UNIVERSITY OF CALICUT

Abstract

BSc in Microbiology-CUCBCSS UG 2014-Scheme and Syllabus- Approved-Implemented-w.e.f 2014 Admissions-Orders issued.

G & A - IV - J

U.O.No. 7451/2014/Admn Dated, Calicut University.P.O, 01.08.2014

Read:-1. U.O. No. 3797/2013/CU, dated 07.09.2013 (CBCSS UG Modified Regulations)
   (File.ref.no. 13752/GA IV J SO/2013/CU).
2. U.O. No. 5180/2014/Admn, dated 29.05.2014 (CBCSS UG Revised Regulations)
   (File.ref.no. 13752/GA IV J SO/2013/CU).
3. Item no. 1 of the minutes of the meeting of the Board of Studies in Microbiology held on 5.6.14.
4. Item no. 37 of the minutes of the meeting of the Faculty of Science held on 27.06.2014.
5. Orders of the VC on 14.07.2014, in the file no, 18602/GA IV /J1/2013/CU.

ORDER

The Modified Regulations of Choice Based Credit Semester System for UG Curriculum w.e.f 2014 was implemented under the University of Calicut vide paper read as (1). The Revised CUCBCSS UG Regulations has been implemented w.e.f 2014 admission, for all UG programme under CUCBCSS in the University, vide paper read as (2).

The Board of Studies in Microbiology finalized the revised syllabus of BSc Microbiology for implementation w.e.f the Academic Year 2014-2015. vide paper read as (3). The Faculty of Science has also approved the minutes of the Board vide paper read as (4).

The Hon'ble Vice Chancellor, considering the exigency, exercising the powers of the Academic Council has approved the items regarding syllabus implementation in the minutes of the concerned Boards of Studies mentioned in the minutes of the Faculty of Science, subject to ratification by the Academic Council, vide paper read as (5).

Sanction has, therefore, been accorded for implementing the Scheme and Syllabus of BSc.in Microbiology under CUCBCSS UG 2014, in the University, w.e.f 2014 Admissions.

Orders are issued accordingly.
(The syllabus is available in the website: universityofcalicut.info)
To

1. All Affiliated Colleges/SDE/Dept.s/Institutions under University of Calicut.
2. The Controller of Examinations, University of Calicut.
3. The Director SDE, University of Calicut.

Forwarded / By Order

Section Officer
<table>
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<th>Semester</th>
<th>Course nature</th>
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## Distribution of different courses and their credits

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<td>V through VI</td>
<td>Project (core)</td>
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### Outline of the various courses offered

- **Total common courses offered**: 10
- **Total core courses offered in the area of specialization (Microbiology) including project work and practical**: 16
- **Total Complementary courses offered including practicals (two complementary subjects)**: 9
- **Total open courses offered for other departments (to choose one out of the two offered)**: 1
- **Total open courses offered for the same departments (to choose one out of the three offered)**: 1

**Total courses offered in the 6 semesters**: 37
**Total credits offered in the 6 semesters**: 120
**Total credits required for qualifying Degree**: 120
**Total credits required for core, complementary and open put together**: 82
**Total credits required for core, complementary and open put together**: 82

### General Course IV offered (Designed by the Board)

1. Molecular Biology and Bioinformatics. : 4 credits

### Open courses offered to students of other Departments with credits (5th Semester)

1. Public health and emerging microbial diseases : 4 credits.
2. Environmental Microbiology : 4 credits

### Open Courses (elective) from the parent department with credits (6th Semester)

1. Cell and tissue culture : 2 credits
2. Bio instrumentation : 2 credits
3. Bio safety and Bioethics : 2 credits
SEMESTER I

MB1B 01  GENERAL MICROBIOLOGY
3  Hrs /week  3 credits

Unit -1    6 hrs
History and development of Microbiology, spontaneous generation vs. biogenesis. Contributions of the following scientists in various areas of Microbiology - Anton van Leeuwenhoek, Joseph Lister, Paul Ehrlich, Edward Jenner, Louis Pasteur, Robert Koch, Martinus W. Beijerinck, Sergei N. Winogradsky, Alexander Fleming, Selman A. Waksman.

Unit-2    4 hrs

Unit-3    10 hrs
Microscopy- bright field, dark field, phase contrast, fluorescent and electron microscopy. Staining techniques- simple and differential- Grams, spore, flagella, volutin, capsule, negative and Fuelgen staining.

Unit-4    10hrs

Suggested Readings

1. Fundamentals of Bacteriology by A.J Salle
2. Microbiology by Pelczar et al
3. Fundamentals of Microbiology by Mertus Frobisher
4. General microbiology by Stanier et al
6. Principles of Microbiology by Ronald Atlas
7. Microbiology: An Introduction by Tortora GJ, Funke BR, and Case CL.
8. Microbiology: Principles and Explorations by Black.
10. Alcamos Fundamentals Of Microbiology
SEMESTER II

MB2B02 MICROBIAL PHYSIOLOGY AND TAXONOMY
2 Hrs /week  3 credits

Unit 1  10 hrs

Bacterial structure-
**External structures**-glycocalyx, capsule, flagella, fimbriae and pili.
**Cell-wall**: Composition and detailed structure of gram positive and gram-negative cell walls, Archaebacterial cell wall, sphaeroplasts, protoplasts, and L-forms. Effect of penicillin and lysozyme on the cell wall.
**Cell Membrane**: Structure, function and chemical composition of bacterial and archaean cell membranes.
**Cytoplasm**: Ribosomes, mesosomes, inclusion bodies, nucleoid, chromosome and plasmids

**Endospore**: Structure, formation, stages of sporulation.

Unit-2  10 hrs

Culture media-Solid and liquid media, use of agar. Selective, Enrichment, Enriched, differential, selective-differential, indicator media, Transport media, simple and complex, synthetic or defined, Anaerobic media. Culture methods-Streak, spread, pour plate methods, stab culture and lawn culture. Anaerobic culture methods.
Culture preservation strategies.

Unit-3  7 hrs

Growth curve and its significance, generation time, steady state culture, synchronous culture and Diauxic culture, Quantitative measurement of bacterial growth by direct and indirect methods.

Unit-4  7 hrs

Transport of nutrients by bacteria- passive, active and group translocation. symport, antiport and uniport, electrogenic and electro neutral transport, transport of Iron.
Microbial metabolism-a brief description-Energy production by anaerobic processes, aerobic processes and photosynthesis- a brief description.

Unit-5  6 hrs


Unit-6  6 hrs
Modes of reproduction in bacteria - fission, budding, fragmentation, sporulation etc. Viral replication - lytic and lysogenic methods. Viral and bacteriophage Quantitation methods - Plaque and pock assay.

**Unit-7  6 hrs**

Basics of microbial taxonomy - concept of species and taxa and strain.
Classification systems - Numerical taxonomy or Adansonian classification, phenetic and phylogenetic Classification.
Various criteria used in bacterial classification : classical, morphological, physiological, metabolic and ecological characteristics.
Molecular characteristics - comparison of proteins, nucleic acid base composition, nucleic acid hybridization and nucleic acid sequencing, 16S rRNA studies.
Classification systems in fungus and their different classes.

**Suggested Readings.**

1. Fundamentals of Bacteriology by A.J Salle
2. Microbiology by Pelczar et al
3. Fundamentals of Microbiology by Mertus Frobisher
4. General microbiology by Stanier et al
6. Principles of Microbiology by Ronald Atlas
7. Microbiology: An Introduction by Tortora GJ, Funke BR, and Case CL.
8. Microbiology: Principles and Explorations by Black.
10. LIPPINCOTS ILLUSTRATED REVIEWS MICROBIOLOGY by HARVEY
11. ALCAMOS FUNDAMENTALS OF MICROBIOLOGY

**MB2B03 (P) MICROBIOLOGY PRACTICAL 1-GENERAL MICROBIOLOGY**

**1 Hrs /week**

1. Introduction to common methods of sterilization
2. Introduction to common laboratory instruments in Microbiology like hot air oven, autoclave, laminar air flow cabinet, incubator etc.
4. Simple Staining.
5. Grams staining.
7. Spore Staining.
8. Flagella Staining.
9. Preparation of media (Nutrient broth, Nutrient agar, Blood agar, Chocolate agar, McConkey agar, EMB agar).
10. Motility determination - Hanging drop method, Semisolid agar method
SEMESTER III

MB3B04 ENVIRONMENTAL AND SANITATION MICROBIOLOGY
4 Hrs /week            3 credits

Unit 1            10 hrs

**Microbiology of air** – atmospheric layers, organisms in air, distribution and sources. Disease forecasting in plants. Indoor and outdoor air. Droplet nuclei, aerosol, infectious dust. Microbiological sampling of air - gravity slide, plate exposure, vertical cylinder, Hirst spore trap, Rota rod sampler, Andersen sampler, Burked trap, hand held air sampler, impingers and filtration. Advantages and disadvantages of these techniques. Brief account of air borne transmission of harmful microbes and Air borne infections.

Unit 2            14 hrs

**Aquatic Microbiology**: Aquatic environment, distribution of microorganisms in aquatic environment – fresh water, estuarine and marine water systems. Factors influencing growth and distributions. Water Purification procedures for single dwelling and municipal water supplies, Concept of indicator organisms, Microbiological examination of water. BOD, COD, Waste water treatment steps and methods. Eutrophication and algal bloom.

Unit 3            10 hrs

**Solid waste management**: Sources and types of solid waste, need for management, Land fills, composting, vermi- composting, anaerobic digesters, methanogenesis and production of biogas. Design and management of biogas plant.

Unit 4            11 hrs


**Suggested Readings.**

2. Microbiology concepts and applications by Pelzar et al.
5. A Handbook of water and waste water microbiology by Mara and Niger Horan.
6. Microbiological Examination Methods Of Food And Water By Silva
7. Text book of Biotechnology by BD Singh
8. Text book of Microbiology by Chakrabarthy
MB 3B05(P) MICROBIOLOGY PRACTICAL 2-MICROBIAL PHYSIOLOGY AND EVS MICROBIOLOGY.

2 Hrs /week

1. Isolation of pure culture by streaking.
2. Enumeration of microbial cells (pour plate and spread plate method).
3. Fungal staining.
4. Fungal Culture.
5. Determination of phenol coefficient.
6. Oligodynamic action of heavy metals on microbes.
7. Effect of temperature on growth of microorganisms - TDT and TDP.
8. Influence of pH on growth.
10. Isolation of bacteriophages from sewage.
15. Determination of MPN Value for water samples
16. Water quality analysis-preliminary, confirmed and completed test

SEMESTER IV

MB4B06 SOIL AND AGRICULTURAL MICROBIOLOGY

Hrs /week 4 3 credits

Unit 1 4 hrs

Introduction to soil Microbiology – Properties of soil (structure, texture, formation). Types and significance of soil microbes – Factors affecting microbial population - Soil fertility test.

Unit 2 6 hrs

Biogeochemical cycle –Role of microorganisms in Carbon, Phosphorous, Nitrogen and sulfur cycles.

Unit 3 10 hrs

Biological Interactions
Microbe–Microbe Interactions. Mutualism, Synergism, Commensalism, Competition, Amensalism, Parasitism, Predation.
Microbe–Plant Interactions.Roots- Rhizosphere and Mycorrhizae, Aerial Plant surfaces, Microbe–Animal Interactions. Role of Microbes in Ruminants, Nematophagus fungi, Luminescent bacteria as Symbiont
**Unit 4** 12 hrs

**Plant pathology** (symptoms, disease cycle and control measures) –
Bacterial diseases - Angular leaf spot of cotton, bacterial leaf blight of rice, crown galls, bacterial cankers of citrus
Fungal disease- Wilt of tomato - *Fusarium oxysporum*  Red rot of sugarcane - *Colletotrichum falcatus*, Early blight of potato - *Alternaria solani*  Wilt of cotton ,
Viral diseases- Papaya ring spot, tomato yellow leaf curl, banana bunchy top

**Unit 5** 13 hrs

**Applications of microbes in agriculture**: Biofertilizers. Symbiotic nitrogen fixation – (Rhizobium, Frankia) –Symbiotic nutrient mobilizers – Endomycorrhizae and Ectomycorrhizae.
Non symbiotic microbes – Azotobacter. Associative Symbiosis – Azospirillum.
Cyanobacteria (Nostoc. Gloeocapsa), Azolla-Anabaena System

Bio pesticides- bacterial, fungal and viral, Advantages over the chemical counter parts.

**Suggested Readings.**


**MB4B07(P) PRACTICAL 3- SOIL AND AGRICULTURAL MICROBIOLOGY**  Hrs/wk 3

(Practical examination for core practicals 1,2 and 3 Total Credits  4)

1. Isolation of rhizobium and azotobacter.
2. Amonification and nitrification of organic compounds.
3. Demonstration of pigment production on nutrient agar medium (*Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Serratia* spp.)
4. Examination of plant diseases
5. Isolation and Enumeration of bacteria and fungi from soil

SEMESTER V

MB5B08  INDUSTRIAL MICROBIOLOGY

4 Hrs/Week 4 Credits

Unit-1  10hrs

Unit-2  8hrs
Industrially important microorganisms - Screening Techniques- Primary and Secondary - Preservation of cultures - Strain improvement- Development of inoculum for various fermentation processes. Media formulations – Water, carbon and nitrogen source, growth factors, precursors, minerals, buffers, aeration ,antifoam agents, inhibitors, precursors and inducers.

Unit-3  4hrs
Downstream processing :- Extraction and purification of intracellular and extra cellular products.

Unit-4  13hrs

Unit-5  10hrs

Suggested Readings.

1. Industrial Microbiology by Prescott and Dunns.
3. Principles of Fermentation Technology by Stanburry and Whitaker
5. Comprehensive Biotechnology by Murray and Moo Yung.


MB5B09 FOOD AND DAIRY MICROBIOLOGY
3 Hrs/Week 3 Credits

Unit-1 2 hrs
Food as a substrate for microorganisms. Types of microorganisms in food – Source of contamination – Factors influencing microbial growth in foods (extrinsic and intrinsic)
Microbial examination of food- viable colony count, examination of fecal Streptococci.

Unit-2 4 hrs
Physical and chemical properties of milk. Milk as a substrate for microorganisms.
Types of microorganisms in Milk-bacteria, fungi and yeast. Sources of microbial contamination of milk. Microbiological analysis of milk. Rapid platform tests- organoleptic, Clot on boiling (COB), turntable acidity alcohol test, DMC, sedimentation test and pH. Standard plate count, MBRT

Unit-3 7hrs
Food fermentations: Cheese, bread, yoghurt, idli, fermented pickles and fermented vegetables, Ice cream, – methods and organisms used. SCP, Probiotics and prebiotics.

Unit-4 10hrs

Unit-5 10hrs
Food Poisoning : food borne infections (a) Bacterial: Staphylococcal, Brucella, Bacillus, Clostridium, Escherichia, Salmonella (b) Fungal : Mycotoxins including aflatoxins, ergotism (c) Viral: Hepatitis, (d) Protozoa – Amoebiasis.

Unit-6 12hrs
Food preservation : Principles of food preservation – methods of preservation.
a. Physical (irradiation, drying, heat processing, pasteurization, chilling and freezing, high pressure and modification of atmosphere) b. Chemical (Sodium benzoate Class I & II). Food Sanitation: Good manufacturing practices – HACCP, Presonnel hygiene.

Suggested Readings.

MB5B10 (P) PRACTICAL 4-INDUSTRIAL, FOOD AND DAIRY MICROBIOLOGY Hrs/wk 4

1. Differences in abrupt and gradual scale up of inoculum.
2. Enrichment of coir pith degraders.
3. Sterilization problems with suspended solids in media.
4. Demonstration of SSF, fixed bed and fluidized bed systems.
5. Pellicle formation.
7. Isoelectric focusing.
8. Salting out.
10. Production of alcohol from fruit juice.
11. Microbiological assay of penicillin.
12. Production of citric acid using Aspergillus.
13. Isolation and screening of industrially important microorganisms from soil/environment – cellulose digesting, amylase producing.
15. Isolation of constituent flora of fermented milk.
16. Production of wine.
17. Methylene blue reductase test.

MB5B11 IMMUNOLOGY 3 Hrs/wk 3 Credits

Unit 1 4hrs
Brief History of Immunology: Edward Jenner, Karl Landsteiner, Robert Koch, Paul Ehrlich, Elie Metchnikoff.

Structure and function of the lymphoreticular system- composition of blood and lymph and their immunological properties.

Unit 2 6 hrs
Immune Cells and Organs Structure, Functions and Properties of: Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic
cell; and Immune Organs – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT

**Unit 3** 7hrs
Concept of innate, acquired immunity, Humoral and cell-mediated, natural and artificial immUnity. Brief descriptions on mechanisms of innate immunological barriers- phagocytosis and inflammation.

**Unit 4** 12 hrs
Antigens – features. Hapten, complete antigen, adjutants, epitope (antigenic determinants.). Factors influencing antigenicity. T dependent and T independent antigens. Role of MHC in antigen presentation- class I and class II, MHC Restriction.

**Unit 5** 4hrs
Antigen and Antibody Reactions-Agglutination, Precipitation, Complement fixation test, neutralization, opsonization, Gel diffusion techniques, Immunoelectrophoresis, labeled antibodies –RIA, ELISA, Western blotting, Immunofluorescent techniques.

**Unit 6** 12hrs

**Unit 7**
Development and Causes of Cancer, Tumor Viruses, Oncogenes, Tumor Suppressor genes, Tumor antigens, Cancer Treatment- molecular approach.

**Suggested Readings.**

7. Immunology by Coleman et al
8. Fundamental Immunology by Paul W.E. et al
9. Introduction to Immunology John W Kimbal et al
10. Text Book of Microbiology by Ananthanarayanan and JayaramPanikkar.
11. Immunology by Coleman et al
12. Introduction to Immunology John W Kimbalet al
Unit 1 - 12hrs

Unit 2 - 6hrs
Morphology, culture, biochemical, pathogenicity, laboratory diagnosis and prevention of bacterial diseases - Staphylococcus aureus, S.pneumoniae, Neisseria gonorrhoeae.

Unit 3 - 6hrs
Morphology, culture, biochemical, pathogenicity, laboratory diagnosis and prevention of bacterial diseases - Mycobacterium tuberculosis, Corynebacterium diphtheriae, Clostridium tetani, Clostridium botulinum, Bacillus anthracis.

Unit 4 - 6hrs
Morphology, culture, biochemical, pathogenicity, laboratory diagnosis and prevention of bacterial diseases - Salmonella typhi, Shigella dysentriae, Vibrio cholerae, Escherichia coli, Pseudomonas aeruginosa, Yersinia pestis.

Unit 5 - 8hrs

Suggested Readings.

6. Medical Microbiology : David Greenwood, Slack, Peutherer
SEMESTER VI

MB6B14  MICROBIAL GENETICS AND GENETIC ENGINEERING

Hrs/wk 5     4 Credits

Unit 1    12 hrs
Mendelian Genetics and its Extension:
Principles of Inheritance, Chromosome theory of inheritance, Laws of Probability, Pedigree analysis, Incomplete and co dominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Environmental effects on phenotypic expression, sex linked inheritance. Extra chromosomal inheritance.

Unit 2    12 hrs

Unit 3    12 hrs
Linkage, Crossing Over gene transfer and Chromosomal Mapping:
Linkage and crossing over, Cytological basis of crossing over, Molecular mechanism of crossing over, Recombination frequency as a measure of linkage intensity, two factor and three factor crosses, Interference and coincidence.
Gene transfer techniques in prokaryotes and its utility in gene mapping- conjugation, transformation, transduction, interrupted mating techniques.

Unit 4    10 hrs

Unit 5    10 hrs
A concise account of methods used in “Recombinant DNA” technology – brief account of cell disruption techniques, vectors, gene transfer techniques, separation techniques and screening strategies.

Unit 3     8hrs
DNA Sequencing. DNA Amplification- PCR, applications of PCR. DNA (Gene) libraries, application of genetic engineering technology- Gene therapy. GM foods, modified plant and animal varieties, terminator gene technology. Ethical problems associated with the use of r DNA technology.

Suggested Readings.
16. Text book of biochemistry by Satyanarayana
17. Text book of Biochemistry by DM. Vasudeven

MB6B15 (P)  PRACTICAL 5-MOLECULAR BIOLOGY  Hrs/wk 4(Practical examination for Core practicals 4 and 5 Total 4 Credits)

1. Demonstration of mitosis and meiosis.
2. Extraction and estimation of DNA.
3. Extraction and estimation of RNA.
4. β-galactosidase induction.
5. Demonstration of polyteen chromosomes.
7. Electrophoresis.
8. Conjugation
9. Transformation
10. Agarose gel electrophoresis of DNA
11. Restriction digestion of DNA

MB6B16  MEDICAL MICROBIOLOGY II
5 Hrs/WeeK  4 Credits

Unit 1  15 hrs
Viral diseases (with reference to symptoms, pathogenesis, transmission, prophylaxis and control)

Polio, Chicken pox, Herpes, Hepatitis, Rabies, Influenza with brief description of bird and swine flu, Dengue, AIDS. An overview of emerging viral
diseases: Japanese Encephalitis, SARS, Chikungunya.

Unit 2  6hrs
Fungal diseases – brief account on superficial, subcutaneous and deep mycoses (systemic). Laboratory diagnosis of fungal infections.

Unit 3  8hrs

Unit 4  6hrs

Unit 5  8hrs
Antibiotics: Classification of antibiotics, mode of actions, emergence and mechanism of resistance. Introduction to various generations of antibiotics.

Suggested Readings.

6. Medical Microbiology : David Greenwood, Slack, Peutherer
11. Medical Microbiology by Macie and McCartney.
12. Viral Ecology By Hurs
Elective Courses (Open) offered for BSc Microbiology Programme in the VIth Semester.

MB6B18 (E1) CELL AND TISSUE CULTURE
4 Hrs/Wk  2 Credits

1. Laboratory cultivation of plant and animal cells and tissue culture. Application of plant and animal cell and tissue culture. Basic laboratory requirements, Maintenance of sterile condition Explant selection, sterilization and inoculation

2. Different types of culture, Callus culture, Suspension culture, Primary cell culture, Attach dependent cells attach independent cells, Cell lines, Organ culture, Types of media used and its formulations. Role of hormones, Hormones: Auxins, cytokinins, Gibberellins, Abscisic Acid, ethylene. Different media used for plant cell.


4. Production of seedless plants, synthetic seeds, Production of secondary metabolites from plant cell suspension culture. Protoplast technology: isolation, culture and plant regeneration, protoplast fusion, identification and characterization of somatic hybrids, applications of protoplast technology. Specific gene transfer: indirect and direct methods.

5. Animal cell culture as a substitute for animal experiments. Testing the viability of cells, dye exclusion methods,stem-cell culture and its applications,cell markers characterising stem cells.
Suggested Readings

2. Genetic engineering, Molecular biology and tissue culture of crop pest and disease management – P.Vidyasekaran, Paya Publication.

MB6B19 (E2)  
BIOSAFETY AND BIOETHICS
4 Hrs/Wk  
2 Credits
Introduction to bioethics, applications of bioethics, Human genome project and its ethical issues, Molecular detection of pre-symptomatic genetic diseases and its importance in health care, prenatal diagnosis, genetic manipulations and their ethical issues, Ethical, legal and social implications of human genome project. Genetic studies on ethnic races.

Suggested Readings

11. Bioethics: An introduction for the Biosciences by Ben Mepham

MB6B18 (E3)  
BIOINSTRUMENTATION
4 Hrs/Wk  
2 Credits
Scope: This paper highlights on vital instrumentation techniques for measurement of physical, physiological and biological factors in human and other living organisms.
Objective: To expose students to various bio physical technique used in modern biological science.

UNIT I
Centrifugation: principle, types, preparative, analytical and ultra centrifuge. Electrochemical techniques: Principles of electrochemical techniques, redox reactions, the pH electrode, Biosensors.

UNIT 2
Spectroscopic techniques: Properties of electromagnetic radiation, instrumentation and applications of UV and Visible spectroscopy, Spectrofluorimetry, atomic spectroscopy, NMRspectroscopic, MALDI-TOF, turbidometry and nephelometry.

UNIT 3
Chromatographic techniques: Principles, instrumentation and applications of different types of chromatography, HPLC, HPTLC, FPLC, GC-MS, LC-MS. Spectrophotometry: visible and UV spectrophotometry.

UNIT 4
Electrophoresis: Principles, instrumentation and applications of different types of electrophoretic techniques, (gel, agarose, SDS-PAGE, pulse field) Isoelectric focusing.

UNIT 5
Radio isotope techniques: The nature of radioactivity, types and rate of radioactive decay, detection and measurement of radioactivity, principle, instrumentation and applications of Geiger Muller counter, solid and Liquid Scintillation counter-autoradiography, Flowcytometry

Suggested Readings

2. David T Plummer, Tata McGraw- Hill publishing company limited; McGrqw office, New Delhi
4. Instrumental methods of chemical analysis – P.K. Sharma

General course IV offered in the IVth semester for B.Sc. Microbiology programme.

MB4A08 MOLECULAR BIOLOGY AND BIOINFORMATICS
4 Hrs/Week 4 Credits

Unit 1 10 hrs
DNA: DNA as the genetic material, Experimental proof. Structure of DNA and RNA, Types and forms – DNA, t-RNA, r-RNA, m-RNA - Definition and functions. Organization of bacterial and eukaryotic chromosomes. Histones and their function. Denaturation and renaturation, cot curves. DNA topology - linking number, topoisomerases.

Unit 2 10 hrs

Unit 3 12 hrs
Unit 4  
20 hrs 
**Introduction to bioinformatics**: its importance and scope 
Biological data bases, primary and secondary sequence databases, Genbank, EMBL, DDBJ, PDB, MMDB, CATH, SCOP, VIDA and KEGG. 
Comparative genomics- Sequence alignment and analysis- BLAST, FASTA, CLUSTALW, MULTALIN. 

(A software assisted teaching method is preferred for demonstration of tools in bioinformatics and no practical examinations will be conducted.)

**Suggested Readings**

1. Text book of Biochemistry by Lehninger 
2. Biochemistry by Stryer 
8. Introduction to Bioinformatics: T.K. Attwood, D.J. Parry-Smith and S. Phukan 
11. Introduction to Bio informatics by Arthur. M Lesk

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**Open Courses offered for other Departments**

**In 5th Semester**

**MB 5D01 PUBLIC HEALTH AND EMERGING MICROBIAL DISEASES**

**Hrs/Week  3       4 Credits**

Concept of health, Dimensions of health, Human development index, Human poverty index, Gender related development index and gender empowerment measure. 

Infectious disease epidemiology. Definition of terms :-infection ( primary, secondary, cross, nosocomial, iatrogenic, exogenous, endogenous, clinical , subclinical ), contamination, infestation, host, infectious disease, communicable disease, epidemic, pandemic, endemic, sporadic, exotic, zoonotic, epizootic enzootic and epornithic diseases. Sources of infection and modes of transmission. Reservoirs, carriers and vectors of communicable diseases. 
Role of WHO in pandemic alerts. 

Immunity- Innate and acquired, Active and passive, Natural and artificial. Local
immunity and Herd immunity. Disease prevention and control-controlling the reservoir, interruption of transmission, Immunisation etc. Principles of active, passive and combined immunisation. Indian national immunisation schedule.


**Suggested Readings**

6. Medical Microbiology : David Greenwood, Slack, Peutherer

**MB5D02. ENVIRONMENTAL MICROBIOLOGY**

3 Hrs/Week 4 Credits


5. Global environmental problems: ozone depletion, greenhouse effect and acid rain, their impacts and biotechnological approaches for management. Definition of xenobiotics and biomagnification. Composting, vermicomposting and biogas production.

Suggested Readings
2. Microbiology concepts and applications by Pelzar et al.
5. Handbook of water and waste water microbiology by Mara and Niger Horan.
6. Microbiological Examination Methods Of Food And Water By Silva
7. Text book of Biotechnology by BD Singh
8. Text book of Microbiology by Chakrabarthy

**MICROBIOLOGY COMPLEMENTARY COURSES**

*For other B.Sc. Programmes*

**MICROBIOLOGY (Complementary for other BSc Programmes)**

**SEMESTER I**
MB1C01. GENERAL MICROBIOLOGY
MB1C02 (P). Practical I

**SEMESTER II**
MB2C03 MICROBIAL METABOLISM AND GENETICS.
MB2C04 (P). Practical II

**SEMESTER III**
MB3C05 APPLIED MICROBIOLOGY
MB3C06 (P). Practical III

**SEMESTER IV**
MB4C07 MEDICAL MICROBIOLOGY AND IMMUNOLOGY
MB4C08 (P). Practical IV

**SEMESTER 1**
MB1C01. GENERAL MICROBIOLOGY

2. Microscopy and staining—general principles, Light microscopy- Bright field, dark field, phase contrast, UV, Fluorescence microscopy, Staining—fixation,
dyes, different methods - simple, differential, negative, Fuelgen staining.
Electron microscopy-TEM and SEM, specimen preparation.
3. Bacterial Taxonomy- Haeckel’s three kingdom concept, Whittaker’s five kingdom concept, Classification systems- Numerical taxonomy phenetic and phylogenetic classification, DNA hybridization and base composition.
6. Sterilization and disinfection - Physical and chemical agents to control microorganisms, definition of terms – sterilization, disinfectant, antiseptics, sanitization,

MB1C02 (P). MICROBIOLOGY PRACTICAL I

1. Cleaning and sterilization of glassware.
2. Introduction to hot air oven, autoclave and incubator.
4. Simple Staining.
5. Grams staining.
7. Spore Staining.
8. Preparation of media (Nutrient broth, Nutrient agar).
9. Isolation of pure culture.
10. Enumeration of microbial cells (pour plate method).
11. Fungal staining.
12. Fungal Culture.

Suggested Readings

1. Fundamentals of Bacteriology by A.J Salle
2. Microbiology by Pelczar et al.
3. Fundamentals of Microbiology by Mertus Frobisher
4. General microbiology by Stanier et al.
6. Principles of Microbiology by Ronald Atlas
7. Microbiology: An Introduction by Tortora GJ, Funke BR, and Case CL.
8. Microbiology: Principles and Explorations by Black.
10. Lippincotts Illustrated Reviews Microbiology by Harvey
11. ALCAMOS FUNDAMENTALS OF MICROBIOLOGY

SEMESTER II
MB2C03. MICROBIAL METABOLISM AND GENETICS

1. Enzymes-characteristics and properties of enzyme, nomenclature, mechanism of enzyme action, factors influencing enzyme activity, inhibition of enzyme action.
4. Gene transfer methods-transformation, conjugation, transduction. Plasmids, transposons, Restriction and modification of DNA, Recombinant DNA.
Expression of foreign genes, Application of genetic engineering.

Suggested Readings

1. Text book of Biochemistry by Lehninger
2. Biochemistry by Stryer
4. Genetics- Pierce
5. Text book of Biochemistry by Satyanarayana

MB2C04 (P) MICROBIOLOGY PRACTICAL II

1. Preparation buffers.
2. Protein Estimation using Lowry’s method
3. Folin - Ciocalteau estimation of unknown protein using Std. graph
4. Carbohydrate estimation
5. Estimation of ascorbic acid in plant matter
6. Paper chromatography
7. TLC
8. Column separation of plant pigments
10. Extraction and estimation of DNA.
11. Electrophoresis.
13. Separation of plant pigments
SEMESTER III
MB3C05. APPLIED MICROBIOLOGY

1. Air Microbiology: Air microflora-sources, factors affecting air microflora, enumeration of microorganisms in air- settling under gravity, centrifugation, impingement, filtration, electrostatic precipitation, Airborne diseases-bacterial, fungal, viral,
6. Industrial Microbiology: Advantages of microbial process over chemical process, Fermentor—basic functions of a fermentor, structure and working. Batch culture, continuous culture, fed-batch culture. Production of penicillin, vitamin B-12, and bakers yeast, SCP. Downstream process

MB3C06 (P). MICROBIOLOGY PRACTICAL III

1. Examination of microflora of soil
2. Determination of BOD of water.
3. Air sampling.
4. Aerobic mesophilic count of fish samples and milk.
5. Methylene blue reductase test.
6. Isolation of rhizobium.
7. Pellicle formation.
9. Isoelectric focusing.
10. Salting out.
12. Demonstration of antibiosis

Suggested Readings

1. Industrial Microbiology —A. H. Patel
2. Industrial microbiology —Casida
3. Industrial Microbiology—Prescott & Dunn.
4. Agricultural Micobiology-Rangaswamy
5. Brock biology of Microorganisms-Madigam
SEMESTER IV
MB4C07. MEDICAL MICROBIOLOGY AND IMMUNOLOGY

1. Types of infection, Source of infection, Modes of transmission, Bacterial diseases caused by – Staphylococcus aureus, Mycobacterium tuberculosis, Clostridium tetani, Clostridium botulinum, Vibrio cholerae, Salmonella typhi.
3. Types of immunity-innate and acquired, Hematopoiesis, Cells and organs of immune system, humoral and cell mediated immunity.
5. Hypersensitivity and its types, autoimmune diseases- different types and its mechanisms.

MB4C08 (P). MICROBIOLOGY PRACTICAL IV

1. Differential count of leukocytes.
2. Lymphocyte isolation.
4. WIDAL agglutination test.
5. RPR test.
6. AFB staining.
8. Antibiotic sensitivity test.

Suggested Readings

1. Immunology- Abbas.
2. Immunology-Janeway.
3. Immunology-Kuby.
4. Immunology-Roitt.
5. Introduction to Microbiology-John. L. Ingraham
7. Medical Microbiology-Brooks, Butal, Slack.
COMPLEMENTARY COURSE:
BIOSTATISTICS AND COMPUTER APPLICATIONS

SEMESTER I
MB1C03 Computer Applications- Fundamentals
MB1C04 (P) Computer Applications Practical I

SEMESTER II
MB2C07. C-Language, Data Base Management System & SQL.
MB2C08 (P) Computer Applications Practical II (with exam)

SEMESTER III
MB3C11 Biostatistics I
MB3C12 (P) Biostatistics Practical I

SEMESTER IV
MB4C15 Biostatistics II
MB4C16 (P) Biostatistics Practical II (with exam)

SEMESTER 1
MB1C03 Computer Applications Fundamentals


Reference Books:
MB1C04 (P) Computer Applications Practical I

Exercises to familiarize the student with various tools and packages available in a Personal Computing environment: word processing, drawing tools, managing information using a spreadsheet, presentation tools.

SEMESTER II
MB2C07. C- Language, Data Base Management System & SQL

1. Programming concepts: algorithm, flowcharts, Variables, constants, basic data types, int, float double and char qualifiers long short and unsigned declarations-Arithmetic expression.
2. Operator: arithmetic, logical bitwise increment decrement, assignment-precedence and order of evaluation conditional expressions scanf, printf operations.
3. Control flow if statement if . . .else and else if constructs-nested if statements switch statements —looping-for loops-nested loop while and do while statements break and continue statements.
4. Array: -initializing array elements multidimensional arrays sorting. Functions arguments and local variables declaration-return values variables auto, static, external and register variables-recursive functions.
5. Structure and unions type def statements data type conversions tyle casting- character strings-string functions escape characters introduction to pointers.
6. Introduction—Purpose of database systems, data models database languages transaction management, database administrator, data base users system structure.
8. Relational Model: Basic concepts, Design issues, mapping constraints, Keys, Entity Relationship Diagram, Weak Entity sets, DML, DDL, DCL Statements In Detail, Normalization-First, Second, Third And BCNF.
9. SQL: Background, Basic Structure, set operations, Aggregate functions, Null Values, Nested Sub queries, Derived relations, Views, Modification of the database, Joined relations data Definition Language, Embedded SQL.

Reference books

4. An Introduction to Database Systems, C. J. Date, 1994, Addison-Wesley
7. Fundamentals of Database Systems, Ramez Elmasri, Shamkant W Navathe
MB2C08 (P). Computer Applications Practical II

1. Menu driven program to concatenate two strings and find the length of a string using pointer.

2. Program to convert upper case into lower case and vice versa.
3. Program to count the number of occurrences of a charter in a string
4. Program to print the right most digit in a number.
5. Program to count the number of numerals, upper case, lower case and special character in a given string.
7. Program to check whether a string is palindrome or not.
8. Program to find the value of Sin(x)/Cos(x) using mathematical series.
9. Program to print the transpose of a matrix.
10. Program to find the product of two matrices.
11. Program to arrange numbers in ascending order.
12. Program to arrange numbers in alphabetic.

SEMESTER III
MB3C11. Biostatistics – I

2. Measures of Central Tendency and Measures of Dispersion – Arithmetic mean, Median, Mode, Geometric mean. Range, Mean deviation, Variance, Standard deviation, Quartile deviation, semi interquartile range, coefficient of variation, indices of diversity.
4. Probability distributions. Bernoulli’s distribution, Binomial distribution, Poisson distribution, and normal distribution. Parameters of these distributions, mean and variance (no derivations expected). Fitting of these distributions to real data sets.
5. Distributions derived from normal distribution – t-distribution, chi-square distribution, and F-distributions and their applications.

Reference Books

MB3C12 (P) Biostatistics Practical I

Students are expected to do practical problems as directed below using computer and Scientific calculator. Use of statistical software SPSS is also advised.

1. For a given data set construct histogram, and draw ogives and frequency polygon to the given data.
2. Calculate Arithmetic mean, median, Mode, Quartiles, Variance and standard deviation for
3. Calculate Geometric mean and harmonic mean to raw data.
4. Fitting of Binomial, Poisson and Normal distribution to given data sets.

**SEMESTER IV**

**MB4C15 Biostatistics II**

5. Partial and Multiple correlations: The concept of partial and multiple correlations - its applications. Calculating partial correlation of order one from simple correlations.

**Suggested Readings**


**MB4C16 (P) Biostatistics Practical II**

Students are expected to do practical problems as directed below using computer and Scientific calculator. Use of statistical software SPSS is also advised.

1. For a given data to test independence of attributes and test of goodness of fit.
2. Analysis of variance for one – way and two – way classified data.
UNIVERSITY OF CALICUT
------- Semester B.Sc. Degree (CCSS) Internal Examination, Month – 20

Microbiology
MB-------- (Number and Name of the Course)

Max Time: 3 Hours Max Weightage: 30

Section A-Answer all the questions each carries ¼ weightage
1. Multiple choice question
2. Multiple choice question
3. Multiple choice question
4. Multiple choice question
5. One word answer
6. One word answer
7. One word answer
8. One word answer
9. One word answer
10. One word answer
11. One word answer
12. One word answer

Section B-Answer all the questions each carries 1 weightage
13. Very very short answer
14. Very very short answer
15. Very very short answer
16. Very very short answer
17. Very very short answer
18. Very very short answer
19. Very very short answer
20. Very very short answer
21. Very very short answer

Section C- Answer any five questions each carries 2 weightage
22. Short answer
23. Short answer
24. Short answer
25. Short answer
26. Short answer
27. Short answer
28. Short answer

Section D- Answer any two questions each carries 4 weightage
29. Short essay
30. Short essay
31. Short essay