

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 2016- 2017 and onwards)

CODE NO.	SUBJECT	LECTURE HRS /WEEK	EXAM DURATION HRS	MAXIMUM MARKS			CREDIT POINTS
				IE	EE	TOTAL	
First Semester							
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
Second Semester							
16MBP07	Immunobiology	5	3	25	75	100	4
16MBP08	Molecular Genetics	5	3	25	75	100	4
16MBP09	Medical Microbiology	5	3	25	75	100	4
16MBP10	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	<u>Skill Based</u> 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	<u>Elective-I</u> 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	<u>Elective-II</u> 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
							90

* 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)

Answer ALL Questions

Either or Type

ALL questions carry EQUAL Marks

3 x 6=18 Marks

Section-B (32 Marks)

Answer any **TWO** Questions out of three questions.

ALL questions carry EQUAL Marks

2 x 16=32 Marks

Total -----
50 Marks

Question Paper Pattern for IE Model Exam (for 75 Marks) (3 hours)

Section-A (30 Marks)

Answer ALL Questions

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

ALL questions carry EQUAL Marks

5 x 6=30 Marks

Section-B (45 Marks)

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

ALL questions carry EQUAL Marks

3 x 15=45 Marks

Total -----
75 Marks

2 a) Components for Practical I. E.

Components	Marks
Test –I	20
Test - II	20
Total	40

2 b) Components for Practical E. E.

Components	Marks
Completion of Experiments	50
Record	5
Viva	5
Total	60

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> Work Diary	25	-	<i>I. E</i> a) Attendance Marks	20
Report	50	50	b) Review Marks	30
Viva –voce	25	50		50
Examination				
Total	100	100		
			<i>E.E</i> ^{*1} a) Final Report Marks	120
			b) Viva-voce Marks	30
				150
			Total	200

*¹Evaluation 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
Total	----- 100 =====

The question paper pattern is as follows:

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

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Code No	Subject	Semester No
16MBP01	PRINCIPLES OF MICROBIOLOGY	I
Objective:	To impart knowledge on the basics and fundamentals of microbial world	
Unit No	Topics	Hours
Unit I	History and Development Scope of Microbiology - Contributions - Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Edward Jenner, Iwanowski, Elie Metchnikoff, Beijerinck, Winogradsky, Paul Ehrlich.	12
Unit II	Microbial Taxonomy 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 (Alexopoulos), algae (Fritsch).	12
Unit III	Sterilization and Disinfection Physical methods – heat – Filtration (Membrane & HEPA). chemical methods – phenols, alcohols, halogens, aldehydes, heavy metals, dyes and quaternary ammonium compounds.	12
Unit IV	Microscopy and Staining 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	Media preparation 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. Prentice 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.



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Code No	Subject	Semester No
16MBP02	BIOMOLECULES	I
Objective:	To emphasis the importance of biomolecules	
Unit No	Topics	Hours
Unit I	Fundamental building blocks Macromolecules – Introduction, classification, structure and functions of Carbohydrates – Lipids – Proteins - Nucleic acids.	12
Unit II	Enzymes 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
Unit III	Bioenergetics Basic principles of thermodynamics – entropy, enthalpy and free energy. High energy phosphates, oxidation – reduction reactions — organization of the respiratory chain in mitochondria.	12
Unit IV	Vitamins and Minerals 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
Unit V	Hormones and Inborn errors of Metabolism 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.I., "Principles of Biochemistry Cox- CBS Publishers, New delhi.
4. Lubert Stryer., "Biochemistry", Freeman and Company, New York.

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Code No	Subject	Semester No
16MBP03	MICROBIAL PHYSIOLOGY AND METABOLISM	I
Objective:	To impart knowledge on various aspects of Microbial physiology and metabolism	
Unit No	Topics	Hours
Unit I	Bacterial cell structure 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	Nutrition 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	Aerobic respiration and Photosynthesis EMP – HMP – ED pathways – glyoxalate cycle – TCA cycle- Electron transport chain-carriers– Oxidative and Substrate level phosphorylation. Photosynthesis – Oxygenic and Anoxygenic, Carbon dioxide fixation.	12
Unit IV	Anaerobic respiration and Fermentation Sulphur, nitrogenous compounds and CO ₂ as final electron acceptor - Fermentation – alcoholic, lactic acid, propionic, butanediol, acetate, amino acid and mixed acid fermentation.	12
Unit V	Biosynthesis and cell signaling 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.


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Code No	Subject	Semester No
16MBP04	APPLIED BIOTECHNIQUES	I
Objective:	To impart knowledge on various aspects of biological techniques	
Unit No	Topics	Hours
Unit I	Spectrophotometry 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	Centrifugation techniques 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	Chromatographic techniques Principles - instrumentation– Paper – TLC – HPLC – GC - gel filtration - Ion –Exchange – Column - Hydroxy apatite - Immuno adsorption - Affinity chromatography - applications.	15
Unit IV	Electrophoresis Principles and applications of Paper - starch gel – agarose - native and denaturing PAGE – 2D PAGE electrophoresis – isoelectrophoresis – isoelectrofocusing.	15
Unit V	Radioisotopes 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

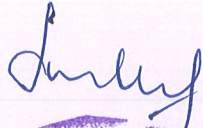
Text Book: Keith Wilson and John Walker., "Practical Biochemistry", WMC Brown Publishers, New Delhi.

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.


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Code No	Subject	Semester No
16MBP05	PRACTICAL I - PRINCIPLES OF MICROBIOLOGY	I
Objective:	To impart practical knowledge on Principles of Microbiology	
LIST OF EXPERIMENTS		
<ol style="list-style-type: none"> 1. Laboratory Safety 2. Cleaning of glasswares 3. Media preparation–Solid and liquid, Selective and differential media and pure culture technique streak, spread and pour plates. 4. Determination of microbial size (Micrometry) – Bacteria and Yeast. 5. Motility determination- Hanging drop and agar deep 6. Isolation and enumeration of microorganisms from soil: bacteria, fungi and actinomycetes. 7. Staining techniques <ol style="list-style-type: none"> a) Gram Staining b) Acid fast Staining c) Endospore Staining d) Capsule Staining 8. Fungal wet mount – LPCB 9. Algal wet mount-filamentous and colonial forms 10. Examination of Hay infusion broth under light microscope for protozoa 11. Anaerobic culture techniques <ol style="list-style-type: none"> a) Wright's tube method 12. Indoor air quality analysis using settle plate method 		


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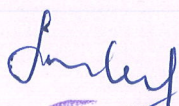
Code No	Subject	Semester No
16MBP06	PRACTICAL II MICROBIAL PHYSIOLOGY AND METABOLISM	I
Objective:	To impart practical knowledge on Microbial physiology and Metabolism	
LIST OF EXPERIMENTS		
<ol style="list-style-type: none"> 1. Growth curve- determination of generation time <ol style="list-style-type: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

Code No	Subject	Semester No
16MBP07	IMMUNOBIOLOGY	II
Objective:	To promote a stream of new information about the immune system	
Unit No	Topics	Hours
Unit I	Introduction to Immunobiology 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	Antigen and Antibodies Antigens – features of antigens – epitopes, cross reactivity, cell surface antigens and auto antigens- haptens- adjuvants and its significance. Immunoglobulin –structure, properties-types- immunoglobulin variation, monoclonal antibody production- applications.	12
Unit III	Hypersensitivity and Complement system Hypersensitivity –types- mechanisms- complement system - classical, alternate, lectine pathway, regulation of the complement system-regulation of Immune system - tolerance - T cell tolerance, B cell tolerance.	12
Unit IV	Transplantation and disorders of Immune system 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	Immunotechnology 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.	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) Kubly. J., "Immunology", W.H. Freeman and co., New York.

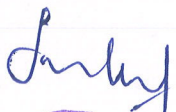

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Code No	Subject	Semester No
16MBP08	MOLECULAR GENETICS	II
Objective:	To impart knowledge on various aspects of molecular genetics	
Unit No	Topics	Hours
Unit I	Genetic Materials Historical introduction- Mendelian principles - Discovery of DNA and DNA as a genetic material. Chemical composition and physical structures of DNA, Watson & crick model. Organization of genetic material: Viruses and Bacteria – Eukaryotes: nucleosomes, Lamp brush chromosomes, Giant chromosomes – Satellite DNA- Concept of Gene.	12
Unit II	Replication and Transcription Enzymology and mechanism of DNA replication – Prokaryotes and eukaryotes - Rolling circle model – theta - plasmid DNA replication – enzymology and mechanism of Transcription in prokaryotes and eukaryotes – post transcriptional modifications – Reverse transcription.	12
Unit III	Translation Enzymology and mechanism of translation in prokaryotes and eukaryotes – genetic code – deciphering of genetic code and important properties of genetic code- structures of rRNA, mRNA and tRNA - translation -post translational modification.	12
Unit IV	Mutation and Recombination Mutation – spontaneous - origin of bacterial mutations – mutagenesis- Induced mutations- physical and chemical agents - mutant selection- Mutagenicity testing. DNA damage and repair. Recombination – Homologous recombination, site specific recombination and transposition.	12
Unit V	Gene transfer in bacteria and gene regulation Transformation – Transduction (specialized & generalized)- Conjugation $F^+ v/s F^-$, $Hfr^+ v/s F^-$, $F' v/s F^-$. Phage genetics - Genetic mapping of T ₄ Phage C- value paradox- hardy Weinberg equilibrium - Regulation of gene activity- operon model - <i>lac</i> , <i>trp</i> and <i>ara</i> operon. Gene mapping.	12

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, New Jersey.


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Code No	Subject	Semester No
16MBP09	MEDICAL MICROBIOLOGY	II
Objective:	To impart knowledge on the basic principles, etiological agents and pathology of global infectious diseases	
Unit No	Topics	Hours
Unit I	Infection 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- Antibioqram	12
Unit II	Gram positive organisms 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
Unit III	Gram negative organisms 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
Unit IV	Mycology 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
Unit V	Parasitology 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 Livingston, 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
16MBP10	VIROLOGY AND NANOTECHNOLOGY	II
Objective:	To emphasis the knowledge about Viruses and Nanoscience	
Unit No	Topics	Hours
Unit I	Introduction to virology History and discovery of viruses - classification of viruses - properties of viruses structure. Cultivation of viruses. Sub viral agents – viroids, virusoids and prions.	12
Unit II	Bacterial viruses Lytic and Lysogenic cycle; structural organization, replication of ϕ X 174, M ₁₃ , Mu, T ₄ , Lambda, P _i , phages; Phage typing – application.	12
Unit III	Plant and animal viruses 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.	12
Unit IV	General concepts of Nanotechnology 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
Unit V	Nanomaterial 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.

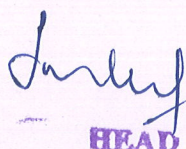
Reference Books

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.

J. K. J.
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Code No	Subject	Semester No
16MBP11	PRACTICAL III IMMUNOBIOLOGY AND MEDICAL MICROBIOLOGY	II
Objective:	To impart practical knowledge on Immunobiology and Medical Microbiology	
LIST OF EXPERIMENTS		
<p>1) Diagnostic Microbiology: Isolation and identification of pathogens from clinical specimens</p> <p>a) Throat swab</p> <p>b) Urine</p> <p>c) Pus</p> <p>d) Faeces</p> <p>e) Blood.</p> <p>2. Isolation and identification of clinically important fungi</p> <p>a) <i>Candida albicans</i></p> <p>b) <i>Aspergillus sp.</i>,</p> <p>c) <i>Cryptococcus neoformans</i></p> <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 & Rh Typing.</p> <p>6. Immunodiffusion – ODD Test.</p> <p>7. Diagnostic Tests – WIDAL (Slide & Tube Test), RA, ASO, CRP, RPR.</p> <p>8. Identification and enumeration of Leucocytes</p> <p>9. Immunoelectrophoresis – Counter Current & Rocket Immunoelectrophoresis.</p> <p>10. ELISA.</p> <p>11. Phenol co-efficient test.</p>		



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Code No	Subject	Semester No
16MBP12	PRACTICAL IV MICROBIAL GENETICS AND VIROLOGY	II
Objective:	To impart practical knowledge on Microbial genetics and Virology	
LIST OF EXPERIMENTS		
<ol style="list-style-type: none"> 1) Isolation of chromosomal DNA from microbes 2) Quantification of DNA by spectrometry. 3) Size determination and fractionation of protein by SDS PAGE. 4) Isolation of Plasmids from microbes 5) Isolation of drug resistant mutants by UV 6) Isolation of auxotrophic mutants by chemical agents 7) Isolation of mutants by Gradient plate and replica plate methods 8) Virus cultivation – Egg inoculation techniques 9) Isolation of Coliphage 10) Titration of Coliphage 11) Isolation of chromosomal DNA from microbes 12) Quantification of DNA by spectrometry. 13) Size determination and fractionation of protein by SDS PAGE. 14) Isolation of Plasmids from microbes 15) Isolation of drug resistant mutants by UV 16) Isolation of auxotrophic mutants by chemical agents 17) Isolation of mutants by Gradient plate and replica plate methods 18) Virus cultivation – Egg inoculation techniques 19) Isolation of Coliphage 20) Titration of Coliphage 		

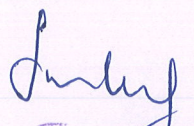
Sarthy
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Code No	Subject	Semester No
16MBP13	ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY	III
Objective:	To emphasis the knowledge on soil microflora and its implication in agriculture	
Unit No	Topics	Hours
Unit I	Microbial interaction Soil micro flora – 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
Unit II	Biofertilizer Nitrogen fixing organism- symbiotic, Non symbiotic - biology of nitrogen fixation - mycorrhizae- ecto and endomycorrhizae, phosphate solubilizers, applications of biofertilizers in agriculture.	12
Unit III	Bioremediation 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
Unit IV	Aerobiology 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
Unit V	Aquatic Microbiology 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


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Code No	Subject	Semester No
16MBP14	FOOD AND DAIRY MICROBIOLOGY	III
Objective:	To emphasis the food and dairy Microflora, preservation and spoilage	
Unit No	Topics	Hours
Unit I	Food Microflora and Preservation of Foods 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.	12
Unit II	Fermented Foods and Food Spoilage 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.	12
Unit III	Fermented dairy products Milk products – butter, cheese, cream, icecream, yoghurt, whey – microbial spoilage of milk, butter, cheese, yogurt, raw milk – dry milk, ice cream, whey.	12
Unit IV	Preservation of dairy products 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.	12
Unit V	Quality assurance and validation 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.	12

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	FERMENTATION TECHNOLOGY	III
Objective:	To impart commercial exploitation of microorganism and involve the products of major economic, environment and social importance in the world.	
Unit No	Topics	Hours
Unit I	Introduction of Fermentation 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.	12
Unit II	Fermentor design and its types 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.	12
Unit III	Upstream process Upstream processing- media formulation, inoculum preparation, sterilization- Batch and continuous -process control in fermentation.	12
Unit IV	Downstream Process Downstream processes-intracellular and extracellular product recovery-cell disruption- flocculation -floatation- filtration -centrifugation- chromatography, dialysis and electro dialysis, distillation, crystallization-precipitation and drying.	12
Unit V	Fermentation products 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.	12

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 Interanational Publisher, New Delhi.
3. Wulfrueger 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.

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Code No	Subject	Semester No
16MBP16	RECOMBINANT DNA TECHNOLOGY	III
Objective:	A complete understanding of molecular techniques through various concepts of enzymology and restriction systems	
Unit No	Topics	Hours
Unit I	Enzymology of Genetic Engineering 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	Plasmid Vector 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	Transgenic plants and animals 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	Methods of Gene transfer and commercial processes 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-antibiotics – cephalosporin – biopolymers- PHB. Vaccines – subunit vaccines – monoclonal antibody- gene therapy - regulating the use of biotechnology	12
Unit V	Recombinant Techniques Southern and northern blotting, PCR and its application. 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

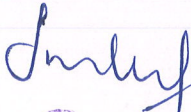
1. Old. RW and Primrose., "Principle of Gene Manipulation", Blackwell Scientific Publication, Boston.
2. Winnecker, E.D., "From gene to clones, Introduction to Gene Technology", VCH Publication, FRG.
3. Bernard. R Glick and Jack J Pasternak., "Molecular biotechnology", Panima Publishing Corporation,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

Code No	Subject	Semester No
16MBP16	PHARMACEUTICAL MICROBIOLOGY	III
Objective:	To emphasis the knowledge of microbial production and spoilage in pharmaceutical products	
Unit No	Topics	Hours
Unit I	Antibiotics and synthetic antimicrobial agents Antibiotics and synthetic antimicrobial agents (Aminoglycosides, β lactams, tetracyclines, anamycins, macrolide antibiotics) - Antifungal antibiotics, antitumor substances. Peptide antibiotics, chloramphenicol, sulphonamides and quinolone antimicrobial agents.	12
Unit II	Mode of action of antibiotics Mechanism of action of antibiotics (inhibitors of cell wall synthesis, nucleic acid and protein synthesis) - bacterial resistance to antibiotics-antiviral - antifungal agents.	12
Unit III	Microbial Contamination Microbial contamination and spoilage pharmaceutical products (sterile injectables, non injectables, ophthalmic preparations and implants) and their sterilization - manufacturing procedures and in process control of pharmaceuticals - Other pharmaceuticals produced by microbial fermentations (streptokinase, streptodornase).	12
Unit IV	Regulatory practices, biosensors and applications in Pharmaceuticals 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
Unit V	Quality Assurance and Validation 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. Hufe, 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 Febiger, Baltimore


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Code No	Subject	Semester No
16MBP17	PRACTICAL V FOOD MICROBIOLOGY AND FERMENTATION TECHNOLOGY	III
Objective:	To impart practical knowledge on Food microbiology and Fermentation technology	
LIST OF EXPERIMENTS		
<ol style="list-style-type: none"> 1. Methylene blue reduction test 2. Litmus milk reaction and phosphatase test 3. Determination of aerobic bacteria in food- Bread 4. Enumeration of yeast and molds in vegetables 5. Detection and confirmation of pathogens from food- <i>Salmonella</i> and <i>Staphylococcus aureus</i> 6. Determination of sterility of canned foods- Fermentation test 7. Direct microscopic examination of curd – observation of <i>Lactobacillus</i> sp. 8. Wine production <ol style="list-style-type: none"> a) estimation of sugar b) acid c) alcohol 9. Organic acid production – Citric acid – Solid state and submerged fermentation. 10. Production and estimation of extra cellular enzymes <ol style="list-style-type: none"> a) Protease by Submerged fermentation b) Amylase by Submerged fermentation c) Cellulase by Solid State fermentation 		


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


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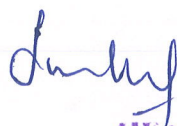
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Code No	Subject	Semester No
16MBP20	RESEARCH METHODOLOGY AND BIOINFORMATICS	IV
Objective:	To impart knowledge about statistics to biologist and its application in research and to enlighten with bioinformatics tools	
Unit No	Topics	Hours
Unit I	Introduction to statistics Statistics for biologist- application in project design. Probability analysis, collection, classification, & tabulation of data, data presentation methods. Histogram, Ogive curves.	14
Unit II	Measures of location Calculation of mean, median, mode, standard deviation, Range, standard error for discrete and continuous series in reference to biological standards.	14
Unit III	Correlation and Regression 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	Project designing 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	Introductory Bioinformatics 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.



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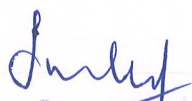
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Code No	Subject	Semester No
16MBP21	CORPORATE MICROBIOLOGY	IV
Objective:	To develop and strengthen the entrepreneurial quality in Microbiology	
Unit No	Topics	Hours
Unit I	Evolution of the concept of entrepreneur Entrepreneurship: Definitions-concept of entrepreneurship, development – need – role of resource, talent and spirit – process of entrepreneurship to socio-economic gains. Industrial microbiology, definition, scope and historical development.	14
Unit II	Institutions and schemes of government of India 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.,	14
Unit III	Skills for entrepreneurs 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	14
Unit IV	Small scale entrepreneurship 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.	15
Unit V	Patents 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.	15

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 in action", 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.


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Code No	Subject	Semester No
16MBP21	COMMERCIAL MICROBIOLOGY	IV
Objective:	To produce the products of economic value	
Unit No	Topics	Hours
Unit I	Mushroom cultivation Mushroom cultivation – cultivation of <i>Agaricus campestris</i> , <i>Agaricus bisporous</i> , <i>Valvarellia volvaciae</i> , Nutritional value, cultivation method, control of pathogen and pest, Medicinal value of Mushroom, Advantages of mushroom.	14
Unit II	Composting 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	Production of Diagnostic kits Production of kits -plasmid DNA isolation, serum electrophoresis and diagnostic kits -WIDAL, ABO blood grouping	14
Unit IV	Commercial product production Commercial product production - Beer, Wine, Antibiotics- Penicillin, enzymes- amylase and protease. Aminoacids - lysine, glutamic acid.	15
Unit V	Entrepreneurial development 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.


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Code No	Subject	Semester No
16MBP22	PRACTICAL VII BIostatISTICS AND BIOinformatics	IV
Objective:	To impart practical knowledge on Biostatistics and Bioinformatics	
LIST OF EXPERIMENTS		
<ol style="list-style-type: none"> 1. Visit NCBI, EMBL, DDBJ, and TIGR.org. Explore them. List out the salient features. 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 3. Retrieve nucleotide sequence for <i>Streptococcus</i> M protein, β - lactamase, Trypsin, Cytochrome oxidase 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 5. Compare the gene prediction results from Genscan, genmark, framed and glimmer. Interpret the sensitivity and specificity of them. 6. Similarity search- Get any two sequence in FASTA format 7. Use ORF finder of NCBI to predict all possible ORF in a DNA sequence 8. Use MOTIF search and PROTPARM tools 9. Design a primer for cloning and set the PCR cycles 10. Graphical representation a. Histogram b. Ogives C. scatter diagram 11. Diagrammatic representation a. line diagram b. bar diagram c. pie diagram 12. Analysis of variance one way and two way. 13. Measures of Location- Mean, Median, Mode 14. Measures of Dispersion- Range, S.D, Variance 15. Correlation- karl pearson's coefficient, spearman's rank correlation 		



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