks****Section-B (32 Marks)****2 x 16=32 Marks**

Answer any TWO Questions out of three questions.

**ALL questions carry EQUAL Marks**

-----	
<b>Total</b>	<b>50 Marks</b>
-----	

**Question Paper Pattern for IE Model Exam  
(for 75 Marks) (3 hours)****Section-A (30 Marks)****5 x 6=30 Marks**

Answer ALL Questions

One Question from each unit with **Either or Type****ALL questions carry EQUAL Marks****Section-B (45 Marks)****3 x 15=45 Marks**

Answer any THREE Questions out of five questions.

**ALL questions carry EQUAL Marks**

-----	
<b>Total</b>	<b>75 Marks</b>
-----	

**2 a) Components for Practical I. E.**

Components	Marks
Test –I	20
Test - II	20
<b>Total</b>	<b>40</b>

**2 b) Components for Practical E. E.**

Components	Marks
Completion of Experiments	50
Record	5
Viva	5
<b>Total</b>	<b>60</b>

**3. Institutional/ Industrial Training, Mini and Major Project Work**

<u>Institutional / Industrial Training</u>		<u>Mini Project</u>	<u>Project Work</u>	
Components	Marks		Components	Marks
<i>I.E</i>			<i>I. E</i>	
Work Diary	25	-	a) Attendance Marks	20
Report	50	50	b) Review Marks	30
Viva –voce Examination	25	50		50
<b>Total</b>	<b>100</b>	<b>100</b>		
			<i>E.E</i> <sup>*1</sup>	
			a) Final Report Marks	120
			b) Viva-voce Marks	30
				150
			<b>Total</b>	<b>200</b>

\*<sup>1</sup>Evaluation of report and conduct of viva voce will be done jointly by Internal and External Examiners

**4. Components for Cyber Security Paper**

Components	Marks
Two Tests (2 x 40)	80
Two assignments (2 x 10)	20
<b>Total</b>	----- <b>100</b> =====

The question paper pattern is as follows:

- a) Test I – 2 hours [4 out of 7 essay type questions]      4 x 10 = 40Marks  
 b) Test II – 2 hours [4 out of 7 essay type questions]      4 x 10 = 40 Marks

-----  
**Total = 80 Marks**  
 -----

- The passing minimum for Cyber Security is 50  
 In case the candidate fails to secure 50 marks which is the passing minimum, he/she may have to reappear for the same in the subsequent semesters.

**5. Question Paper Pattern for EE Theory**

**(for 75 Marks) (3 hours)**

**Section-A (30 Marks)**

**5 x 6=30 Marks**

Answer **ALL** Questions

One Question from each unit with **Either or Type**

**ALL questions carry EQUAL Marks**

**Section-B (45 Marks)**

**3 x15=45 Marks**

Answer any **THREE** Questions out of five questions.

**ALL questions carry EQUAL Marks**

-----  
**Total 75 Marks**  
 -----


-----X-----

Code No	Subject	Semester No
16MBP01	PRINCIPLES OF MICROBIOLOGY	I
<b>Objective:</b>	To impart knowledge on the basics and fundamentals of microbial world	
<b>Course Outcome</b>	On completion of the course, students learn about <ul style="list-style-type: none"> <li>• The contributions of different scientists in the field of Microbiology</li> <li>• Microbial taxonomy - concepts and techniques for identification</li> <li>• Different methods of sterilization</li> <li>• Students obtain the skills to handle the microscopes and the identification of the microorganisms, so they can be employed in the research and in the medical laboratories</li> <li>• Preparation of media and pure culture techniques</li> </ul>	
Unit No	Topics	Hours
Unit I	<b>History and Development</b> Scope of Microbiology - Contributions - Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Edward Jenner, Iwanowski, Elie Metchnikoff, Beijerinck, Winogradsky, Paul Ehrlich.	12
Unit II	<b>Microbial Taxonomy</b> Domains and kingdoms of life - Ultra structure of a bacterial cell- Bacterial Nomenclature – Classification of bacteria by physiological, metabolic, serological and molecular methods –Bergey’s manual of systematic bacteriology- General characteristics of protozoa, classification of Fungi (Alexopolus), algae (Fritsch).	12
Unit III	<b>Sterilization and Disinfection</b> Physical methods – heat – Filtration (Membrane & HEPA). chemical methods – phenols, alcohols, halogens, aldehydes, heavy metals, dyes and quaternary ammonium compounds.	12
Unit IV	<b>Microscopy and Staining</b> Principle and applications of Light microscopes- Bright field- Dark field, Phase Contrast, Fluorescence, Con-focal scanning microscope and electron (TEM, SEM) Microscopes. Preparation and staining of specimens, staining- Simple, Gram, Acid fast, Negative, Capsule, Endospore, Flagellar and fungal staining.	12
Unit V	<b>Media preparation</b> Types of media, Pure culture techniques – Tube dilution, pour, spread and streak plate. Anaerobic culture techniques – Wright’s tube, Roll tube, McIntosh fildes jar method. Culture collections.	12

**Text Book:** Michael J. Pelczar, Jr. E.C.S. Chan, Moel., "Microbiology", Mc Graw Hill Book R. Krieg, New Delhi

#### Reference Books

1. Prescott, L.M J.P. Harley and C.A. Klein., "Microbiology", Wm, C. Brown publishers, Boston.
2. Stainer R.Y. Ingraham J.L. Wheelis H.H and Painter P.R., "The Microbial world", Eagle Works Cliffs N.J. Prentica Hall.
3. Holt, J.S., Kreig, N.R., Sneath, P.H.A and Williams, S.T., "Bergey's Manual of Determinative Bacteriology", Williams and Wilkins, Baltimore.
4. R.C Dubey., "Textbook of Microbiology", S. Chand and Company Ltd, New Delhi.

  
HEAD

Department of Microbiology,  
 Pandurathan College of Arts & Science  
 Coimbatore - 641 028

Code No	Subject	Semester No
16MBP02	BIOMOLECULES	I
<b>Objective:</b>	To emphasis the importance of biomolecules	
<b>Course Outcome</b>	On completion of the course, students learn about: <ul style="list-style-type: none"> <li>• The importance of Macromolecules and micromolecules</li> <li>• The characteristics and action of enzymes</li> <li>• The principles of thermodynamics</li> <li>• The properties and physiological functions of vitamins</li> <li>• The hormones and their disorders &amp; syndromes</li> </ul>	
Unit No	Topics	Hours
<b>Unit I</b>	<b>Fundamental building blocks</b> Macromolecules – Introduction, classification, structure and functions of Carbohydrates – Lipids – Proteins - Nucleic acids.	12
<b>Unit II</b>	<b>Enzymes</b> Classification of enzymes with examples, coenzymes and cofactors – Active site: Lock and key model- induced fit hypothesis. Factors affecting enzyme activity. Type of inhibition of enzyme action. Chemical and industrial applications of enzymes. Enzyme inhibitors - oxidases, dehydrogenases, oxygenases	12
<b>Unit III</b>	<b>Bioenergetics</b> Basic principles of thermodynamics – entropy, enthalpy and free energy. High energy phosphates, oxidation – reduction reactions — organization of the respiratory chain in mitochondria.	12
<b>Unit IV</b>	<b>Vitamins and Minerals</b> Classification, properties and physiological functions of vitamins – fat soluble – (A,D,E and K) and water soluble (B and C) – deficiency – causes, manifestations and management – Macronutrients – Physiological importance of calcium , Phosphorus, Magnesium, Sodium and Potassium – Trace elements – Physiological functions of Iron, Copper and Iodine.	12
<b>Unit V</b>	<b>Hormones and Inborn errors of Metabolism</b> General characteristics – classification – chemistry and functions of thyroid stimulating hormone (TSH) – oxytocin – vasopressin – thyroid – tyrosine – pancreas – insulin – diabetes. Hereditary anemias – sickle cell anemia and thalassemia – errors of carbohydrate – lipid and protein metabolism – disease and syndromes.	12

**Text Book:** Deb A.C., "Fundamentals of biochemistry", New Central Book Agency, Calcutta.

**Reference Books**

1. Ambika Shanmugam., "Fundamentals of Biochemistry for Medical students" WMC Brown Publishers, New Delhi.
2. Sathyanarayana U., "Biochemistry", Books and Allied Pvt. Ltd., New Delhi.
3. Lehninger A.L., and Nelson D.L., "Principles of Biochemistry Cox- CBS Publishers, New delhi.
4. Lubert Stryer., "Biochemistry", Freeman and Company, New York.

Code No	Subject	Semester No
16MBP03	<b>MICROBIAL PHYSIOLOGY AND METABOLISM</b>	<b>I</b>
<b>Objective:</b>	To impart knowledge on various aspects of Microbial physiology and metabolism	
<b>Course Outcome</b>	On completion of the course, students learn about <ul style="list-style-type: none"> <li>• Subcellular structure of microbes</li> <li>• Nutritional requirements of microorganisms</li> <li>• Aerobic respiration and photosynthesis</li> <li>• Anaerobic respiration and fermentation</li> <li>• Cell signaling</li> </ul>	
Unit No	Topics	Hours
Unit I	<b>Bacterial cell structure</b> Subcellular structures of Microbes- Capsule, slime layer- cell wall- Gram positive and Gram negative, cytoplasmic membrane - pili- flagella - storage granules- ribosomes - genetic material - Comparison of prokaryotic and eukaryotic organisms- Sporulation – General characteristics of Archaeobacteria.	12
Unit II	<b>Nutrition</b> Nutritional requirements of Microorganisms –nutritional groups of microbes- transport mechanisms and types-simple diffusion – facilitated diffusion- active transport- group translocation- Ion transport. Growth curve – generation time - factors influencing microbial growth –growth kinetics-Batch and continuous cultivation -synchronous growth -diauxic growth.	12
Unit III	<b>Aerobic respiration and Photosynthesis</b> EMP – HMP – ED pathways – glyoxyalate cycle – TCA cycle- Electron transport chain-carriers– Oxidative and Substrate level phosphorylation. Photosynthesis – Oxygenic and Anoxygenic, Carbon dioxide fixation.	12
Unit IV	<b>Anaerobic respiration and Fermentation</b> Sulphur, nitrogenous compounds and CO <sub>2</sub> as final electron acceptor - Fermentation – alcoholic, lactic acid, propionic, butanediol, acetate, amino acid and mixed acid fermentation.	12
Unit V	<b>Biosynthesis and cell signaling</b> Biosynthesis of bacterial cell wall, biosynthesis of aminoacids (Pyruvate family)- Biosynthesis of fatty acids- general and Denovo pathway- biosynthesis of purine and pyrimidine nucleotides, salvage pathways- bioluminescence. Cell signaling- types-mechanisms-G-protein linked receptors, hormone receptors and second messengers	12

**Text Book:** Caldwell DR., "Microbial physiology and Metabolism", WMC Brown Publishers, New Delhi.

**Reference Books**

1. Prescott, Harley, and Klein's "Microbiology" Joanne M. Willey, Linda Sherwood, Christopher J. Woolverton. McGraw-Hill Higher Education New York.
2. Moat, A.G. and Foster, J.W., "Microbial Physiology", Springer, New York.
3. Schlegel HG., "Microbiology" Cambridge University press, London.
4. Stainer, R.Y., Ingraham, J.L., Wheelis, M.L. and Painter, P.R., "Microbial Physiology", McGraw-Hill Higher Education New York.

*[Signature]*  
HEAD

Department of Microbiology,  
Rajasthan College of Arts & Science,  
Coimbatore 641 018



Code No	Subject	Semester No
16MBP04	APPLIED BIOTECHNIQUES	I
<b>Objective:</b>	To impart knowledge on various aspects of biological techniques	
<b>Course Outcome</b>	On completion of the course, students learn <ul style="list-style-type: none"> <li>• The instrumentation and application of different types of Spectroscopes and NMR</li> <li>• The various macromolecules and their separation using centrifugation</li> <li>• To comprehend the chromatographic techniques</li> <li>• The Electrophoretic principles</li> <li>• To discuss about the use of radioisotopes in life science</li> </ul>	
Unit No	Topics	Hours
Unit I	<b>Spectrophotometry</b> Principles, instrumentation and applications of spectrophotometry - UV - Visible and IR spectroscopy. Principles theory and applications of spectrofluometry - Flame photometry - NMR - 3D structure by X-ray diffraction - ESR - Colorimetry.	15
Unit II	<b>Centrifugation techniques</b> Principle and Instrumentation of centrifuges- design -preparative rotors-analytical samples containers- separation methods in preparative ultracentrifuges - density gradient separations - applications of preparative and analytical ultracentrifuges - safety aspects in the use of centrifuges.	15
Unit III	<b>Chromatographic techniques</b> Principles - instrumentation- Paper - TLC - HPLC - GC - gel filtration - Ion -Exchange - Column - Hydroxy apatite - Immuno adsorption - Affinity chromatography - applications.	15
Unit IV	<b>Electrophoresis</b> Principles and applications of Paper - starch gel - agarose - native and denaturing PAGE - 2D PAGE electrophoresis - isoelectrophoresis - isoelectrofocusing.	15
Unit V	<b>Radioisotopes</b> Use of radio isotopes in life sciences- radioactive labeling - principles and applications of tracer techniques- detection and measurement of radioactivity using ionization chamber - Geiger Muller and scintillation counters - autoradiography and its applications.	15

*Text Book: Keith Wilson and John Walker., "Practical Biochemistry", WMC Brown Publishers, New Delhi.*

#### Reference Books

1. David Freifelder., "Physical Biochemistry", Joanne M. Willey, Linda Sherwood, Christopher J. Woolverton. McGraw-Hill Higher Education New York.
2. Boyer., "Practical Biochemistry", Springer, New York.
3. Kathleen Talaro and Arthur Talaro ., " Foundation in Microbiology" WCB Publishers, London.
4. Lehninger A.L., and Nelson D.L., " Principles of Biochemistry Cox- CBS Publishers, New delhi.

Code No	Subject	Semester No
16MBP05	PRACTICAL I - PRINCIPLES OF MICROBIOLOGY	I
<b>Objective:</b>	To impart practical knowledge on Principles of Microbiology	
<b>Course Outcome</b>	On completion of the course, students learn to <ul style="list-style-type: none"> <li>• Outline laboratory safety and handling of glasswares</li> <li>• Develop basic skills in aseptic techniques</li> <li>• Perform various staining techniques</li> <li>• Determine the motility testing</li> <li>• Cultivate bacteria with different cultivation technique</li> <li>• Determine the size of the bacteria</li> <li>• Examine the protozoa under microscope by using hay infusion method</li> </ul>	
<b>LIST OF EXPERIMENTS</b>		
<ol style="list-style-type: none"> <li>1. Laboratory Safety</li> <li>2. Cleaning of glasswares</li> <li>3. Media preparation–Solid and liquid, Selective and differential media and pure culture technique streak, spread and pour plates.</li> <li>4. Determination of microbial size (Micrometry) – Bacteria and Yeast.</li> <li>5. Motility determination- Hanging drop and agar deep</li> <li>6. Isolation and enumeration of microorganisms from soil: bacteria, fungi and actinomycetes.</li> <li>7. Staining techniques               <ol style="list-style-type: none"> <li>a) Gram Staining</li> <li>b) Acid fast Staining</li> <li>c) Endospore Staining</li> <li>d) Capsule Staining</li> </ol> </li> <li>8. Fungal wet mount – LPCB</li> <li>9. Algal wet mount-filamentous and colonial forms</li> <li>10. Examination of Hay infusion broth under light microscope for protozoa</li> <li>11. Anaerobic culture techniques               <ol style="list-style-type: none"> <li>a) Wright's tube method</li> </ol> </li> <li>12. Indoor air quality analysis using settle plate method</li> </ol>		

Code No	Subject	Semester No
16MBP06	PRACTICAL II MICROBIAL PHYSIOLOGY AND METABOLISM	I
<b>Objective:</b>	To impart practical knowledge on Microbial physiology and Metabolism	
<b>Course Outcome</b>	On completion of the course, students learn about: <ul style="list-style-type: none"> <li>• Growth curve</li> <li>• Various factors affecting growth</li> <li>• Biochemical characterization of microorganisms</li> <li>• Separation of biomolecules by different methods</li> </ul>	
<b>LIST OF EXPERIMENTS</b>		
<ol style="list-style-type: none"> <li>1. Growth curve- determination of generation time <ol style="list-style-type: none"> <li>a) Direct microscopy- Neubauer counting chamber</li> <li>b) Viable count</li> <li>c) turbidity method</li> </ol> </li> <li>2. Effect of various intrinsic factors on the growth of bacterium and fungi <ol style="list-style-type: none"> <li>a) pH</li> <li>b) Temperature</li> </ol> </li> <li>3. Thermal death point</li> <li>4. Thermal death time</li> <li>5. Biochemical characterization <ol style="list-style-type: none"> <li>a) IMViC test</li> <li>b) Catalase test</li> <li>c) Oxidase test</li> <li>d) TSI agar test</li> <li>e) Urease test</li> <li>f) Nitrate reduction test</li> <li>g) Carbohydrate fermentation test</li> <li>h) Coagulase test</li> </ol> </li> <li>6. Polymer hydrolysis <ol style="list-style-type: none"> <li>a) Starch</li> <li>b) Gelatin</li> <li>c) Casein</li> </ol> </li> <li>7. Isolation of bioluminescence bacteria from sea water.</li> <li>8. Separation of amino acids by paper chromatography</li> <li>9. Separation of sugars by thin layer chromatography</li> <li>10. Separation of proteins by SDS- PAGE</li> </ol>		

Code No	Subject	Semester No
18MBP07	IMMUNOBIOLOGY	II
<b>Objective:</b>	To promote a stream of new information about the immune system	
<b>Course Outcome</b>	On completion of the course, students learn about: <ul style="list-style-type: none"> <li>• Immune system and immune response</li> <li>• Features of antigen and antibodies</li> <li>• Hypersensitivity and complement system</li> <li>• Autoimmune diseases and immunodeficiency diseases</li> <li>• Antigen antibody interaction and immunotechniques.</li> </ul>	
Unit No	Topics	Hours
Unit I	<b>Introduction to Immunobiology</b> History of Immunology- Types of immunity – Innate and Adaptive - Immune response- Humoral- cell mediated -Hematopoiesis–cells and organs involved in immune system-Phagocytosis.	12
Unit II	<b>Antigen and Antibodies</b> Antigens – features of antigens – epitopes, cross reactivity, cell surface antigens and auto antigens- haptens- adjuvants and its significance. Immunoglobulin – structure, properties-types- immunoglobulin variation, class switching- monoclonal antibody production- applications.	12
Unit III	<b>Hypersensitivity and Complement system</b> Hypersensitivity –types- mechanisms- complement system - classical, alternate, lectine pathway, regulation of the complement system- regulation of Immune system – cytokines-tolerance - T cell tolerance, B cell tolerance.	12
Unit IV	<b>Transplantation and disorders of Immune system</b> MHC, types of graft, mechanism of graft rejection, acceptance and prevention - cancer - types- HLA typing tumor antigens-immunity against cancer-immunotherapy- Vaccine-types and vaccination. Autoimmune diseases and immunodeficiency diseases.	12
Unit V	<b>Immunotechnology</b> Antigen-Antibody interaction – affinity- avidity -Principle and applications of agglutination, precipitation, complement fixation test, immuno fluorescence, radio immuno assay, enzyme immunoassay, immuno electron microscopy, flow cytometry and cell cytotoxicity assay-immunomic microarray-lymphochip. Computational Vaccinology-B cell epitope prediction, T cell epitope prediction-isotope prediction-immunopolymorphism-study of polymorphic gene in immunosystem..	12

**Text Books:** Tizard, R.I., "Immunology-An Introduction", Saunder's College publishers, Philadelphia.

#### Reference Books

- 1) Coleman, R.M., Lourbard, M.F and Sicard, R.E., "Fundamental immunology", W.H. Freeman and co., New York.
- 2) Roitt, I.M., "Essential of Immunology", Black Well Scientific Publishers, New York.
- 3) Ashim K. Chakravarthy., Immunology, TataMcGraw-Hill, New Delhi
- 4) Kuby. J., "Immunology", W.H. Freeman and co., New York.

Code No	Subject	Semester No
18MBP08	MOLECULAR GENETICS	II
<b>Objective:</b>	To impart knowledge on various aspects of molecular genetics	
<b>Course Outcome</b>	Upon successful completion of this course, the students will be able to <ul style="list-style-type: none"> <li>• Understand the structure and organization of genetic material</li> <li>• Learn the enzymology and replication of DNA</li> <li>• Comprehend translation process</li> <li>• Understand the mutagenic agents, DNA damage and repair mechanisms.</li> <li>• Learn gene regulation and gene transfer methods</li> </ul>	
Unit No	Topics	Hours
<b>Unit I</b>	<b>Genetic material and Replication</b> Genetics - Mendelian principles, Segregation, Independent Assortment, Dominance –Identification of genetic material (Griffith, Hershey & Chase, Avery's Experiments), RNA as a genetic material, Watson and Crick model of DNA. DNA replication – Meselson & Stahl experiment- Bidirectional and Rolling circle replication. Differences in Prokaryotes and Eukaryotic replication.	<b>12</b>
<b>Unit II</b>	<b>Transcription and Translation</b> Transcription – Initiation, Elongation and Termination- synthesis of mRNA in Prokaryotes and Eukaryotes. Structure of rRNA, mRNA and tRNA – RNA processing-Capping and Polyadenylation. Genetic code – Translation - Initiation, Elongation and Termination – antisense RNA - signal sequences and Protein transport.	<b>12</b>
<b>Unit III</b>	<b>DNA damage and repair</b> Mutation – Spontaneous and Induced mutations- Physical and chemical mutagens- Site specific mutagenesis-Mutagenicity testing (Ames test) - DNA repair, Direct repair, Mechanism of excision repair, Nucleotide excision repair and SOS repair.	<b>12</b>
<b>Unit IV</b>	<b>Concept of gene and gene regulation</b> Organization of gene in Prokaryotes & Eukaryotes – introduction- Operon concept, lac, trp & ara operons, Promoters, terminators, attenuators and antiterminators, induction and repression; the lac operon catabolite repression.	<b>12</b>
<b>Unit V</b>	<b>Gene transfer Mechanisms and Transposons</b> Genetic Recombination – Homologous recombination, Site specific recombination. Conjugation $F^+$ v/s $F^-$ , $Hfr^+$ v/s $F^-$ , $F'$ v/s $F^-$ , Transformation – Transduction (Generalized & Specialized)-Phage genetics - Genetic mapping of $T_4$ Phage, Transposable elements- Insertion sequence, complex, compound.	<b>12</b>

**Text Book:** David Freifelder., "Molecular biology", Narosa publishing house, New Delhi.

**Reference Books**

1. Gardner, E. J, Simmons, M J & D P Snustard., "Principles of Genetics", John Wiley & Sons, New York.
2. Robert H. Tamarin., "Principles of Genetics", WmC Brown Publishers, New York.
3. Lewin.B., "Gene", Oxford University Press, New York
4. Klug .W.S. & Cummings, MR., "Essentials of Genetics", Mentics Hail, NewJersey.

Code No	Subject	Semester No
16MBP09	MEDICAL MICROBIOLOGY	II
<b>Objective:</b>	To impart knowledge on the basic principles, etiological agents and pathology of global infectious diseases	
<b>Course Outcome</b>	Upon successful completion of this course, the students learn about <ul style="list-style-type: none"> <li>• Infection, Collection ,transport and examination of clinical specimen</li> <li>• Pathogenecity and laboratory diagnosis of gram positive organisms</li> <li>• Common gram negative organisms</li> <li>• Superficial, subcutaneous and systemic mycoses</li> <li>• The life cycle, pathogenecity and laboratory diagnosis of parasitic infections</li> </ul>	
Unit No	Topics	Hours
<b>Unit I</b>	<b>Infection</b> Infection- sources and methods of transmission -Infectious disease cycle – sample collection, transport and examination of clinical specimens-blood, Sputum, CSF, urine, stool, serological and molecular methods for diagnosis-Antibiogram	12
<b>Unit II</b>	<b>Gram positive organisms</b> Bacteriology: Gram positive organisms - morphology, pathogenicity, laboratory diagnosis, prophylaxis and treatment of <i>Staphylococcus aureus</i> , <i>Streptococcus pyogenes</i> , <i>Bacillus anthracis</i> , <i>Corynebacterium diphtheriae</i> , <i>Clostridium tetani</i> , <i>Mycobacterium tuberculosis</i> , <i>Mycobacterium leprae</i> . <i>Spirochaetes</i> – <i>Treponema pallidum</i> , and <i>Leptospira icterohaemorrhagiae</i> .	12
<b>Unit III</b>	<b>Gram negative organisms</b> Bacteriology: Gram negative organisms - Morphology, pathogenicity, laboratory diagnosis, prophylaxis and treatment of <i>E. coli</i> , <i>Klebsiella pneumoniae</i> , <i>Salmonella typhi</i> , <i>Shigella dysenteriae</i> , <i>Pseudomonas aeruginosa</i> , <i>Vibrio cholerae</i> , <i>Bordetella pertussis</i> , <i>Yersinia pestis</i> , <i>Neisseria gonorrhoeae</i> , and <i>Neisseria meningitidis</i> .	12
<b>Unit IV</b>	<b>Mycology</b> Mycoses – superficial, subcutaneous and systemic infections – Dermatophytoses, <i>Cryptococcosis</i> , madura mycosis, <i>Histoplasmosis</i> , <i>Candida albicans</i> , <i>Aspergillosis</i> and <i>Blastomycosis</i> .	12
<b>Unit V</b>	<b>Parasitology</b> Life cycle, Pathogenicity and laboratory diagnosis of <i>Entamoeba histolytica</i> , <i>Trichomonas vaginalis</i> , <i>Plasmodium vivax</i> , <i>Leishmania donovani</i> , <i>Taenia solium</i> , <i>Ascaris lumbricoides</i> , <i>Enterobius vermicularis</i> and <i>Wuchereria bancrofti</i> .	12

**Text Book:** Ananthanarayan and Jayaram Paniker., "Textbook of Microbiology", University Press India Pvt Ltd. New Delhi.

**Reference Books**

1. Jawetz E Melnic JL and Adelberg EA , review of Medical Microbiology Lange Medical Publications, USA.
2. Mackie and Mc catney, , Medical Microbiology No I and II. Churchill Livingstone, USA.
3. Bailey and Scotts "Diagnostic Microbiology", 9th edition, Baron and Finegold CV Mosby Publications, USA.
4. David Greenwood "Medical Microbiology", Churchill Livingstone, USA.

Code No	Subject	Semester No
18MBP10	<b>VIROLOGY AND NANOTECHNOLOGY</b>	II
<b>Objective:</b>	To emphasize the knowledge about Viruses and Nanoscience	
<b>Course Outcome</b>	Upon successful completion of this course, the students will be able to <ul style="list-style-type: none"> <li>• Understand the structure and cultivation of viruses</li> <li>• Understand life cycle of bacteriophage, phage typing methods</li> <li>• To describe the life cycle of plant and animal viruses</li> <li>• Learn the basic concepts of Nanotechnology</li> <li>• Understand the applications of Nanotechnology in medical, pharmaceutical and other industries</li> </ul>	
Unit No	Topics	Hours
<b>Unit I</b>	<b>Introduction to virology</b> History and discovery of viruses - classification of viruses - properties of viruses structure. Cultivation of viruses. Sub viral agents – viroids, virusoids and prions-purification of virus-antiviral agents	12
<b>Unit II</b>	<b>Bacterial viruses</b> Lytic and Lysogenic cycle; structural organization, replication of $\phi$ X 174, Ms <sub>2</sub> , M <sub>13</sub> , Mu, T <sub>4</sub> , Lambda, P <sub>i</sub> , phages; Phage typing – application.	12
<b>Unit III</b>	<b>Plant and animal viruses</b> Plant viruses –Structure and reproductive Life cycle of type species of plant viruses like (TMV, cauliflower mosaic virus). Viruses of algae & fungi. Viral diseases of animals and human – pathogenicity, diagnosis, treatment of Picorna, Orthomyxo, Paramyxo, Rhabdo, HIV, Pox, Herpes and Hepatitis viruses, Ebola virus, Zika and Dengue viruses.	12
<b>Unit IV</b>	<b>General concepts of Nanotechnology</b> Introduction and classification: Classification of Nanostructures-1D,2D and 3D nanomaterials- Nanoscale Architecture. Synthesis of Nanomaterials: Top down –ballmillerling: Bottom up-co-precipitation-sol-gel- electrodeposition -using natural nanoparticles –chemical vapor deposition.	12
<b>Unit V</b>	<b>Nanomaterial</b> The carbon Nanotube-New forms of carbon-Types of Nanotubes-Formation of Nanotubes-Uses for nanotubes-Biological Applications. Applications of Nanomaterials: Applications of batteries-high power magnets.	12

**Text Book :** Jay A Levy, Heinz Fraenkel-conrat, Robert A Owens., "Virology", Prentice Hall, Englewood cliffs, New jersey.

#### Reference Books

1. Luria S.E. Darnel, J.E Jr. Baltimore. D and Campbell A., "General Virology", Wiley and sons, France.
2. Nicholas H. Acheson., "Fundamentals of Molecular Virology", Wiley Publications, France.
3. Shubhrata.R.Mishra., "Virus and plant diseases", Discovery publishing house, New Delhi.
4. K.K.Jain., "Nano Biotechnology", Horizons Biosciences, Tamil Nadu.

Code No	Subject	Semester No
16MBP11	<b>PRACTICAL III</b> <b>IMMUNOBIOLOGY AND MEDICAL MICROBIOLOGY</b>	<b>II</b>
<b>Objective:</b>	To impart practical knowledge on Immunobiology and Medical Microbiology	
<b>Course Outcome</b>	<p>On completion of the course, students learn about:</p> <ul style="list-style-type: none"> <li>• Identification of pathogens from clinical specimen</li> <li>• Identification of clinically important fungi</li> <li>• Precipitation and agglutination reactions</li> <li>• Performing antibiotic sensitivity testing</li> <li>• Immunological diagnostic tests</li> </ul>	
<b>LIST OF EXPERIMENTS</b>		
<p>1) Diagnostic Microbiology: Isolation and identification of pathogens from clinical specimens</p> <ol style="list-style-type: none"> <li>a) Throat swab</li> <li>b) Urine</li> <li>c) Pus</li> <li>d) Faeces</li> <li>e) Blood.</li> </ol> <p>2. Isolation and identification of clinically important fungi</p> <ol style="list-style-type: none"> <li>a) <i>Candida albicans</i></li> <li>b) <i>Aspergillus sp.</i>,</li> <li>c) <i>Cryptococcus neoformans</i></li> </ol> <p>3. Antibiotic susceptibility test - Kirby Bauer technique</p> <p>4. Examination of blood smear study for <i>Plasmodium sp.</i>,</p> <p>5. Agglutination reaction - Blood grouping &amp; Rh Typing.</p> <p>6. Immunodiffusion – ODD Test.</p> <p>7. Diagnostic Tests – WIDAL (Slide &amp; Tube Test), RA, ASO, CRP, RPR.</p> <p>8. Identification and enumeration of Leucocytes</p> <p>9. Immunoelectrophoresis – Counter Current &amp; Rocket Immunoelectrophoresis.</p> <p>10. ELISA.</p> <p>11. Phenol co-efficient test.</p>		



Code No	Subject	Semester No
16MBP12	PRACTICAL IV MICROBIAL GENETICS AND VIROLOGY	II
<b>Objective:</b>	To impart practical knowledge on Microbial genetics and Virology	
<b>Course Outcome</b>	On completion of the course, students learn about: <ul style="list-style-type: none"> <li>• Various tests for the separation of Biomolecules</li> <li>• Identification of mutants using different mutagenic agents</li> <li>• Cultivation of viruses</li> <li>• Detection of coliphage from sewage water</li> </ul>	
<b>LIST OF EXPERIMENTS</b>		
<ol style="list-style-type: none"> <li>1) Isolation of chromosomal DNA from microbes</li> <li>2) Quantification of DNA by spectrometry.</li> <li>3) Size determination and fractionation of protein by SDS PAGE.</li> <li>4) Isolation of Plasmids from microbes</li> <li>5) Isolation of drug resistant mutants by UV</li> <li>6) Isolation of auxotrophic mutants by chemical agents</li> <li>7) Isolation of mutants by Gradient plate and replica plate methods</li> <li>8) Virus cultivation – Egg inoculation techniques</li> <li>9) Isolation of Coliphage</li> <li>10) Titration of Coliphage</li> </ol>		



HEAD

Department of Microbiology  
Sri. J. J. S. College of Arts & Science  
Coimbatore - 641 028

Code No	Subject	Semester No
16MBP13	ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY	III
<b>Objective:</b>	To emphasis the knowledge on soil microflora and its implication in agriculture	
<b>Course Outcome</b>	On completion of the course, students learn about: <ul style="list-style-type: none"> <li>• Microbe Microbe interaction</li> <li>• Biofertilizers</li> <li>• Bioremediation</li> <li>• Bacteriological analysis of Water and Air</li> <li>• Distribution of microorganisms in water and its significance</li> </ul>	
Unit No	Topics	Hours
<b>Unit I</b>	<b>Microbial interaction</b> Soil micro flora – weathering and humus formation - microbial interaction- symbiosis, mutualism, commensalism, ammensalism, parasitism, and predation with suitable examples, Biogeochemical cycles of carbon, nitrogen, sulphur, phosphorus and iron.	12
<b>Unit II</b>	<b>Biofertilizer</b> Nitrogen fixing organism- symbiotic, Non symbiotic - biology of nitrogen fixation - mycorrhizae- ecto and endomycorrhizae, phosphate solubilizers, applications of biofertilizers in agriculture.	12
<b>Unit III</b>	<b>Bioremediation</b> Biodegradation of organic pollutants- xenobiotics - bio leaching, biodegradation of polymers- bioremediation- in situ & ex situ, biomining, bioaugmentation - biostimulation- composting- vermicomposting – Biogas – SCP – mushroom cultivation.	12
<b>Unit IV</b>	<b>Aerobiology</b> Air microbiology – composition of air, sources of air flora, enumeration of microorganisms in air, air sanitation- significance of air micro flora- air borne diseases- air pollution.	12
<b>Unit V</b>	<b>Aquatic Microbiology</b> Distribution of microorganism in water- fresh, marine, estuary- Eutrophication- bacteriological analysis of water- water pollution, BOD, COD- waste water treatment- water borne diseases.	12

**Text book :** Ronald M. Atlas, Richard Bartha "Microbial ecology Fundamentals and Applications", Pearson Publication, India.

#### Reference Books

1. Joseph. C Daniel., "Environmental aspects of microbiology", Brightsun Publication, London
2. N.S. Subba Rao., "Soil microbiology", Oxford and IBH Publication, New Delhi.
3. R.R Mishra., "Soil microbiology", CBS Publishers and distributors, New Delhi.
4. G.Rangaswami and D.J.Bagyaraj., "Agricultural Microbiology", PHI learning private ltd., New Delhi

*San 4/1*

Code No	Subject	Semester No
16MBP14	<b>FOOD AND DAIRY MICROBIOLOGY</b>	<b>III</b>
<b>Objective:</b>	To emphasis the food and dairy Microflora, preservation and spoilage	
<b>Course Outcome</b>	On completion of the course, students learn about: <ul style="list-style-type: none"> <li>• Food and dairy micro flora and the preservation methods</li> <li>• Spoilage in fermented foods</li> <li>• The different fermented dairy products</li> <li>• Food laws and regulations as per the WHO standards, HACCP &amp; Disposal of the waste products</li> <li>• Microbiology quality control and quality schemes.</li> </ul>	
Unit No	Topics	Hours
<b>Unit I</b>	<b>Food Microflora and Preservation of Foods</b> Introduction- Importance of food microbiology – types of microorganisms in food – source of contamination (Primary sources) – factors influencing microbial growth of food (extrinsic and intrinsic) Food preservation: Principles of food preservation – methods of food preservation Asepsis – high temperature – low temperature – drying – radiation – chemical.	<b>12</b>
<b>Unit II</b>	<b>Fermented Foods and Food Spoilage</b> Fermented food – pickled cucumber , saurkraut- soysauce , bread , idli – Contamination and spoilage – cereals, sugar products, vegetables and fruits, meat and meat products, fish and seafood – poultry, spoilage of canned foods – food borne diseases.	<b>12</b>
<b>Unit III</b>	<b>Fermented dairy products</b> Milk products – butter, cheese, cream, icecream, yoghurt, whey – microbial spoilage of milk, butter, cheese, yogurt, raw milk – dry milk, ice cream, whey.	<b>12</b>
<b>Unit IV</b>	<b>Preservation of dairy products</b> Examination or accessing microbial load of milk and milk products – quantitative and qualitative test. Preservation of milk and milk products- pasteurization – sterilization- radiation – ionizing radiation – chemicals.	<b>12</b>
<b>Unit V</b>	<b>Quality assurance and validation</b> Principles and use of HACCP in food Industry - Food laws and regulations - National – PFA Essential Commodities Act (FPO, MPO etc.) – Codex Alimentarius, ISO – 9000 series , ISO 22000 & BS 5750 - Regulatory Agencies – WTO - Consumer Protection Act - Relevance of Microbiological standards & criteria for food safety – Sampling plans – Microbiological guidelines Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP) in dairy industry.	<b>12</b>

**Text Books:** Adams M.R. and M.O. Moss., "Food Microbiology", The royal Society of Chemistry, Cambridge, New York

**Reference Books**

1. Fraizer W.C. and Westhoff D.C., "Food Microbiology", TATA McGraW Hill Publishing Company Ltd. New Delhi.
2. Robinson R., "Dairy Microbiology, Elsevier Applied Science Pub, New York.
3. Yadav J.S. Sunitha G. and V.K. Batish., "Comprehensive dairy Microbiology", Metropolitan Book Co., New Delhi.
4. A H Patel., "Industrial Microbiology", MacMillan Publisher, New Delhi.

Code No	Subject	Semester No
16MBP15	<b>FERMENTATION TECHNOLOGY</b>	<b>III</b>
<b>Objective:</b>	To impart commercial exploitation of microorganism and involve the products of major economic, environment and social importance in the world.	
<b>Course Outcome</b>	On completion of the course, students learn about: <ul style="list-style-type: none"> <li>• Industrial microorganisms and Strain improvement</li> <li>• The types and design of bioreactors</li> <li>• Upstream processing</li> <li>• Product recovery and purification</li> <li>• Production of antibiotics, drugs, SCP, Proteins Enzymes, Vaccines and food products in large and small scale industries</li> </ul>	
Unit No	Topics	Hours
<b>Unit I</b>	<b>Introduction of Fermentation</b> Scope of industrial microbiology- Historical development of fermentation technology - Types of fermentation-solid state, submerged, types of culture system - batch, continuous, fed batch- Screening: primary, secondary- preservation of culture- strain development -fermentation economics.	<b>12</b>
<b>Unit II</b>	<b>Fermentor design and its types</b> Fermentor design and types- Stirred tank reactor, bubble column reactor, airlift bioreactor, fluidized bed reactor - tower fermentor, shake flask fermentor- stirring and mixing, gas exchange and mass transfer, use of computers in fermentation technology.	<b>12</b>
<b>Unit III</b>	<b>Upstream process</b> Upstream processing- media formulation, inoculum preparation, sterilization- Batch and continuous -process control in fermentation.	<b>12</b>
<b>Unit IV</b>	<b>Downstream Process</b> Downstream processes-intracellular and extracellular product recovery-cell disruption- flocculation -floatation- filtration -centrifugation-chromatography, dialysis and electro dialysis, distillation, crystallization-precipitation and drying.	<b>12</b>
<b>Unit V</b>	<b>Fermentation products</b> Antibiotic fermentation- Penicillin, Streptomycin, Tetracycline- Organic acid- vinegar, citric acid. Enzymes- amylase, protease, amino acids- L- Glutamic acid and Lysine, Vitamins- Vitamin B12, Vitamin C, Beverages- Beer, Wine. SCP production.	<b>12</b>

**Text book:** P.F. Stanbury, A.Whitaker, S.J.Hall., "Principles of Fermentation Technology", Aditya Books Private Limited, New Delhi

**Reference Books**

1. A H Patel. "Industrial Microbiology", MacMillan Publisher, New Delhi.
2. L. E Casida, JR., "Industrial Microbiology", New Age International Publisher, New Delhi.
3. Wulferueger and AnnelieseCrueger., "Biotechnology A text book of Industrial Microbiology", Panima Publishing Corporation, New Delhi.
4. Michael J. Waites, Neil L. Morgan, John S. rockey and Gary Higton., "Industrial Microbiology An Introduction", Blackwell Science Publisher, New Delhi.

*Jan 14*

Code No	Subject	Semester No
16MBP16	RECOMBINANT DNA TECHNOLOGY	III
<b>Objective:</b>	A complete understanding of molecular techniques through various concepts of enzymology and restriction systems	
<b>Course Outcome</b>	On completion of the course, students learn about <ul style="list-style-type: none"> <li>• Enzymes involved in genetic engineering</li> <li>• Plasmid vectors</li> <li>• Transgenic plants and animals</li> <li>• Methods of gene transfer</li> <li>• Recombinant techniques</li> </ul>	
Unit No	Topics	Hours
Unit I	<b>Enzymology of Genetic Engineering</b> Introduction to genetic engineering- Restriction enzymes, ligases, polymerases, alkaline phosphatases, nucleases, modifying enzymes. Joining of DNA fragments to vectors, homo polymer tailing, cohesive and blunt end ligation, adaptors and linkers. Isolation - purification of DNA (Chromosomal and Plasmid), isolation and purification of RNA, chemical synthesis of DNA.	12
Unit II	<b>Plasmid Vector</b> Construction of pBR 322 and pUC 18. Viral vectors-λ Phage- M13 -cosmid, phagemid, yeast artificial chromosome. Expression vector: Origin of replication- promoter- ribosome binding site- reporter gene- selectable marker gene - terminator. cassettes and fusion vectors.	12
Unit III	<b>Transgenic plants and animals</b> Ti plasmid – insect, virus, herbicide resistant plants– microbial insecticides- transgenic mice – retroviral method – DNA Microinjection method – embryonic stem cell method- transgenic pig- cattle- sheep- goat.	12
Unit IV	<b>Methods of Gene transfer and commercial processes</b> Methods of gene transfer- microinjection, protoplast fusion, macroinjection, microprojectile, electroporation, liposome, polyethylene glycol. Microbial synthesis of commercial products - proteins-insulin-pharmaceuticals – interferons - human growth hormone - somatostatin- antibiotios – cephalosporin – biopolymers- PHB. Vaccines – subunit vaccines – monoclonal antibody- gene therapy - regulating the use of biotechnology	12
Unit V	<b>Recombinant Techniques</b> Southern and northern blotting, PCR and its applicaton. DNA Sequencing: Maxam - Gilbert (Chemical) and Sanger – Nicolson dideoxy / enzymatic sequencing method, pyrosequencing. DNA finger printing and its application. Human Genome Project - history and its application genomic library and cDNA library – human gene therapy.	12

**Text Book:** T.A Brown., "An introduction to Gene Cloning", Champman and Hall, New York.

**Reference Books**

1. Old. RW and Primrose., "Principle of Gene Manipulation," Blackwell Scientific Publication, Boston.
2. Winnecker, E.D., "From gene to clones, Introduction to Gene Technology", VCH Publication, FRG.
3. Bernard. R Glick and Jack J Pasternak., "Molecular biotechnology", Panima Publishing Corporation, India.
4. U.Sathyanarayana., Biotechnology Books and Allied(P) Ltd., India.

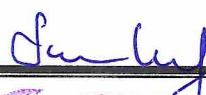
Code No	Subject	Semester No
16MBP16	PHARMACEUTICAL MICROBIOLOGY	III
<b>Objective:</b>	To emphasize the knowledge of microbial production and spoilage in pharmaceutical products	
<b>Course Outcome</b>	On completion of the course, students learn about <ul style="list-style-type: none"> <li>• Antibiotics and synthetic antimicrobial agents</li> <li>• Mode of action of antibiotics</li> <li>• Spoilage of pharmaceuticals products</li> <li>• Government regulatory policies</li> <li>• Quality assurance in pharmaceutical industries</li> </ul>	
Unit No	Topics	Hours
<b>Unit I</b>	<b>Antibiotics and synthetic antimicrobial agents</b> Antibiotics and synthetic antimicrobial agents (Aminoglycosides, $\beta$ lactams, tetracyclines, ansamycins, macrolide antibiotics) - Antifungal antibiotics, antitumor substances. Peptide antibiotics, chloramphenicol, sulphonamides and quinolone antimicrobial agents.	12
<b>Unit II</b>	<b>Mode of action of antibiotics</b> Mechanism of action of antibiotics (inhibitors of cell wall synthesis, nucleic acid and protein synthesis) - bacterial resistance to antibiotics-antiviral - antifungal agents.	12
<b>Unit III</b>	<b>Microbial Contamination</b> Microbial contamination and spoilage pharmaceutical products (sterile injectibles, non injectibles, ophthalmic preparations and implants) and their sterilization - manufacturing procedures and in process control of pharmaceuticals - Other pharmaceuticals produced by microbial fermentations (streptokinase, streptodornase).	12
<b>Unit IV</b>	<b>Regulatory practices, biosensors and applications in Pharmaceuticals</b> Government regulatory practices and policies - FDA perspective. Reimbursement of drugs and biologicals, legislative perspective. Rational drug design - immobilization procedures for pharmaceutical applications (liposomes). Macromolecular, cellular and synthetic drug carriers - Biosensors in pharmaceuticals - Application of microbial enzymes in pharmaceuticals.	12
<b>Unit V</b>	<b>Quality Assurance and Validation</b> Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP) in pharmaceutical industry - regulatory aspects of quality control - quality assurance and quality management in pharmaceuticals ISO, WHO and US certification.	12

**Text Book:** D. Golan, A. Tashjian, E. Armstrong, J. Galanter, A.W. Armstrong, R. Arnaout and H. Rose., "Principles of Pharmacology", Lippincott Williams and Wilkins, New York.

**Reference Books**

1. J. Hardman, Lee Limbird and A.G. Gilman., "Goodman and Gilman's The Pharmacological Basis of Therapeutics". Lippincott Williams and Wilkins, New York.
2. Hugel, W.B. and Russel, "Pharmaceutical Microbiology", AD. Blackwell Scientific, Oxford
3. Lancini, G. and Parenti, F. "Antibiotics", Springer-Verlag.
4. Block, S.S. "Disinfection, sterilization and preservation", Lea and Febigor, Baltimore


Code No	Subject	Semester No
16MBP17	<b>PRACTICAL V</b> <b>FOOD MICROBIOLOGY AND FERMENTATION TECHNOLOGY</b>	<b>III</b>
<b>Objective:</b>	To impart practical knowledge on Food microbiology and Fermentation technology	
<b>Course Outcome</b>	On completion of the course, students learn about: <ul style="list-style-type: none"> <li>• Acquire skills in testing of milk</li> <li>• Can access the quality of canned foods</li> <li>• Will be able to describe wine production</li> <li>• Can estimate enzyme production</li> <li>• Can enumerate and examine microbes from food products</li> </ul>	
<b>LIST OF EXPERIMENTS</b>		
<ol style="list-style-type: none"> <li>1. Methylene blue reduction test</li> <li>2. Litmus milk reaction and phosphatase test</li> <li>3. Determination of aerobic bacteria in food- Bread</li> <li>4. Enumeration of yeast and molds in vegetables</li> <li>5. Detection and confirmation of pathogens from food- <i>Salmonella</i> and <i>Staphylococcus aureus</i></li> <li>6. Determination of sterility of canned foods- Fermentation test</li> <li>7. Direct microscopic examination of curd – observation of <i>Lactobacillus</i> sp.</li> <li>8. Wine production               <ol style="list-style-type: none"> <li>a) estimation of sugar</li> <li>b) acid</li> <li>c) alcohol</li> </ol> </li> <li>9. Organic acid production – Citric acid – Solid state and submerged fermentation.</li> <li>10. Production and estimation of extra cellular enzymes               <ol style="list-style-type: none"> <li>a) Protease by Submerged fermentation</li> <li>b) Amylase by Submerged fermentation</li> <li>c) Cellulase by Solid State fermentation</li> </ol> </li> </ol>		



HEAD

Department of Microbiology,  
Marathwada College of Arts & Science  
Coimbatore- 641 022

Code No	Subject	Semester No
16MBP18	<b>PRACTICAL VI RECOMBINANT DNA TECHNOLOGY, ENVIRONMENTAL AND PHARMACEUTICAL MICROBIOLOGY</b>	<b>III</b>
<b>Objective:</b>	To impart practical knowledge on Recombinant DNA technology and Pharmaceutical Microbiology	
<b>Course Outcome</b>	On completion of the course, students learn about <ul style="list-style-type: none"> <li>• Restriction Mapping</li> <li>• Transformation of competent cells</li> <li>• Isolation of plant growth promoting rhizobacteria and symbiotic bacteria</li> <li>• Chemical and biological methods of water quality testing</li> <li>• Sterility testing methods</li> </ul>	
<b>LIST OF EXPERIMENTS</b>		
<ol style="list-style-type: none"> <li>1. Restriction mapping of <math>\lambda</math> DNA.</li> <li>2. Enzyme Induction (ONPG)</li> <li>3. Competent cell production</li> <li>4. Transformation of competent cells</li> <li>5. Isolation of free living nitrogen fixers –<i>Azotobacter</i>, <i>Azospirillum</i></li> <li>6. Isolation of symbiotic nitrogen fixer -<i>Rhizobium</i></li> <li>7. Isolation of ammonifiers, nitrifiers and denitrifiers</li> <li>8. Isolation of Phosphate solubilizers</li> <li>9. Estimation of biological oxygen demand (BOD)</li> <li>10. Estimation of COD</li> <li>11. MPN Technique – Detection of potability of water</li> <li>12. Sterility testing of Pharmaceutical products – Antibiotics.</li> <li>13. Demonstration of Minimum Inhibitory concentration</li> </ol>		

  
 HEAD  
 Department of Microbiology  
 Madhav College of Arts & Sciences  
 Coimbatore- 641 028



Code No	Subject	Semester No
16MBP20	RESEARCH METHODOLOGY AND BIOINFORMATICS	IV
<b>Objective:</b>	To impart knowledge about statistics to biologist and its application in research and to enlighten with bioinformatics tools	
<b>Course Outcome</b>	At the end of this course the students will be able to: <ul style="list-style-type: none"> <li>• Identify suitable statistical test procedures for a given data set</li> <li>• Apply statistical tools in biological research</li> <li>• Perform statistical procedures using statistical software for a given data set</li> <li>• Perform literature searches and systematic reviews.</li> <li>• Learn the basic concept in Bioinformatics.</li> </ul>	
Unit No	Topics	Hours
Unit I	<b>Introduction to statistics</b> Statistics for biologist- application in project design. Probability analysis, collection, classification, & tabulation of data, data presentation methods. Histogram, Ogive curves.	14
Unit II	<b>Measures of location</b> Calculation of mean, median, mode, standard deviation, Range, standard error for discrete and continuous series in reference to biological standards.	14
Unit III	<b>Correlation and Regression</b> Simple correlation coefficient, correlation regression-simple and linear basic ideas of significant test-hypothesis testing, level of significant test, test based on studies-t-test, chi-square and goodness of fit.	14
Unit IV	<b>Project designing</b> Selection of research problem. Designing a project-objective, executing the research-thesis writing-review of literature, methods-data collection for bioscience research-preparation of master's thesis. Presenting the research findings.	15
Unit V	<b>Introductory Bioinformatics</b> Application of bioinformatics in research. Data based tools and their use, sequence alignment, predictive methods using DNA & protein sequencing. Homology phylogeny and evolutionary trees. databanks – Genbank, NCBI, EMBL, DDBJ – protein databanks.	15

**Text Books:** S.P.Guptha., "Statistical methods", Sultan chand and Sons, New Delhi.

**Reference Books**

- 1) Palanisamy & Manoharan., "Statistical Methods of Biology", Paramount Publications, New Delhi.
- 2) Khan and Khan., "Fundamentals of Biostatistics", Atiya Khanum Ukaaz publications Hyderabad.
- 3) Kothari GR., "Research Methodology- Methods and techniques", urley eastern limited, New Delhi
- 4) Ignacimuthu S., "Basic Bioinformatics", Alpha Science International, New Delhi.

*[Signature]*  
HEAD

Department of Microbiology  
Vandashan College of Arts & Science  
Coimbatore- 641 028

Code No	Subject	Semester No
16MBP21	<b>CORPORATE MICROBIOLOGY</b>	<b>IV</b>
<b>Objective:</b>	To develop and strengthen the entrepreneurial quality in Microbiology	
<b>Course Outcome</b>	On completion of the course, students learn about: <ul style="list-style-type: none"> <li>• The concept of entrepreneurship</li> <li>• Institutions and schemes of Government of India</li> <li>• Entrepreneurial skills</li> <li>• Patents</li> <li>• Small scale entrepreneurship</li> </ul>	
Unit No	Topics	Hours
<b>Unit I</b>	<b>Evolution of the concept of entrepreneur</b> Entrepreneurship: Definitions-concept of entrepreneurship, development – need – role of resource, talent and spirit – process of entrepreneurship to socio-economic gains. Industrial microbiology, definition, scope and historical development.	<b>14</b>
<b>Unit II</b>	<b>Institutions and schemes of government of India</b> Schemes and programmes, department of science and technology schemes, nationalized banks – other financial institutions etc., – SFC-NSIC-SSIC-SIDBI-DIC-TAHDCO-CODISSIA-SID-MSME- commercial banks etc.,	<b>14</b>
<b>Unit III</b>	<b>Skills for entrepreneurs</b> Communication skills, problem solving skills; business plan development; Market need – market research, SWOT analysis, identifying competition. Financial plan – obtaining finance for business-business insurance-marketing – mix-product-distribution- price- promotion- marketing goals	<b>14</b>
<b>Unit IV</b>	<b>Small scale entrepreneurship</b> Biocomposting- domestic waste, agricultural and industrial waste, vermi – composting. SCP production – mushroom cultivation. Biofertilizers and Biopesticides. Production of diagnostic kits -WIDAL, ABO blood grouping-ASO.	<b>15</b>
<b>Unit V</b>	<b>Patents</b> History of patenting, composition, subject matter and characteristics of a patent, Inventor, Infringement, cost of patent. Patents in India and other countries. Open Source Software- WIPO.	<b>15</b>

**Text Book:** S.L Gupta., "Entrepreneurship Development", International Book house, India

**Reference Books**

1. Ronald M Atlas and Richard Bartha., "Microbial Ecology", Pearson publication, Germany.
2. Greene., "Entrepreneurship ideas inaction", Thomson learning, New York.
3. Anil kumar S., "Entrepreneurship Development", New Age International, India.
4. Satyanarayana U., "Biotechnology", Books and Allied P Ltd, Kolkata, India.

*[Signature]*  
HEAD

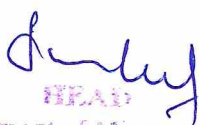
Department of Microbiology  
Rajasthan College of Arts & Science  
Coimbatore- 641 07x

Code No	Subject	Semester No
16MBP21	COMMERCIAL MICROBIOLOGY	IV
<b>Objective:</b>	To produce the products of economic value	
<b>Course Outcome</b>	On completion of the course, students learn about: <ul style="list-style-type: none"> <li>• Mushroom cultivation</li> <li>• Composting and application of microbes</li> <li>• Production of diagnostic kits</li> <li>• Production of microbial products</li> <li>• Entrepreneurial process and development</li> </ul>	
Unit No	Topics	Hours
Unit I	<b>Mushroom cultivation</b> Mushroom cultivation – cultivation of <i>Agaricus campestris</i> , <i>Agaricus bisporous</i> , <i>Volvarellia volvaciae</i> , Nutritional value, cultivation method, control of pathogen and pest, Medicinal value of Mushroom, Advantages of mushroom.	14
Unit II	<b>Composting</b> Composting – Microbiology of composting, preparation of compost, types of composting, advantages of composting, vermicomposting. biofertilizer – chemical fertilizer versus biofertilizer, organic farming, <i>Rhizobium</i> , <i>Azospirillum</i> , <i>Azotobacter</i> and phosphate solubilizer as biofertilizer.	14
Unit III	<b>Production of Diagnostic kits</b> Production of kits -plasmid DNA isolation, serum electrophoresis and diagnostic kits -WIDAL, ABO blood grouping	14
Unit IV	<b>Commercial product production</b> Commercial product production - Beer, Wine, Antibiotics- Penicillin, enzymes- amylase and protease. Aminoacids - lysine, glutamic acid.	15
Unit V	<b>Entrepreneurial development</b> Entrepreneurial development – activity, institute involved, process of entrepreneurship -socio-economic gain, schemes and programme for entrepreneurship. History of patent, characteristics of patent, inventor-cost of patent, patent in India and other Countries.	15

**Text book:** R.C Dubey., "Textbook of Biotechnology" New age Publishers, New Delhi.

**Reference Books**

1. Ronald M Atlas and Richard Bartha., "Microbial Ecology", Pearson publication, Germany.
2. Greene., "Entrepreneurship ideas inaction", Thomson learning, New York.
3. Anil kumar S., "Entrepreneurship Development", New Age International, India.
4. Satyanarayana U., "Biotechnology", Books and Allied P Ltd, Kolkata, India.

  
 HEAD  
 Department of Microbiology  
 Hindusthan College of Arts & Science  
 Coimbatore- 641 021

Code No	Subject	Semester No
16MBP22	<b>PRACTICAL VII BIostatISTICS AND BIOinformatics</b>	IV
<b>Objective:</b>	To impart practical knowledge on Biostatistics and Bioinformatics	
<b>Course Outcome</b>	<p>On completion of the course, students learn about:</p> <ul style="list-style-type: none"> <li>• Exploring data from the web resources</li> <li>• Statistical methods for analysis of biological data</li> <li>• Use of statistical operations in biology.</li> <li>• Performing statistical procedures using statistical software for a given data set</li> <li>• Biological databases, sequence retrieval, similarity search and gene prediction</li> <li>• Designing of primers</li> </ul>	
<b>LIST OF EXPERIMENTS</b>		
<ol style="list-style-type: none"> <li>1. Visit NCBI, EMBL, DDBJ, and TIGR.org. Explore them. List out the salient features.</li> <li>2. Retrieve protein sequence for tyrosinase and find out if this protein is present in <i>Agaricus bisporus</i>, <i>Colletotrichum lagenarium</i> and <i>Fusarium oxysporum</i> using BLAST P and 'limit by entrez' query option</li> <li>3. Retrieve nucleotide sequence for <i>Streptococcus</i> M protein, <math>\beta</math> - lactamase, Trypsin, Cytochrome oxidase</li> <li>4. Dissect trypsin (code 1TRY) protein and colour residues (Asp102, His 57, Ser195) that constitute the catalytic triad show only helix in the molecule, show only sheets, show only backbone. And catalytic triad in space fill</li> <li>5. Compare the gene prediction results from Genscan, genmark, framed and glimmer. Interpret the sensitivity and specificity of them.</li> <li>6. Similarity search- Get any two sequence in FASTA format</li> <li>7. Use ORF finder of NCBI to predict all possible ORF in a DNA sequence</li> <li>8. Use MOTIF search and PROTPARM tools</li> <li>9. Design a primer for cloning and set the PCR cycles</li> <li>10. Graphical representation a. Histogram b. Ogives C. scatter diagram</li> <li>11. Diagrammatic representation a. line diagram b. bar diagram c. pie diagram</li> <li>12. Analysis of variance one way and two way.</li> <li>13. Measures of Location- Mean, Median, Mode</li> <li>14. Measures of Dispersion- Range, S.D, Variance</li> <li>15. Correlation- karl pearson's coefficient, spearman's rank correlation</li> </ol>		

  
HEAD

Department of Microbiology  
Hindusthan College of Arts & Science  
Coimbatore - 641 029