

HAJEE KARUTHA ROWTHER HOWDIA COLLEGE

(An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai.)

(Re-Accredited at “A” Grade by NAAC,Banglore)

UTHAMAPALAYAM - 625533.



DEPARTMENT OF MICROBIOLOGY

BACHELOR OF SCIENCE - MICROBIOLOGY

SYLLABUS

(Effect from the Academic Year 2013– 2014 Onwards)

HAJEE KARUTHA ROWTHER HOWDIA COLLEGE (AUTONOMOUS)

UTHAMAPALAYAM

Choice based credit system

B.Sc., Microbiology (Semester)

Course Scheme & Scheme of Examinations

(Effective from the academic year 2013-2014 onwards)

Qualification : Passed in H.Sc., or any other Examination accepted by the Syndicate as Equivalent .

Duration of the course : B.Sc., Microbiology-3 academic years (6 semesters)

OBJECTIVES OF THE COURSE:

1. To promote the students to understand the impact of microbiology in life.
2. To develop practical skills in microbiology for their job oriented career.
3. To promote the students to be self employed in the field of microbiology such as mushroom farming, Dairy etc.
4. To enable the students to apply microbiology to the various fields such as agriculture, industries, clinical, genetic engineering etc.
5. To insist the golden opportunities for their career in research and job in the field of microbiology.

SUBJECTS OF STUDY:

- Part I : Tamil/Arabic/Malayalam.
Part II : English
Part III : I) Core subject-Microbiology
II) Allied subjects
Part IV : I) Non major subjects.
II) Skill based subjects.
III) Environmental studies.
IV) Value Education.
Part V : Extension Activities

Structure of Question papers

Internal – 25 marks

External -75 marks

Total – 100 marks

Question paper: Three parts A,B and C

Section A 10x1=10 marks (multiple choice)

Section B 5x7=35 marks (either A or B)

Section C 3x10=30 marks(3 out of 5 questions)

I.For internal examination: 25 marks

1. Two tests to be conducted – 15 marks (average of two tests to be taken)
2. Group discussion / Seminar / Quiz – 5 marks.
3. Two assignments – 5 marks each (average of two assignments to be taken)
4. 1st internal examination – between 30th and 40th working days.
5. 2nd internal examination – between 70th and 80th working days.
6. Eligibility for the degree – Passing minimum 35 %

External examination = Passing minimum 23 out of 75

No minimum for internal exam

PART I/II/III/IV	Subject Code	Title of the Paper	Teaching hours per week	No. of credits	Duration of exam (hrs)	Marks allotted		
						Internal	External	Total
SEMESTER I								
PART I	13UTAL11	Tamil / Arabic / Malayalam - Paper I	6	3	3	25	75	100
PART II	13UENL11	English – Paper I	6	3	3	25	75	100
PART III	13UMBC11	Core I :General Microbiology	4	4	3	25	75	100
		Core Lab I : Major Practical I	2*	—	—	—	—	—
	13UCHA11	Allied I : Chemistry I	4	4	3	25	75	100
		Allied lab: Chemistry practical I	2*	—	—	—	—	—
PART IV	13UMBS11	SBS 1-Mushroom Technology	2	2	3	25	75	100
	13UMBS12	SBS 2-Biocontrol	2	2	3	25	75	100
	13UMBN11	NME-Food and Dairy Microbiology	2	2	3	25	75	100
SEMESTER II								
PART I	13UTAL21	Tamil /Arabic / Malayalam – Paper II	6	3	3	25	75	100
PART II	13UENL21	English – Paper II	6	3	3	25	75	100
PART III	13UMBC21	Core II : Biochemistry	4	4	3	25	75	100
	13UMBC2P	Core Lab : Major Practical I	2	2	3	40	60	100
	13UCHA21	Allied II :Chemistry II	4	4	3	25	75	100
	13UCHA2P	Allied lab: Chemistry practical I	2	1	3	40	60	100
PART IV	13UMBS21	Dairy Technology	2	2	3	25	75	100
	13UMBS22	Diagnostic Microbiology	2	2	3	25	75	100
	13UMBN21	NME-Mushroom Cultivation	2	2	3	25	75	100

PART I/II/III/IV	Subject code	Title of the Paper	Teaching hours per week	No. of credits	Duration of exam (hrs)	Marks allotted		
						Internal	External	Total
SEMESTER III								
PART I	13UTAL31	Tamil /Arabic/ Malayalam Paper III	6	3	3	25	75	100
PART II	13UENL31	English–Paper III	6	3	3	25	75	100
PART III	13UMBC31	Core III - Molecular Biology & Microbial Genetics	4	4	3	25	75	100
		Core lab II: Major Practical II	2*	—	—	—	—	—
	13UCHA31	Allied I- Ancillary Chemistry III	4	4	3	25	75	100
		Allied lab: Chemistry practical II	2*	—	—	—	—	—
	13UMBA31	Allied II- General Biology	4	4	3	25	75	100
		Allied lab - Biology Practical	2*	—	—	—	—	—
SEMESTER IV								
PART I	13UTAL41	Tamil/Arabic/ Malayalam –Paper IV	6	3	3	25	75	100
PART II	13UENL41	English–Paper IV	6	3	3	25	75	100
PART III	13UMBC41	Core IV - Immunology	4	4	3	25	75	100
	13UMBC4P	Core lab - Major Practical II	2	2	3	40	60	100
	13UCHA41	Allied I- Ancillary Chemistry IV	4	4	3	25	75	100
	13UCHA4P	Allied lab: Chemistry practical II	2	1	3	40	60	100
	13UMBA41	Allied II- Cell biology	2	4	3	25	75	100
	13UMBA4P	Allied lab - Biology Practical I	4	1	3	40	60	100

PART I/II/III/IV	Subject code	Title of the Paper	Teaching hours per week	No. of credits	Duration of exam (hrs)	Marks allotted		
						Internal	External	Total
SEMESTER V								
PART III	13UMBC51	Core V - Medical Microbiology	4	4	3	25	75	100
	13UMBC52	Core VI - Agriculture & Environmental Microbiology	4	4	3	25	75	100
	13UMBC53	Core VII - Bioinformatics	4	4	3	25	75	100
		Core lab III - Major practical III	4*	—	—	—	—	—
		Core lab IV - Major practical IV	4*	—	—	—	—	—
	13UMBA51	Allied II – Genetics and Biostatistics	4	4	3	25	75	100
		Allied lab - Biology Practical II	2*	—	—	—	—	—
PART IV	13UMBS51	SBS V : Bio chemical Techniques	2	2	3	25	75	100
		Environmental studies	2	2	3	25	75	100
SEMESTER VI								
PART III	13UMBC61	CoreVIII – Recombinant DNA Technology	4	4	3	25	75	100
	13UMBC62	Core IX – Industrial Microbiology	4	4	3	25	75	100
	13UMBC63	Core X – Food Microbiology	4	4	3	25	75	100
	13UMBC6P	Core lab III - Major practical III	4	7	3	40	60	100
	13UMBC6Q	Core lab IV - Major practical IV	4	7	3	40	60	100
	13UMBA61	Allied II – Environmental Biology	4	4	3	25	75	100
	13UMBA6P	Allied lab - Biology Practical II	2	1	3	40	60	100
PART IV	13UMBS61	SBS IV -Environmental microbiology	2	2	2	25	75	100
		Value Education	2	2	3	25	75	100
PART V	13UEAC61	Extension activities	0	2	—	100	—	100

Core	Semester I	General Microbiology	13UMBC11
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Objectives

- To understand the basic concepts in Microbiology.
- To understand the basic structure and features of microbes.

Unit I

Introduction – Definition, scope and history of Microbiology. Classification of microorganisms - Difference between the prokaryotic and eukaryotic microorganisms.– general principles and nomenclature – Haeckel’s three kingdom concept, Whittaker’s five kingdom concept. Microbiology and Human Health - Contributions of Leeuwenhoek, Jenner, Spallanzani, Louis Pasteur, John Needham and Robert Koch.

Unit II

Microscopy – simple, compound microscope, light & dark field microscope, electron and phase contrast microscopes – parts, functions and applications- Resolving power, Numerical aperture etc.,

Unit III

Prokaryotes – bacteria, archea, actinomycetes, structure and functions of cell and cellular components, slime, capsule, pili, flagella, cell wall, cytoplasmic membrane, mesosomes, ribosome, nucleoid and other cytoplasmic inclusions. Differences between prokaryotic and eukaryotic cells.

Unit IV

Salient features of Algae, structure and reproduction of Chlamydomonas, Chlorella, Euglena, Diatoms, Dinoflagellates. Salient features of fungal morphology, structures and reproduction; *Rhizopus*, *Aspergillus*, *Penicillium* and *Saccharomyces*,

Unit V

Salient features of Bacteria: *Bacillus*, *Clostridium*, *E. coli*, *Salmonella*, Blue green algae, *Streptomyces* and *Mycoplasma*. Viruses: T4, Lambda, TMV, HIV. Protozoa: *Plasmodium*.

References

1. Prescott, Harley and Klein. 2006. Microbiology 6/e. The McGraw-Hill Companies.
2. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. 1993. Microbiology. Tata McGraw Hill Publishing Co., Ltd., New Delhi.
3. Schlegel, H.G.1993. General Microbiology. Cambridge University Press, Cambridge.
4. Stainer, R.Y., Ingraham, Wheelis, M.G. and Paintor, P.R.1986. The Microbial World. Prentice Hall, New Jersey.

SBS	Semester I	Mushroom technology	13UMBS11
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Objectives

- To create awareness among the students about mushroom cultivation
- To promote the mushroom production in student communities through training, spawn production.

Unit I

History of edible mushrooms- Major genera of edible mushrooms – Structure and key for identification – Food values of mushroom – Medicinal values of mushrooms.

Unit II

Methods of cultivation of mushrooms – Substrate for mushroom production - Insect, pest and diseases of mushroom – Mushroom industry – Economics of mushroom production.

Unit III

Exotic mushrooms – Truffles (*Tuber melanosporum*) - Poisonous mushrooms – identification

References

1. By Nitabhal, Mushroom Technology Publications
2. ICAR Publications (--), Cultivation of edible mushrooms .
3. V.N. Pathak, Nagendra Yadav and Maneesha Gaur, Mushroom Production and Processing Technology/ Vedams Ebooks Pvt Ltd., New Delhi (2000)

SBS	Semester I	Biocontrol	13UMBS12
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Objectives

- To create awareness about the use of microorganisms as bio pesticides.
- To promote the importance of bio insecticides.

Unit I

Outline of pest management programme – Insect pest management and Rodent pest management - Need of Biocontrol agents. Economics of Biocontrol

Unit II

Biopesticides - microbes used in biopesticides, *Bacillus thuringensis*, *B. sphaericus*, *Metarizyum* and *Trichoderma*- Insect control, Nuclear Polyhedro Virus and CPV- potentials and limitations.

Unit III

Biology and ecology of organisms for Biocontrol- Predators and Parasitoids- *Trichogramma*

References

1. Roy G. Van Driesche and Bellows Jr. TS., Biological Control –Guide to its application s, Springer (1996).
2. Helmut Fritz Van Embden and Service MW, Pest and vector control, Cambridge University Press (2004).

NME	Semester I	Food & Dairy Microbiology	13UMBN11
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Objectives

- To understand the impact of Microbes in food & dairy.
- To promote the techniques in food preservation.

Unit I

Importance of Food and Dairy Microbiology- Food as substrate for microbial growth- intrinsic and extrinsic factors affecting growth and survival of microorganism in foods - Microorganisms present in the vegetables, fruits, cereals, milk, egg, etc.

Unit II

Features of food spoilage like fruits, vegetables, milk and milk products - Milk sterilization techniques, Phosphatase test- Spoilage of bread and cereals, egg, meat, fish and poultry.

Unit III

Food preservation by removal of microorganisms, low temperature, high temperature, irradiation and chemical methods. Food borne infection, food borne intoxications. Detection of food-borne pathogens.

References

1. Adams. MR and Moss, MO. 2005. Food Microbiology, New age International Pvt. Ltd publications.
2. Frazier, WC and Westhoff DC. 2003. Food Microbiology, 4th edition, McGrawHill, NewYork.
3. Hobbs BC and Roberts D 1993. Food Poisoning and Food Hygiene. Edwards Arnold, London.
4. Yousef, AE and Carlstrom C. 2003. Food Microbiology-A Laboratory manual, Wiley Interscience.
5. Jay JM, 2000. Modern Food Microbiology, Aspen Publishers.
6. Robinson, R.K.1990. Dairy Microbiology, Elsevier Applied Science, London.

Core	Semester II	Biochemistry	13UMBC21
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Objectives

- To create awareness about the importance of Biomolecules.
- To understand the importance of different pathway.

Unit I

Water and Life – pH and Buffers. Oxidative and reduction reactions, redox potential, free energy and reaction, ATP energetics.

Unit II

Carbohydrates-Classification-Monosaccharides (glucose,fructose), Disaccharides(lactose, sucrose) Polysaccharides (starch,cellulose). Metabolism - Embden-Meyerhof-Parnas, Entner-Doudoroff, Pentose Phosphate pathways - TCA cycle.

Unit III

Lipids:Physical and Chemical properties of fatty acids- Nomenclature of fatty acids- Phospholipids- Spingolipids- Lipoproteins, Oxidation of fatty acids (β -Oxidation)

Unit IV

Proteins:Structure,Classification, properties of amino acids and proteins. Primary, secondary, tertiary and quaternary structures of proteins .

Unit V

Nucleic acids :Components, Double helical structure- Nucleic acid denaturation- Classes of nucleic acids.

References:

1. Lehninger, AL., Principles of Biochemistry. 1993, 2nd edition, CSB Publishers.
2. Conn, E.E., Stumpf, P.K , Bruening, G and Doi, Outlines of Biochemistry, 5/e –R.H, John Wiley & Sons (1987)
3. Voet, D and Voet, JG, Biochemistry, 1990, John Wiley & Sons, NY.
4. Stryer, L., Biochemistry, 2/e, 1998, W.H. Freeman and Company, NY.
5. P. Palanivelu, Enzymes, Ribozymes and DNAzymes, 2007, Twentyfirst Century Publications, Palkalai Nagar, Madurai - 625 021.

Skill Based	Semester II	Dairy Technology	13UMBS21
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Objectives

- To encourage and promote the students in the field of dairy technology for their career.
- To promote and participate the students in every way in the economic development of dairy industry.

Unit I

Milk-Physiochemical properties of milk-microbiology of milk-Factors affecting composition of milk-food and nutritive value of milk.

Unit II

Special Milk-Homogenized milk, flavoured milk, fermented milk-Flavour defects in milk their causes and prevention.

Unit III

Dried Milk-milk drying system-cold treatment, Drum drying system, spray drying system.

Unit IV

Cheese –Types-Preparation of Swiss cheese, cheddar cheese-defects in cheese causes and prevention.

Unit V

Indian dairy products-Kheer, Khoa, Panir, Ghee- preparation and preservation-quality analysis of dairy products-various agencies in Quality management-FDA,WHO,AGMARK,ISI-HACCP,GMP.

Reference

- 1.Sukumar De.,1997 Outlines of Dairy technology,Oxford university press.
- 2.William C Frazier et al,Food Microbiology 4th edition Tata McGraw-Hill publications.

Skill Based	Semester II	Diagnostic Microbiology	13UMBS22
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Objectives

- To introduce laboratory principles and safety methods to the students
- To familiarize the students about clinical diagnosis of diseases.

Unit I

Role of Microbiology Lab-safety regulations. Types, collection and handling of specimens. Preparation of serum and plasma.

Unit II

Laboratory identification of infectious agents. Staining techniques: simple, Gram, acid-fast and spore staining.

Unit III

Diagnosis of mycotic infection- skin infection and parasitic infection-amoebiasis.

Unit IV

Microbiological analysis of different types of clinical specimens: urine, stool, pus and throat swab.

Unit V

Determination of minimal inhibitory concentration (MIC) of antibiotics. Antimicrobial susceptibility tests

References:

Mukherjee, K.L., 1988, Medical Laboratory Technology Volumes-I to III, Tata McGraw-Hill Publishing Company Limited, New Delhi

NME	Semester II	Mushroom Cultivation	13UMBN21
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Objectives

- To create awareness among the students about mushroom cultivation
- To promote the mushroom production in student communities through training, spawn production.

Unit I

History of mushrooms- Major genera of edible mushrooms – Structure and key for identification of mushrooms.

Unit II

Food values of mushroom – Medicinal values of mushrooms- Economic importance of mushroom.

Unit III

Substrate for mushroom production-composting methods-long and short time method-Methods of cultivation of mushrooms-oyster mushroom, paddy straw mushroom.

Unit IV

Diseases of mushroom-Fungal diseases- soft mildew, brown plaster mold, white plaster mold, olive green mold, inky cap, truffle disease, bubble disease, brown spot disease - Insect pest of mushroom – sciarids, phorids, spring tails, cecid,mites, nematodes .

Unit V

Poisonous mushrooms – *Amanita*, *Boletus*, *Clitocybe*, *Coprinus* -Identification of Poisonous mushrooms.

References

1. Nitabhal, Mushroom Technology,orient longman publications.
2. Pathak V.N ,Nagendra Yadav and Maneesh Gaur,Mushroom production and processing technology /Vedams Ebooks Pvt Ltd,NewDelhi(2000)

Core Lab	Semester II	Major Practical – I	13UMBC2P
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Objectives

- To introduce the basic handling techniques in Microbiology.
- To understand the basics techniques in biochemistry.

Basic Microbiology

1. Parts, working principle and applications of compound microscope
2. Sterilization methods: moist heat, dry heat, filtration, disinfectants
3. Isolation of bacteria and fungi from environmental samples
4. Measurement of bacterial size by micrometry method
5. Pure culture techniques: streak, spread and pour plate methods
6. Observation of bacterial motility by hanging drop method
7. Staining methods: Gram-staining, endospore-staining

Biochemical tests for bacterial identification

1. Carbohydrate fermentation
2. IMVIC tests
3. Catalase test
4. Oxidase test
5. Starch and protein hydrolysis.

Biochemistry

1. pH meter- principle and measurements
2. Estimation of Carbohydrates
3. Estimation of Proteins (Lowry's method)
4. Separation of amino acids by Paper chromatography

Reference

1. P.Gunasekaran, Microbiology: A Laboratory manual, New Age international publishers,1996.
2. N.Kannan, A Laboratory manual in general microbiology,Panima publishers, 2002.
3. P.Palanivelu, Analytical Biochemistry & Separation Techniques, 3rd edition – 21st century publications ,Palkalai nagar, Madurai.
4. J.Jayaraman,Laboratory manual in Biochemistry, 5/e,New age international publishers,1996.

Core	Semester III	Molecular Biology & Microbial Genetics	13UMBC31
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Objectives

- To make the students understand the central dogma of life.
- To familiarize the basic concepts of Molecular Biology & Microbial Genetics.

Unit I

Structural aspects of DNA and RNA - double helical model- various forms of DNA- tRNA- rRNA-Genome organization - Eukaryotes.

Unit II

Replication- Semi conservative mode of replication- Enzymology of Replication- The processes of DNA replication-Eukaryotic replication

Unit III

Transcription - prokaryotes and Eukaryotes - Enzymology of Transcription- process of transcription in prokaryotes and Eukaryotes - initiation and elongation and termination- factors involved.

Unit IV

Translation- Translation in prokaryotes - Enzymology of Translation- process of translation in prokaryotes - initiation and elongation and termination- factors involved. The triplet nature of genetic codon

Unit V

Transposable genetic elements- IS elements- transposons- *Tn10*, Tn5, Tn3 modes of transposition- non-replicative and replicative.

References

1. Benjamin Lewin, Gene VII, 2000: Oxford University Press.
2. Watson, Hopkins, Roserts, Steits and Weiner, Molecular biology of the Gene,4/e, 1987, The Benjamin/Cumming Publishing Company, Inc.
3. Larry Snyder and Wendy Champness, Molecular Genetics of Bacteria,2/e, , 2003. ASM press, Washington DC.
4. David Friefelder, Molecular Biology, 1987, Narosa Publishing House.

Allied II	Semester III	General biology	13UMBA31
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Objectives

- To introduce about the classification and physiology of plants.
- To understand the physiology of human system.

Unit –I

Basis of classification-units of classification-Species,Genus,Family-Nomenclature-Binomial system.Bentham and hooker system of classification of plants.

Unit-II

Morphology,structure and reproduction of plants.Algae-General characters and classification-sargassum as an example.Fungi- General characters and classification-Yeast as an example.Bryophytes- General characters and classification-Funaria as an example.

Unit III

Pteridophytes-selaginella,heterospory and seed habit.Gymnosperm-Pinus-economic uses of gymnosperm.Angiosperm-Monocot flower-Allium sp,Dicot flower-Tribulus terrestris.

Unit IV

Human physiology-Structure and function of Digestive system-Respiratory system-circulatory system-Blood and their properties-Excretory system.

Unit V

Muscular system-Nervous system-Endocrine glands-Reproductive system-Harmones-menstrual cycle.

References:

- 1.A.C Dutta,Botany for Degree students,Oxford university press.
- 2.W.T.tailor and R.J.Wehe-General Biology,East West press pvt ltd.
- 3.E.L.Jordan and verma.Invertebrate Zollogy,S.Chandra &Co,New Delhi.
4. E.L.Jordan and verma.Chordate Zollogy,S.Chandra &Co,New Delhi.

Core	Semester IV	Immunology	13UMBC41
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Objectives

- To understand the structure and functions of immune system.
- To promote the knowledge of Auto immune diseases.

Unit I

Elements of Immunity: Overview of the Immune system- Basic concepts in immunology (History), principles of innate and acquired immunity - Cells and organs of the immune system.

Unit II

Antibody structure: Classification and characterization, agglutination, complement system, immune tolerance, Classes of antigens and their characteristics.

Unit III

Humoral and cell mediated immune response: B-cell maturation. Activation and differentiation, Major Histocompatibility complex (MHC) - antigen processing and presentation T and B cell maturation, activation and differentiation.

Unit IV

Hypersensitivity-Type I,II,III,and IV reactions. Different types of auto immunity, T,B cell, Phagocyte and NK cell associated diseases.

Unit V

Transplantation immunology: Basics of graft rejection, Tissue typing, Clinical transplantation, Tumor antigen, Immune response to tumor.

References

1. Roitt, I.M., Essential of immunology, 1998., ELBS, Blackwell scientific publication.
2. Kuby, J., Immunology,3/e, 1997.. W.H.Freeman and company, NY.
3. Travers. J., Immunobiology, The immune system in health and disease-3/e - 1997 - Garland publishers, NY.
4. Ananthanarayanan R. & Jayaram Panicker, C.K. Textbook of Microbiology, Orient Longman, 2005.

Core Lab	Semester IV	Major Practical-II	13UMBC4P
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Objectives

- To familiarize the students in molecular biological techniques.
 - To understand the basics techniques in immunology.
1. Isolation of DNA from *E.coli*.
 2. Separation of DNA by Agarose gel electrophoresis.
 3. Separation of Proteins by SDS-PAGE.
 4. Separation of serum/plasma.
 5. Blood cell count: RBC count, WBC count – total and differential
 6. Blood typing: ABO, Rh.
 7. Agglutination tests: Widal test.
 8. Precipitation: Ouchterlony's double immune diffusion.
 9. Immuno electrophoresis

Allied II	Semester IV	Cell biology	13UMBA41
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Objectives

- To introduce about the basic structure of cell.
- To understand the mechanism of various cell regulation.

Unit-I

Cell structure-Prokaryotic and eukaryotic-Plant and Animal cell-Plasma membrane-chemistry and ultra structure-Fluid mosaic model-Protoplasm-chemistry and organization-microtubules and microfilaments

Unit-II

Cytoplasmic organelles in Eukaryotes -ER, Golgi complex, lysosomes, Mitochondria, Chloroplast, Ribosomes, mesosomes

Unit-III

Nucleus-structure and functions, chromatin-Eu and Hetero chromatin, chemistry-chromosome-kinds-functions, nucleolus-structure-functions-mechanism of photosynthesis and generation of ATP.

Unit-IV

Cell cycle-mitosis and meiosis-interphase and division phase-Cell growth-normal and cancerous.

Unit-V

Microscopy-Types-Light-Electron and Phase contrast microscope structure and function.

References:

1. Albert, Bray, D. Lewis, J. Raff, M. Roberts, K. and Watson, J. D. -Molecular biology of the cell, New York, Garland 1983
2. De Robertis E. D. P., F. A. Saez and De Robertis E. M. F. -cell biology, 1990.
3. K. V. Krishnamoorthy -methods in plant histochemistry, S. Viswanathan publications 1988.
4. P. S. Verma and V. K. Agarwal. Text book of cytology. S. Chand & Co., New Delhi 1995.
5. P. S. Verma and V. K. Agarwal. Text book of Cellbiology, Genetics, Evolution and Ecology. S. Chand & Co., New Delhi.

Allied Lab	Semester IV	Ancillary Biology Practical	13UMBA4P
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Objectives

- To introduce about the basic structure of cell.
- To understand the mechanism of various cell regulation.

Botany

1. vegetative structure and reproductive structure in sargassum, yeast, funaria, seleginella and pinus (section cutting of sargassum and seleginella, pinus stem and needles)
2. structure of monocot flower - *Allium cepa*
3. structure of Dicot flower - *Tribulus terrestris*

Zoology

1. Cockroach - external and digestive system, reproductive system and nervous system.
2. Frog - External, digestive system, urogenital system and brain (spotters only) .
3. Morphology of the representative for each phylum spotters only - Amoeba, Euglena, paramecium, Hydra, Planaria, Liverfluke, Tania, Ascaris, earthworm, Prawn, Pila, Starfish, Shark, Mugil, pigeon, rat.
4. Blood cells of man and blood vessels.
5. Study of mitosis by smear technique of *Allium cepa* root.
6. Demonstration of Histochemical staining methods.
7. Determination of blood groups & Rh factors.
8. Determination of haemoglobin.
9. Blood cell counts.

Core	Semester V	Medical Microbiology	13UMBC51
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Objectives

- To create awareness about the infectious diseases.
- To familiarize the various methods of diagnosis and treatment.

Unit I

The History of Infectious Diseases: Human – microbe interactions – epidemiology of infectious diseases – mechanism of pathogenesis-Host-defense mechanisms.

Unit II

Diagnosis and control of microbial diseases – Collection and identification of pathogens from the specimen of Urine, sputum and throat swab. -Antimicrobial chemotherapy and susceptibility testing. Mechanism of action of β -lactams (penicillin & cephalosporin) - drugs affecting protein synthesis (Tetrocycline and amino glycoside) and Sulfa drugs – Mode of action of antiviral and antifungal drugs.

Unit III

Bacterial diseases: Transmission, diagnosis, clinical symptoms and treatment for bacterial diseases- plague, tuberculosis, cholera, typhoid, and Staphylococcal diseases.

Unit IV

Viral diseases: Epidemiology, prophylaxis, clinical symptoms and treatment for human viral diseases. rabies, viral hepatitis, poliomyelitis, AIDS.

Unit V

Fungal and protozoan diseases: Cutaneous mycoses, systemic mycoses, opportunistic mycoses. Life cycle, diagnosis and treatment of following protozoan diseases – amoebiasis, malaria,

References

1. Jawetz, E. Melnic, JL, & Adelberg, EA. Medical microbiology 22/e McGraw Hill Companies, 2004.
2. Mims, C. Playfair, J Roitt, I, Wakelin, D. & Williams, R. Medical Microbiology, 3/e Mosby publications, 2004.
3. Prescott, Harley and Klein, Microbiology, 6/e The McGraw-Hill Companies, 2008.
4. Ananthanarayanan R. & Jayaram Panicker, C.K. Textbook of Microbiology, Orient Longman, 2005.

Core	Semester V	Agriculture & Environmental Microbiology	13UMBC52
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Objectives

- To understand the role of microbes in agriculture and environment.
- To create awareness about biofertilizers and disease management.

Unit I

Soil microbes: Bacteria, Fungi and Actinomycetes (distribution) – Microbial interaction: mutualism, amensalism and commensalisms - Soil enzymes – Plant microbial interactions- N₂ fixation, symbiotic and free living- phosphate solubilization– Mycorrhizal association; ecto and endomycorrhizae, actinorrhizae

Unit II

Plant microbe interactions - pathogenesis, mechanism of pathogen establishment and symptoms. Plant diseases caused by Bacteria, *Xanthomonas*, *Mycoplasma*, Fungi, *Pyricularia*, *Fusarium* and Viruses, TMV, CMV.

Unit III

Disease control- Fungicides, Pesticides, Biological control mechanisms - Production of bioinsecticides, bacterial and viral.

Unit IV

Biofertilizers: production and methods of application – Biopesticides: bacterial, fungal and viral – Microbial nematicides and microbial herbicides – Biotechnology in Agriculture: Bt. cotton and herbicide tolerant plants. PGPR, Mycorrhizae and role of microrrhizae in agriculture.

Unit V

Role of microorganisms in biogeochemical cycles (N, P and C cycles) – Biodegradation of xenobiotics (chlorinated pesticides) – MEOR - bioleaching of metals – microbes in waste treatment: solid waste (sanitary land fill and composting) and liquid waste – sewage treatment –BOD – pollution indicating microbes.

References

1. Rangasami G and Bagyaraj DJ. 1993. Agricultural Microbiology 2/e Prentice- Hall publications.
2. Ronald Atlas, Bartha, Richard, 1987. Microbial ecology 2/e Benjamin-Cummings publications.
3. Prescott, Harley and Klein, 2006. Microbiology. The McGraw Hill companies.
4. Madigan, M.T., Martinko, J.M. and Parker, J., 1997, Brock Biology of Microorganisms 8/e. Prentice-Hall Inc.

Core	Semester V	Bioinformatics	13UMBC53
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Objectives

- To promote the basics of computer.
- To understand the applications of computer in life science.

Unit I

Components of computers input/output devices, Storage devices, Graphic devices, Operations system- MS DOS & WINDOWS - Networks-HTTP, HTML,Internet .

Unit II

Use of commercial software: Wordstar, Windows, Power Point, MS Excel, Print artist.

Unit III

Biological databases- DNA databases-EMBL,DDBJ and protein databases –PIR,SWISS PROT. Collection and downloading information from databases –SRS.

Unit IV

DNA sequencing methods-Maxam gilbert and sanger coulsan methods.Pattern,motifs and profiles.

Unit V

Sequence alignment –Pairwise and multiple sequence alignment,FASTA,BLAST and CLUSTAL. Phylogenetic analysis.

References

1. Christopher J Rawlings, Software Directory for molecular Biologists Stockton Press, Mac Millan Publishers, 1986.
2. A directory – DBT, Data basis in life sciences and Biotechnology: Govt. of India, March 1995.
3. R.M.Kamp, T. Choli-Papadaopoulou B. Witman Liebold., Protein Structure Analysis – Springer Lab Manual.
4. T.N. Bryant, JWT Wimpenny, Computer in microbiology- a practical approach. IRL, Press, 1989.
5. By Zar, Bio-Statistics Analyses. Second Edition. Prentice Hall International Englewood Cliffs, New Jersey.

SBS	Semester V	Bio chemical Techniques	13UMBS51
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Objectives

- To introduce the basic principles and applications of various techniques.
- To understand the working mechanisms of the instruments.

Unit-I

Chromatography-Column,Paper,TLC,Adsorption,Partition, and gel filtration.

Unit II

Advanced biochemical Techniques-GC, HPLC, Ion exchange and Dialysis.

Unit-III

Electrophoresis-Principle and application of different types of electrophoresis-Agarose,SDS-PAGE.

Unit IV

Centrifugation-Principle and application-Types of centrifugation.

Unit-V

Principles and applications of PCR, Spectrophotometry-Simple and UV.

Reference.

- 1.Palanivelu.P,Analytical Biochemistry and separation Techniques,21st century publications, Palkalai nagar,Madurai.
- 2.Practical Biochemistry-Willson&Wilson.

Allied II	Semester V	Genetics and Biostatistics	13UMBA51
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Objectives

- To introduce the importance of statistics in life science.
- To understand the basics of mendel genetics.

Unit-I

Mendelian Genetics-Mendel's works,experiments,observations and results-mendel's laws-terms-Back cross,Test cross-complete and incomplete dominance-co dominance

Unit-II

Allelic interaction-Multiple Alleles-blood group inheritance-Rh factor-Multiple gene inheritance- genes and chromosomes-crossing over and linkage.

Unit-III

Biostatistics-Introduction-Data collection-Types of data –primary, secondary and tertiary data-sampling and sampling designs-random and non random sampling.

Unit-IV

Representation of data-Diagramatic-simple bar diagram,Pie diagram-graphical representation-Histogram,frequency curve,cumulative frequency curve-Measures of central tendency-Explanation-Types of average-Arithmetic mean-median-Mode-Continuous series-discrete series.

Unit –V

Measures of dispersion-Explanation-Types-range-Mean deviation-Standard deviation-Variance-correlation and regression.

References

- 1.Principles of Genetics-edmund.W.Sinnot,Dunn,L.C
- 2.Molecular Biology-David Frifielder.
- 3.An introduction to Biostatistics.2005.N.Gurumani
- 4.Statistics.Pillai.R.S.N and bhagavathi 2003

Core	Semester VI	Recombinant DNA Technology	13UMBC61
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Objectives

- To understand about the basics of gene cloning.
- To promote the applications of gene cloning in various fields.

Unit I

General Strategies of cloning –Gene cloning enzymes Restriction enzymes and types,DNA ligase,Taq polymerase,Klenow,Terminal nucleotide transferase,Alkaline phosphatase,linkers and adopters.

Unit II

Vectors- Plasmids- constructed plasmids, pBR322, pUC18 - Lambda phage derived vectors, cosmids and their applications. BAC and YAC as vectors.

Unit III

Methods of gene transfer –Transformation, Transduction, Transfection, microprojectile bombardment, Southern and Northern blotting techniques.

Unit IV

Transgenic animals,transgenic mice and sheep. - Agrobacterium mediated gene transfer mechanism - Markers and Reporter genes and their applications - Transgenic plants – insecticide resistance, herbicide and drought tolerance. Production of Insulin- Growth hormone (STH)- Interferons, etc.

Unit V

Intellectual property rights, patent,forms of patents, process of patenting, Indian and international agencies involved in patenting, patenting biological materials.

References

1. Brown, T.A., Genetics – A Molecular Approach, Chapman Hall, London, 2004.
2. Darnell, J. Lodish, H., and Baltimore, D., Molecular Cell Biology, Scientific American Books Inc., Iowa. 2006
3. Glick,B.R. and Pasternak, J.J.,2006, Molecular Biotechnology- Principles and Applications of Recombinant DNA technology, ASM press, Washington.

Core	Semester VI	Industrial Microbiology	13UMBC62
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Objectives

- To encourage and promote the students in the field of Industrial Microbiology.
- To promote the applications of microbes in various industries.

Unit I

Fermentor-Basic design, parts and function. Types of fermentor-Batch, CSTF, Tower fermentor and packed bed bioreactor. Computer applications in fermentation technology.

Unit II

Screening of industrially important microbes-Primary and screening techniques. Strain development, preservation-mineral oil and lyophilization. Inoculum preparation, Inoculum build-up.

Unit III

Ideal production medium-raw materials-Carbon sources-molasses, cheese whey, sulfate waste liquor, Lipid source-hydrocarbons and vegetable oils-Nitrogen sources-corn steep liquor, soya bean meal.

Unit IV

Fermentation-Types: aerobic fermentation(Penicillin, Vitamin B12), anaerobic (Ethanol) and solid state(Gibberellic acid). biological assays.

Unit V

Detection and assay of fermentation products- physio chemical and biological assays. Biosafety levels, guidelines and regulations.

References

1. Crueger, W. and A. Crueger (2000), Biotechnology, A Text book of Industrial Microbiology, Panima Publishers, New Delhi.
2. Nandari, H., (2005), Industrial Biotechnology, Dominant Publications and Distributors, New Delhi.
3. Stanbury, O.F., Whitakar, A., and Hall, S.J., (1997), Principles of Fermentation Technology, Aditya Books (P) Ltd., New Delhi
4. Patel, A.H, Industrial Microbiology, The Tata McGraw-Hill Companies, 2008.

Core	Semester VI	Food Microbiology	13UMBC63
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Objectives

- To encourage and promote the students in the field of Food Microbiology.
- To promote the applications of microbes in various Food industries.

Unit I

Importance of Food Microbiology- Food as substrate for microbial growth- intrinsic and extrinsic factors affecting growth and survival of microorganism in foods - Microorganisms present in the vegetables, fruits, cereals, milk, egg, etc.

Unit II

Features of food spoilage like fruits, vegetables, milk and milk products - Milk sterilization techniques, Phosphatase test- Spoilage of bread and cereals, egg, meat, fish and poultry.

Unit III

Food preservation by removal of microorganisms, low temperature, high temperature, irradiation and chemical methods. Preservation of different kinds of foods meat,vegetables,cereals,poultry and its products.

Unit IV

Food borne infection, food borne intoxications. Detection of food-borne pathogens.

Unit V

Fermented foods–production and preservation-pickles, sauerkraut, idli, wine, beer, bread, cheese etc.

References

1. Adams. MR and Moss, MO. 2005. Food Microbiology, New age International Pvt. Ltd publications.
2. Frazier, WC and Westhoff DC. 2003. Food Microbiology, 4th edition, McGrawHill, NewYork.
3. Hobbs BC and Roberts D 1993. Food Poisoning and Food Hygiene. Edwards Arnold, London.
4. Yousef, AE and Carlstrom C. 2003. Food Microbiology-A Laboratory manual, Wiley Interscience.
5. Jay JM, 2000. Modern Food Microbiology, Aspen Publishers.
6. Robinson, R.K.1990. Dairy Microbiology, Elsevier Applied Science, London.

SBS	Semester VI	Enzymology & Enzyme Technology	13UMBS61
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Objectives

- To introduce about the Enzymes and co factors.
- To understand the application of enzymes in various fields.

Unit- I

Nomenclature and Classification of enzymes (with examples)-General properties of enzymes (Optimum pH, Optimum Temp & Substrate Concentration).

Unit II

Steady state kinetics and derivation of Michaelis-Menten, Linweaver-Burk, equations and their plots-Activation energy-Enzyme specificity

Unit- III

Extraction of enzymes-Purification of enzymes-Enzyme inhibitors.

Unit- IV

Mechanism of enzyme catalysis- Coenzymes-NAD, FAD- Metal ions in enzyme catalysis.

UnitV

Application of enzymes (Clinical & Industrial)-Immobilization of enzymes.

References

- 1.Palanivelu.P ,Enzymes, Ribozymes and DNAzymes.,21st century publications, Palkalai nagar, Madurai.
- 2.T.Palmer,Enzymes-Biochemistry,Biotechnology,Clinical chemistry-EastWest press,NewDelhi.
- 3.Conn,E.E.,Stumpf,P.K,Bruening,G and Doi,R.H,John Wiley & Sons.Outlines of Biochemistry.

Core Lab	Semester VI	Major Practical III	13UMBC6P1
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Objectives

- To skill the students towards clinical microbiological techniques.
- To understand about the various testing of environmental samples.

Medical Microbiology

1. Antibiotic susceptibility test: disc diffusion method
2. Measurement of minimal inhibitory concentration (MIC) and minimal lethal concentration (MLC)
3. Isolation and identification of *Staphylococcus*, *Streptococcus*.
4. Collection and processing of medical samples

Agriculture & Environmental Microbiology

1. Isolation and characterization of soil microbes
2. Serial dilution method for enumeration of soil bacteria
3. Identification of microbial pathogen in paddy and vegetable crops (field study).
4. Isolation of symbiotic nitrogen fixing bacteria from root nodules - *Rhizobium*
5. Isolation of free-living nitrogen fixing bacteria from rhizosphere - *Azotobacter*
6. Isolation of phosphate solubilizing bacteria – *Pseudomonas*
7. Examination of mycorrhizae – VAM
8. Potability testing of water (MPN test)

Core Lab	Semester VI	Major Practical IV	13UMBC6P2
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Objectives

- To skill the students towards Advanced microbiological techniques.
- To motivate the students in the field of industry oriented career.

r DNA TECHNOLOGY

1. Isolation of chromosomal DNA from microbial cells.
2. Separation of DNA by agarose gel electrophoresis
3. Determination of purity and quantification of DNA
4. Isolation and purification of a plasmid DNA
5. Restriction Digestion Analysis
6. Ligation
7. Transformation of *E. coli* using plasmid (pUC18/19)
8. Blue-white Selection of transformants

Industrial Microbiology

1. Isolation of amylase and protease producing bacteria and fungi
2. Crowded plate technique for antibiotics producing microbes
3. Alcohol (ethanol) production
4. Immobilization of yeast

Food Microbiology

1. Enumeration of microbial population in food samples meat, pickles, ice cream, fruit juices
2. Milk quality test-MBRT

Allied II	Semester VI	Environmental Biology	13UMBA61
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Objectives

- To introduce the importance of Environment in life.
- To understand the basics of ecosystem.

Unit-I

Environmental biology and its relevance to human civilization- environmental factors- Physical, chemical and biological –and their influence in living system-population explosion and its consequences-Deforestation and its consequences.

Unit-II

Ecosystem and flow energy and nutrients-Concept of ecosystem, biosphere and types of ecosystem-biotic and abiotic factors-primary and secondary productivity-food chain and food web-ecological pyramids-biogeochemical cycles.

Unit-III

Resource and conservation-Natural resources-aquatic and terrestrial resources-renewable and non renewable energy (introduction)-Aquatic resources-sewage treatment-fish culture and management-Terrestrial resources-Agriculture-soil fertility and nitrogen fixation-biofertilizers.

Unit-IV

Environmental pollution and management-Types of pollution-Air, Water, Soil and Noise-sources, effect and control measures-environmental pollution management and environmental education.

Unit-V

Population biology-Population parameters and their estimation-life table-reproductive effort-evolution of demographic traits-population growth models-species interaction and competition-population-regulation-density dependent and independent.

References:

1. Dasmann, R., Environmental Conservation-II Ed.
2. J. Kormondy, Concepts of Ecology-II Ed.
3. Odum, E.P. Fundamentals of Ecology-1980.
4. Ehrlich, P.R., J.P. Holdrege and R.W. Kolm, Man and Ecosphere, 1989.
5. Verma, P.S and V.K Agarwal., Environmental Biology, S.Chand & Co., New Delhi, 1995.

Allied Lab	Semester IV	Ancillary Biology Practical	13UMBA6P
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Objectives

- To introduce about the basic of genetics.
- To understand about the testing of various environmental sample.

1.Survey of mendelian traits in man.

2.Law of probability.

3.Determination of blood groups & Rh factors .

4.Determination of haemoglobin.

5.blood cell counts.

6.Estimation of dissolved Oxygen in different water samples.

7. Estimation of salinity in different water samples.

8. Estimation of alkalinity in different water samples.

9.Soil testing for pH, alkalinity,nitrate and phosphates.

10.Problems in Measures of central tendencies-Mean,median and Mode.

11.Problems in Measures of dispersion-Standard deviation.