



UNIVERSITY OF CALICUT

Abstract

BSc in Microbiology-CUCBCSS UG 2014-Scheme and Syllabus- Approved-Implemented-w.e.f 2014 Admissions-Errors and Omissions corrected- corrigendum issued.

G & A - IV - J

U.O.No. 875/2015/Admn

Dated, Calicut University.P.O, 27.01.2015

- 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. UO No:U.O.No. 7451/2014/Admn Date: 01.08.14
6. UO Note from Parikshabhavan No: 28608/EX1/ASST-3/2014/PB 16.12.14
7. Corrected Syllabus forwarded by the Chairman, BOS in Microbiology

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, and orders issued as per paper read as (5).

As per paper read as (6) Pareekshabhavan has reported some errors and omissions in the Syllabus as follows:

1) The order of elective courses in the sixth semester are seen different in the scheme and the Syllabus. 2) The scheme of examination is not complete with the maximum marks for each course/semester/programme. 3) The pattern of Question Papers not provided

As per paper read as (7) the Chairman, BOS in Microbiology has corrected the error and forwarded the updated syllabus.

Therefore the Scheme and Syllabus implemented vide paper read as (5) stands corrected to this effect. Corrigendum is issued accordingly. (The corrected syllabus is attached herewith and is available in the website: universityofcalicut.info)

Muhammed S
Deputy Registrar

To

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

UNIVERSITY OF CALICUT

Syllabus For B.Sc. Programme in MICROBIOLOGY and Syllabus for MICROBIOLOGY as complementary subject for B.Sc. Course

**CHOICE BASED CREDIT SEMESTER SYSTEM
(CBCSS-UG) –modified regulationsw.e.f.2014**

UNIVERSITY OF CALICUT

***Scheme for B.Sc. Microbiology Degree under the
Choice Based Credit and Semester System (CUCBCSSUG)-2014
(6 Semesters; 37 Courses; 120 Credits)***

Semester	Course nature	Course code	Course title	Hours/ week	Credits	Total credits	Scheme of Evaluation (in marks)	
							Internal I (20%)	External (80%)
I	Common English course I	MB1A01		4	4	18	20	80
	Common English course II	MB1A02		5	3		20	80
	Additional language course I	MB1A07(03)	Communication skill in the languages other than English for B.Sc alternate pattern	5	4		20	80
	Core course I	MB1B01	General Microbiology	3	3		20	80
	1 st Complementary course I	MB1C01	Elementary Biochemistry-I	2	2		20	80
	1 st Complementary-Practical course I	MB1C02 (P)	Elementary Biochemistry – Practical I	2	Credits after exam at the end of semester IV			
	2 nd Complementary course I	MB1C03	Computer Applications Fundamentals	2	2		20	80
	2 nd Complementary-Practical course I	MB1C04 (P)	Computer Applications Practical I	2	Credits after exam at the end of semester IV			
II	Common English course III	MB2A03		4	4	20	20	80
	Common English course IV	MB2A04		5	3		20	80
	Additional language course II	MB2A09(03)	Literature in languages other than English for B.Sc. Alternate pattern	5	4		20	80
	Core course II	MB2B02	Microbial Physiology and Taxonomy	2	3		20	80
	Core practical course I	MB2B03 (P)	Practical 1-General Microbiology	1	Credits after exam at the end of semester IV			
	1 st Complementary course II	MB2C05	Elementary Biochemistry-II	2	2		20	80

	1 st Complementary- Practical course II	MB2C06(P)	Elementary Biochemistry Practical II	2	Credits after exam at the end of semester IV			
	2 nd Complementary course II	MB2C07	C – Language, Data Base Management System & SQL	2	2		20	80
	2 nd Complementary- Practical course II	MB2C08(P)	Computer Applications Practical II (Examination for Computer application practical I &II)	2	2		20	80
III	General course I	MB3A05	Numerical Skills	4	4	16	20	80
	General course II	MB3A06	General Informatics	4	4		20	80
	Core course III	MB3B04	Environmental and Sanitation Microbiology	4	4		20	80
	Core practical course II	MB3B05(P)	Practical 2 Microbial Physiology and EVS Microbiology	3	Credits after exam at the end of semester IV			
	1 st Complementary course III	MB3C09	Enzymology and Metabolism - I	3	2		20	80
	1 st Complementary- Practical course III	MB3C10(P)	Practical- Enzymology and Metabolism -I	2	Credits after exam at the end of semester IV			
	2 nd Complementary course III	MB3C11	Biostatistics I	3	2		20	80
	2 nd Complementary- Practical course III	MB3C12(P)	Biostatistics-practical -I	2	Credits after exam at the end of semester IV			
IV	General course III	MB4A07	Entrepreneurship Development	4	4	26	20	80
	General course IV	MB4A08	Molecular biology and Bioinformatics	4	4		20	80
	Core course IV	MB4B06	Soil and Agricultural Microbiology	4	4		20	80
	Core practical course III	MB4B07(P)	Practical 3- Soil and Agricultural Microbiology (Practical examination for core practicals 1,2 and 3)	3	4		20	80
	1 st Complementary course IV	MB4C13	Enzymology and Metabolism - II	3	2		20	80
	1 st Complementary- Practical course IV	MB4C14(P)	Practical-Enzymology and Metabolism.	2	4		20	80

			(Practical examination for 1 st complementary practicals 1,2,3 and 4)					
	2 nd Complementary course IV	MB4C15	Biostatistics II	3	2		20	80
	2 nd Complementary-Practical course IV	MB4C16(P)	Biostatistics Practical II (Practical Exam for Biostatistics practical I-II)	2	2		20	80
V	Core course V	MB5B08	Industrial Microbiology	4	4	20	20	80
	Core course VI	MB5B09	Food and Dairy Microbiology	4	4		20	80
	Core practical course IV	MB5B10(P)	Practical 4-Industrial, Food and Dairy Microbiology	4	Credits after exam at the end of semester VI			
	Core course VII	MB5B11	Immunology	4	4		20	80
	Core course VIII	MB5B12	Medical Microbiology-I	4	4		20	80
	Project work	MB5 B13 (Pr)	Project Work	2	Credits after exam at the end of semester VI			
	Open course-for other departments	MB5D01/MB5D02	Open course- for other departments	3	4		20	80
VI	Core course IX	MB6B14	Microbial genetics and genetic engineering	5	4	20	20	80
	Core practical course V	MB6B15(P)	Practical 5-molecular biology (Practical examination for core practicals 4,5)	4	4		20	80
	Core course X	MB6B16	Medical Microbiology-II	5	4		20	80
	Core practical course VI	MB6B17(P)	Practical 6- Immunology and Medical Microbiology (Practical examination for practical 6)	4	3		20	80
	Open course-from the parent department (Core)	MB6B18(E1)	Cell and Tissue culture	4	2		20	80
		MB6B18(E2)	Bioinstrumentation					
		MB6B18(E3)	Biosafety and Bioethics					
Project work	MB6B19(Pr)	Project work (Examination along with the core practical examination)	3	3		10	40	

Distribution of different courses and their credits

Semester	Course type	No of Courses	Credits
I and II	Common-English	4	14
I and II	Common-Addl language	2	8
III and IV	General Common	4	16
I to IV	Complementary	11	24
I to VI	Core	13	49
V	Open (other dept.)	1	4
VI	Open (parent dept.)	1	2
V through VI	Project (core)	1	3
Total		37	120

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 offered 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

Scheme of Examination, Evaluation and Grading:

- There shall be University examinations at the end of each semester.
- Practical examinations shall be conducted by the university at the end of even semesters.
- Practical examination, project / dissertation evaluation and viva voce shall be conducted by one external examiner and one internal examiner appointed by the university.
- Project evaluation shall be conducted at the end of 6th semester.
- Each Practical examination shall be conducted in two consecutive days of six hours duration.
- Evaluation and grading are in accordance with the general guidelines given by the university.
- The questions should be answered only in English

The evaluation scheme for each course (core) shall contain two parts

- (1) Internal evaluation (2) External evaluation
- 20% marks shall be given to the internal evaluation. The remaining 80% of marks shall be for the external evaluation.
 - Marks for the external evaluation 80
 - Marks for the internal evaluation 20

Components of and marks for the internal evaluation of theory courses are given below

Attendance	5
Test paper	10
Seminar/viva/assignment	5
Total	20

Scheme for practical examinations

- Maximum marks for external evaluation 80
- Maximum marks for internal evaluation 20

Components and of marks for the internal evaluation of practical courses are given below

Attendance	5
Records	10
Lab involvement	5
Total	20

For practical examination the question paper will have the following components

Components	Marks
Procedure writing	10
Experiment 1	20
Experiment 2	15
Spotters (5 Nos)	10
Records	10
Viva	15
Total	80

PROJECT EVALUATION

- Each student will have to do a research project during the entire course under the guidance of a faculty member of the college.
 - A group of students can collectively undertake the project under the supervision of a member of the faculty.
 - The total member in a group may be restricted to a maximum of 4.
 - Maximum marks for project will be 50 (internal 10 and external 40)
 - Internal evaluation will be done by the supervising faculty by considering
 - Involvement
 - Punctuality
 - Viva
 - External evaluation will be done by the external examiner by considering
 - Relevance of the study
 - Presentation
 - Use of molecular and statistical tools
 - Viva
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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 von 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

Eukaryote and prokaryote - differences. Differentiate archaeobacteria, eubacteria and Cyano bacteria. Bacterial forms and arrangement of cells – coccus, bacillus, spirals, coma, actinomycetes, kidney shaped, stalked, pleomorphic. Diplo, chain, trichome, palisade, and arrangements. Mold and yeast forms. Viral and bacteriophage forms.

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

Sterilisation techniques- Physical and chemical methods- flaming, boiling, autoclaving, inspissation, Heat, filtration, Radiation. Aseptic methods- laminar air flow hood. Phenol coefficient.

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*
5. Text book of Microbiology by Prescott.
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.
9. *Brock Biology of Micro-organisms*.
10. Alcamos Fundamentals Of Microbiology

SEMESTER II

MB2B02 MICROBIAL PHYSIOLOGY AND TAXONOMY

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, Archaeobacterial 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 archaeal 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

Effect of various parameters and Environmental factors on microbial growth- Temperature, pH, O₂, solute concentration. Classification based on specific requirement-based on temperature, pH, O₂ and solute concentration .Nutritional requirements of bacteria- C, electron, energy, and minerals. Nutritional types of bacteria- based on the requirement and their combinations. Modes of bacterial nutrition.

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, 16 S 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*
5. Text book of Microbiology by Prescott.
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.
9. *Brock Biology of Micro-organisms*.
10. LIPPINCOTT'S ILLUSTRATED REVIEWS MICROBIOLOGY by HARVEY
11. ALCAMOS FUNDAMENTALS OF MICROBIOLOGY
12. Gottschalk G. (1986). *Bacterial Metabolism*. 2nd edition. Springer Verlag Madigan MT, Martinko JM and Parker J. (2003)
13. Moat AG and Foster JW. (2002). *Microbial Physiology*. 4th edition. John Wiley & Sons.
14. Reddy SR and Reddy SM. (2005). *Microbial Physiology*. Scientific Publishers India.

MB2B03 (P) MICROBIOLOGY PRACTICAL 1-GENERAL MICROBIOLOGY Hrs/wk -1

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.
3. Microscope and its maintenance.
4. Simple Staining.
5. Grams staining.
6. Capsule 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 Hrs /week 4 3 credits

Unit 1 10 hrs

Microbiology of air – atmospheric layers, organisms in air, distribution and sources. Disease forecasting in plants. Indoor and out door air. Droplet nuclei, aerosol, infectious dust. Microbiological sampling of air - gravity slide, petri plate exposure, vertical cylinder, Hirst spore trap, Rota rod sampler, Andersen sampler, Burkard 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, vermin composting, anaerobic digesters, methanogenesis and production of biogas. Design and management of biogas plant.

Unit 4 11 hrs

Xenobiotic metabolism – Novel pollutants, persistence and biomagnification, Recalcitrant halocarbons, nitroaromatic compounds, PCB, dioxins, synthetic polymers, alkyl benzyl sulphonates, and petroleum hydrocarbons – their biodegradation. Bioremediation of polluted environment – Oil spills, heavy Metals and other xenobiotics. Microbial leaching and corrosion of metals.

Suggested Readings.

1. Microbial Ecology by Ronald M. Atlas, Richard Bartha.
2. Microbiology concepts and applications by Pelzar *et al*
3. Microbiology by Prescott.
4. Fundamentals of Microbiology by Mertus Frobisher.
5. A Hand book 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
9. Microbial Ecology. John Wiley & Sons.
10. Campbell RE. (1983). *Microbial Ecology*. Blackwell Scientific Publication, Oxford, England.
11. Maier RM, Pepper IL and Gerba CP. (2009). *Environmental Microbiology*. 2nd edition, Academic Press.
12. Stolp H. (1988). *Microbial Ecology: Organisms Habitats Activities*. Cambridge University Press, Cambridge, England.

MB 3B05(P) MICROBIOLOGY PRACTICAL 2-MICROBIAL PHYSIOLOGY AND EVS MICROBIOLOGY. Hrs /week 2

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.
9. Bacterial growth curve.

10. Isolation of bacteriophages from sewage.
12. Determination of water quality.
13. Determination of BOD of water.
14. Air sampling by open plate method.
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, Nematophagous 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 falcatum*, 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 – Azotobacte . Associative Symbiosis – Azospirillum.

Cyanobacteria (Nostoc. Gloeocapsa), Azola-Anabena System

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

Suggested Readings.

1. Microbial Ecology. John Wiley & Sons, Inc., New York 2.
2. Introduction to Soil Microbiology by Alexander, M.(1977). John Wiley & Sons, Inc.,
3. Agricultural microbiology, 2nd edition. Rangaswami G., Bagyaraj D. J. Prentice hall of India.
4. Ronald M. Atlas., Richard Bartha. Microbial Ecology. Benjamin Cummings. 1998
5. Robert, L Tate (1995). Soil Microbiology. First edition, John Wiley and Sons, Inc. New York edition. Pearson Education.
6. Rangaswami G and Mahadevan A (2002). Disease of Crop Plants in India. Fourth edition, PHI Learning (P) Ltd., New Delhi.
7. Subba Rao NS (2004). Soil Microbiology. Fourth edition, Oxford and IBH Publishing Co.Pvt. Ltd., New Delhi.
8. Mishra RR (2004). Soil Microbiology. First edition, CBS Publishers and distributors, New Delhi.
9. Devlin RM. (1975). *Plant Physiology*. 3rd edition, Willard Grant Press.
10. Stolp H. (1988). *Microbial Ecology: Organisms Habitats Activities*. Cambridge University Press, Cambridge, England.
11. Agrios GN. (2006). *Plant Pathology*. 5th edition. Academic press, San Diego,
12. Lucas JA. (1998). *Plant Pathology and Plant Pathogens*. 3rd edition. Blackwell Science, Oxford.
13. Mehrotra RS. (1994). *Plant Pathology*. Tata McGraw-Hill Limited.
14. Rangaswami G. (2005). *Diseases of Crop Plants in India*. 4th edition. Prentice Hall of India Pvt. Ltd., New Delhi.
15. Singh RS. (1998). *Plant Diseases Management*. 7th edition. Oxford & IBH, New Delhi.

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

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

Hrs/Week 4 4 Credits

Unit-1 10hrs

Basic Concepts of Fermentations :- Fermentor – Components, Types of fermentors- Batch, Fed-batch, Continuous, liquid state , Solid State fermentors. Control systems in fermentation – sterilization, pH, Temperature, Oxygen and aeration, agitation, foam. Computer applications in fermentation technology.

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

Microbial production of Wine, Ethanol. Acetone/ butanol by Clostridium species. Organic acids - Citric acid and Lactic acid, Acetic acid. Enzyme - Alpha amylase by bacteria and fungus. Vitamin B12 by streptomyces sp – Antibiotics – Penicillin. Steroid transformations

Unit-5 10hrs

Introduction to intellectual property and intellectual property rights – types: patents, copy rights, trade marks, design rights, geographical indications – importance of IPR – patentable and non patentables – patenting life – legal protection of biotechnological inventions – world intellectual property rights organization (WIPO).

Suggested Readings.

1. Industrial Microbiology by Prescott and Dunns.
2. Principles of Fermentation Technology. Manual of Industrial Microbiology and Biotechnology by Demain and Devis.
3. Principles of Fermentation Technology by Stanburry and Whitaker
4. Crueger W and Crueger A. (2000). *Biotechnology: A textbook of Industrial Microbiology*. 2nd edition. Panima Publishing Co. New Delhi.
5. Comprehensive Biotechnology by Murray and Moo Yung.
6. Sivakumar PK, Joe MM and Sukesh K (2010). An introduction to Industrial Microbiology. First edition, S.Chand & Company Ltd, New Delhi.

7. Agrawal AK and Pradeep Parihar (2006). Industrial Microbiology. Student edition, Jodhpur.
8. Patel AH (2005). Industrial Microbiology. Published by Mac Millan India Ltd., Chennai
9. Stanbury PF, Whitaker A and Hall SJ (1997). Principles of Fermentation Technology. Second edition, Pergmon Press.
10. LE Cassida JR (2005). Industrial Microbiology. New Age International (P) Ltd., New Delhi.

MB5B09 FOOD AND DAIRY MICROBIOLOGY

Hrs/Week 3 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, reducates test 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

General principles underlying spoilage, Spoilage different kinds of foods, cereals and cereal products – sugar and sugar products – vegetable and fruits – meat and meat products – fish and other sea foods – eggs and poultry – dairy and fermentative products (ice cream/milk/bread/wine).

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, Personnel hygiene.

Suggested Readings.

1. Food Microbiology by Adams, M.R. and Moss, M.O.1995.The Royal Society of Chemistry, Cambridge.
2. Food Microbiology by Frazier, W.C. and Westhoff, D.C.1988.TATA McGraw Hill Publishing company ltd., New Delhi.
3. Modern Food Microbiology by Jay, J.M.1987.CBS Publishers and distributors, New Delhi.
4. Basic Food Microbiology by Banwart, G.J.1989.Chapman & Hall New York.
5. A Modern Introduction to Food Microbiology by Board, R.C.1983.Blackwell Scientific Publications, Oxford.
6. Dairy Microbiology by Robinson, R.K.1990. Elsevier Applied Science, London.
7. Food Poisoning and Food Hygiene, Hobbs, B.C. and Roberts, D.1993. Edward Arnold.
8. MICROBIOLOGICAL EXAMINATION METHODS OF FOOD AND WATER by SILVA
9. Lund BM, Baird Parker AC, and Gould GW. (2000). *The Microbiological Safety and Quality of Foods*. Vol. 1-2, ASPEN Publication, Gaithersberg, MD.
10. Gould GW. (1995). *New Methods of Food Preservation*. Blackie Academic and Professional, London.

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.
6. Cell disruption techniques.
7. Isoelectric focusing.
8. Salting out.
9. Bioassay.
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.
14. Aerobic mesophilic count of milk.
15. Isolation of constituent flora of fermented milk.
16. Production of wine.
17. Methylene blue reductase test.

MB5B11 IMMUNOLOGY

Hrs/wk 3 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, adjuvants, 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.

Basic structure of immunoglobulin – Ig G – Different classes of immunoglobulins and their function. Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic). Clonal selection theory. Production of Polyclonal & Monoclonal antibodies & their application. Hybridoma technology. Complement system- activation and functions.

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

Hypersensitivity – different types -immediate and delayed – Anaphylaxis, immune complex diseases. Autoimmune diseases – mechanisms and classification. Transplantation immunology- mechanism of graft rejection.

Unit 7

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

Suggested Readings.

1. Abbas AK, Lichtman AH, Pillai S. (2007). *Cellular and Molecular Immunology*.
2. 6th edition Saunders Publication, Philadelphia.
3. Delves P, Martin S, Burton D, Roitt IM. (2006). *Roitt's Essential Immunology*. 11th edition Wiley-Blackwell Scientific Publication, Oxford.
4. Goldsby RA, Kindt TJ, Osborne BA. (2007). *Kuby's Immunology*. 6th edition W.H. Freeman and Company, New York.
5. Murphy K, Travers P, Walport M. (2008). *Janeway's Immunobiology*. 7th edition Garland Science Publishers, New York.
6. Peakman M, and Vergani D. (2009). *Basic and Clinical Immunology*. 2nd edition Churchill Livingstone Publishers, Edinberg.
7. Richard C and Geiffrey S. (2009). *Immunology*. 6th edition. Wiley Blackwell Publication.
8. Immunology by Coleman et al
9. Fundamental Immunology by Paul W.E. et al
10. Introduction to Immunology John W Kimbal et al
11. Text Book of Microbiology by Ananthanarayanan and JayaramPanikkar.
12. Immunology by Coleman et al
13. Introduction to Immunology John W Kimbalet al

MB5B12 MEDICAL MICROBIOLOGY - I

Hrs/Week 4 3 Credits

Unit 1- 12hrs

Infection and disease-definition.

Types of infections – Primary, secondary, cross, endogenous, exogenous, nosocomial, congenital, teratogenic, iatrogenic, laboratory and latent. Various sources of Infection – human beings, animals, insects, soil, water and food. Carriers of infection – different types. Methods of transmission of infections – contact, inhalation, ingestion, inoculation and congenital. Definitions of MID, ID50, MLD, LD50, bacteremia, Septicemia, contagious epidemic, endemic, pandemic, sporadic and prosodesmic diseases. Epizootic and enzootic. Factors influencing the virulence of pathogens

Collection and transport of clinical specimens for microbiological examinations- Virulence factors of bacteria causing human infections- Normal flora of human body.

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 botulinm*, *Bacillus anthracis*.

Unit 4 6hrs

Morphology, culture, biochemical, pathogenicity, laboratory diagnosis and prevention of bacterial diseases - *Salmonella typhi*, *Shigella dysenteriae*, *Vibrio cholerae*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Yersinia pestis*.

Unit 5 8hrs

Morphology, culture, biochemical, pathogenicity, laboratory diagnosis and prevention of bacterial diseases - *Treponema pallidum*, *Leptospira interrogans*, *Mycoplasma pneumoniae*, *Chlamydia trachomatis*. *Rickettsial infections*.

Suggested Readings.

1. Ananthanarayan R and Paniker CKJ. (2005). *Textbook of Microbiology*. 7th edition (edited by Paniker CKJ). University Press Publication.
2. Brooks GF, Carroll KC, Butel JS and Morse SA. (2007). *Jawetz, Melnick and Adelberg's Medical Microbiology*. 24th edition. McGraw Hill Publication.
3. Goering R, Dockrell H, Zuckerman M and Wakelin D. (2007). *Mims' Medical Microbiology*. 4th edition. Elsevier.
4. Joklik WK, Willett HP and Amos DB (1995). *Zinsser Microbiology*. 19th edition. Appleton-Century-Crofts publication.
5. Willey JM, Sherwood LM, and Woolverton CJ. (2008). *Prescott, Harley and Klein's Microbiology*. 7th edition. McGraw Hill Higher Education.
6. *Medical Microbiology* : David Greenwood, Slack, Peutherer
7. Satish Gupte (2005). *The Short Textbook of Medical Microbiology*. Eighth edition, Jaypee Brothers, Medical publishers (P) Ltd., New Delhi.
8. Baron EJ, Peterson LR and Finegold SM (1994). *Bailey and Scotts diagnostic Microbiology*. 9th edition, Mosby publications.
9. Rajan S (2009). *Medical Microbiology*. First edition, MJP Publishers, Chennai.
10. Rajesh Bhatia and Ratan Lal Ichhpujani (2004). *Essentials of Medical Microbiology*. Third edition, Jaypee Brothers, Medical Publishers (P) Ltd., New Delhi.
11. *Medical Microbiology* by Macie and McCartney.

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

Mutations :Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy. Gene mutations: Induced versus Spontaneous mutations, Back versus Suppressor mutations, Molecular basis of Mutations in relation to UV light and chemical mutagens, Detection of mutations-Ames test, Replica plating. Concept of Luria Delbrukii experiment.

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

Cell cycle and its regulation. Mitosis and meiosis. Check points and its significance. Programmed Cell death.

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.

1. Molecular Biology of the Gene by Watson, JD, Hopkins NH, Roberts JW, Steitz JA, Weiner AAM, 1987. The Benjamin/Cummings publishing company.
2. Genes V by Lewin B, 1994. Oxford University press.
3. Molecular Cell Biology by Lodish, H, Baltimore D, Berk A, Zipursky SL, Matsudaira P, Darnell J., 1995. Scientific American Books.
4. Molecular Biology by Freifelder D., 1991 Narosa Publishing Home.
5. Principles of Gene Manipulation, 4th Ed., by R.S.Old and S.B.Primrose. 1989.
 - a. Blackwell Scientific Publications, London.
6. Biochemistry by Stryer L.,1995. W.H. Freeman and company.
7. Principles of Genetics by Gardner EJ, Simmons MJ, Snustad DP, 1991. John Wiley & Sons.
 - a. & Sons.
8. Genes and Genomes by Singer M, Berg P.,1991 University Science Books.
9. Alcamo IE. (2001). *DNA Technology: The Awesome Skill*. 2nd edition. Elsevier Academic Press, Brown TA. (2006). *Gene Cloning and DNA Analysis*. 5th edition. Blackwell Publishing, Oxford,
10. Clark DP and Pazdernik NJ. (2009). *Biotechnology-Appling the Genetic Revolution*. Elsevier Academic Press, USA.
11. Glick BR and Pasternak JJ. (2003). *Molecular Biotechnology*. 3rd edition. ASM Press Washington D.C.
12. Nigam A and Ayyagari A. (2007). *Lab Manual in Biochemistry, Immunology and Biotechnology*. Tata McGraw Hill, India.
13. Primrose SB and Twyman RM. (2006). *Principles of Gene Manipulation and Genomics*, 7th edition. Blackwell Publishing, Oxford, U.K.
14. Sambrook J, Fritsch EF and Maniatis T. (2001). *Molecular Cloning-A Laboratory Manual*. 3rd edition. Cold Spring Harbor Laboratory Press.
15. Willey JM, Sherwood LM, and Woolverton CJ. (2008) *Prescott, Harley and Klein's Microbiology*. 7th edition. McGraw Hill Higher Education.
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) 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 polyteem chromosomes.
6. Paper chromatography.
7. Electrophoresis.
8. Conjugation
9. Transformation
10. Agarose gel electrophoresis of DNA
11. Restriction digestion of DNA

MB6B16 MEDICAL MICROBIOLOGY II

Hrs/Week 5

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

Protozoal diseases – amoebiasis and malaria. Helminth infections – tapeworm, hook worm, round worm and filariasis. Flagellates – very brief account. Laboratory diagnosis of parasitic infections.

Unit 4 6hrs

Immunoprophylaxis – vaccines - history and development. Different types – live, killed, subUnit, toxoids, bacterial, viral etc. Different routes of administration – oral and parenteral – advantages and disadvantages (eg: BCG, OPV & IPV, DPT, MMR, TAB – brief account).

Unit 5 8hrs

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

Suggested Readings.

1. Ananthanarayan R and Paniker CKJ. (2005). *Textbook of Microbiology*. 7th edition (edited by Paniker CKJ). University Press Publication.
2. Brooks GF, Carroll KC, Butel JS and Morse SA. (2007). *Jawetz, Melnick and Adelberg's Medical Microbiology*. 24th edition. McGraw Hill Publication.
3. Goering R, Dockrell H, Zuckerman M and Wakelin D. (2007). *Mims' Medical Microbiology*. 4th edition. Elsevier.
4. Joklik WK, Willett HP and Amos DB (1995). *Zinsser Microbiology*. 19th edition. Appleton-Century-Crofts publication.
5. Willey JM, Sherwood LM, and Woolverton CJ. (2008). *Prescott, Harley and Klein's Microbiology*. 7th edition. McGraw Hill Higher Education.
6. Medical Microbiology : David Greenwood, Slack, Peutherer
7. Satish Gupte (2005). *The Short Textbook of Medical Microbiology*. Eighth edition, Jaypee Brothers, Medical publishers (P) Ltd., New Delhi.
8. Baron EJ, Peterson LR and Finegold SM (1994). *Bailey and Scotts diagnostic Microbiology*. 9th edition, Mosby publications.

9. Rajan S (2009). Medical Microbiology. First edition, MJP Publishers, Chennai.
10. Rajesh Bhatia and Ratan Lal Ichhpujani (2004). Essentials of Medical Microbiology. Third edition, Jaypee Brothers, Medical Publishers (P) Ltd., New Delhi.
11. Medical Microbiology by Macie and McCartney.
12. Viral Ecology By Hurs

MB6B17 (P) PRACTICAL 6- IMMUNOLOGY AND MEDICAL MICROBIOLOGY Hrs/wk 4
(Practical Examination for core practical 6) 3 Credits

1. AFB staining.
2. Biochemical reactions for identification of various groups of bacteria.
3. Identification of bacterial isolates from clinical samples.
4. Antibiotic sensitivity test.
5. Differential count of leukocytes.
6. Lymphocyte isolation.
7. Blood grouping.
8. WIDAL agglutination test.
9. ASO latex agglutination test.
10. RA latex agglutination test.
11. RPR test.

Elective Courses (Open) offered for BSc Microbiology Programme in the VIth Semester.

MB6B18 (E1) CELL AND TISSUE CULTURE
Hrs/Wk 4 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.
3. Plant regeneration: organogenesis. Somatic embryogenesis; somaclonal variation, its genetic basis and application in crop improvement. Clonal propagation, production of pathogen – free virus free plants haploid production: Induction and growth parameters; Chromosomal variability in callus culture. Plant regeneration Androgenesis; Anther and pollen culture.
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

Suggested Readings

1. Culture of animal cells – R.Ian Freshney 4th edition John Wiley and Sons.
2. Genetic engineering, Molecular biology and tissue culture of crop pest and disease management – P.Vidhyasekaran, Paya Publication.
3. Animal cell reactors – Chesters Ho & Daneil IC Wang- Butter worth Heinemann.
4. Plant Molecular Biology 2nd Ed: D. Grierson, S.N. Covey. Chapman & Hall.

MB6B18 (E2) BIOINSTRUMENTATION

Hrs/Wk 4 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, NMR spectroscopic, 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, Flow cytometry

Suggested Readings

1. Keith Wilson and John Walker. Practical Biochemistry- principles and techniques; Cambridge University press, London, UK. 2.
2. David T Plummer, Tata McGraw- Hill publishing company limited; McGraw office, New Delhi
3. C.R. Kothari, 2 nd Edition, 2004. Research methodology- methods and techniques. New Age International (P) limited publishers, New Delhi.
4. Instrumental methods of chemical analysis – P.K. Sharma
5. Biophysical chemistry – Upadhyay., Upadhyay and Nath
6. A Biologist's guide to principle and techniques of practical biochemistry – Brigian L. Williams.
6. Handbook of Biomedical Instrumentation – R.S. Khandpur, Tata McGraw Hill

MB6B18 (E3) BIOSAFETY AND BIOETHICS
Hrs/Wk 4 2 Credits

UNIT 1

Introduction to biosafety, definition, Objectives of safety guidelines, Risk assessment, Assessment of risk during laboratory research, Risk assessment for planned introduction, risk assessment for biotechnology products.

UNIT 2

Biosafety during industrial production using GMO's. Biosafety guidelines in India. Containment – Physical containment, Biological containment, Planned introduction of genetically modified organisms.

UNIT 3

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
12. Bioethics and Biosafety by Satheesh M.K.I.K. International publishing house, 2008.

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

MB4A08 MOLECULAR BIOLOGY AND BIOINFORMATICS

Hrs/Week 4 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

Replication of Prokaryotic and eukaryotic DNA. Semiconservative replication of DNA. Models of replication- D-Loop, rolling circle and theta model. Mutation-introduction. General DNA repair mechanisms.

Unit 3 12 hrs

Transcription- prokaryotic and eukaryotic. Post transcriptional modifications.
Translation- prokaryotes and eukaryotes, Genetic code. Post translational modifications.
Brief account of gene regulation in prokaryotes – operon concept – lac and trp operon.

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.
Application of bioinformatics- Drug designing and molecular docking, Homology modeling, Phylogenetics, Micro arrays. Structure visualization- Rasmol.

(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
3. Molecular Biology of the Gene by Watson, JD, Hopkins NH, Roberts JW, Steitz JA, Weiner AAM, 1987. The Benjamin/Cummings publishing company.
4. Genes V by Lewin B, 1994. Oxford University press.

5. Molecular Cell Biology by Lodish, H, Baltimore D, Berk A, Zipursky SL, Matsudaira P, Darnell J., 1995. Scientific American Books.
6. Molecular Biology by Freifelder D., 1991 Narosa Publishing Home.
7. Principles of Gene Manipulation, 4th Ed., by R.S.Old and S.B.Primrose. 1989. Blackwell Scientific Publications, London
8. Introduction to Bioinformatics: T.K. Attwood, D.J. Parry-Smith and S. Phukan
9. Bioinformatics: Sequence and Genome analysis. David W. Mount
10. Bioinformatics: Genes, proteins and computers. C.A. Orengo, D.T. Jones and J.M. Thornton
11. Introduction to Bioinformatics by Arthur. M Lesk

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. Determinants of health. Responsibility for health-Individual, Community, State and International responsibility. Indicators of health.

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.

Symptomatology, epidemiology, preventive measures of disease– Hepatitis,-A,B,E, HIV, Tuberculosis, Enteric fever, Weil's disease, microbial food poisonings. Emerging diseases- Dengue fever, Chikungunya, Swine flu, Hand, Foot and Mouth disease. Bioterrorism.

Suggested Readings

1. Ananthanarayan R and Paniker CKJ. (2005). *Textbook of Microbiology*. 7th edition (edited by Paniker CKJ). University Press Publication.
2. Brooks GF, Carroll KC, Butel JS and Morse SA. (2007). *Jawetz, Melnick and Adelberg's Medical Microbiology*. 24th edition. McGraw Hill Publication.
3. Goering R, Dockrell H, Zuckerman M and Wakelin D. (2007). *Mims' Medical Microbiology*. 4th edition. Elsevier.

4. Joklik WK, Willett HP and Amos DB (1995). *Zinsser Microbiology*. 19th edition. Appleton-Century-Crofts publication.
5. Willey JM, Sherwood LM, and Woolverton CJ. (2008). *Prescott, Harley and Klein's Microbiology*. 7th edition. McGraw Hill Higher Education.
6. Medical Microbiology : David Greenwood, Slack, Peutherer
7. Satish Gupte (2005). *The Short Textbook of Medical Microbiology*. Eighth edition, Jaypee Brothers, Medical publishers (P) Ltd., New Delhi.
8. Baron EJ, Peterson LR and Finegold SM (1994). *Bailey and Scotts diagnostic Microbiology*. 9th edition, Mosby publications.
9. Rajan S (2009). *Medical Microbiology*. First edition, MJP Publishers, Chennai.
10. Abbas AK, Lichtman AH, Pillai S. (2007). *Cellular and Molecular Immunology*. 6th edition Saunders Publication, Philadelphia.
11. Delves P, Martin S, Burton D, Roitt IM. (2006). *Roitt's Essential Immunology*. 11th edition Wiley-Blackwell Scientific Publication, Oxford.
12. Goldsby RA, Kindt TJ, Osborne BA. (2007). *Kuby's Immunology*. 6th edition W.H. Freeman and Company, New York.

MB5D02. ENVIRONMENTAL MICROBIOLOGY

Hrs/Week 3 4 Credits

1. Basic concepts of Ecology and Environment. Components of Environment: Hydrosphere, lithosphere, atmosphere and biosphere –food chains, food webs and tropic levels. Energy transfer efficiencies between tropic levels
2. Soil Microbiology: Humus, Microflora of soil, Nitrogen cycle - Nitrogen fixation, nitrification, denitrification. Rhizosphere – Rhizosphere microorganisms.
3. Faecal pollution of waters - waterborne diseases, indicator organisms. Sanitary examination of water. Water purification. Sewage treatment.
4. Dispersal of airborne microorganisms. Droplet nuclei, Air borne diseases.
5. Global environmental problems: ozone depletion, green house effect and acid rain, their impacts and biotechnological approaches for management. Definition of xenobiotics and biomagnification. composting , vermicomposting and biogas production.

Suggested Readings

1. Microbial Ecology by Ronald M. Atlas, Richard Bartha.
2. Microbiology concepts and applications by Pelzar *et al*
3. Microbiology by Prescott.
4. Fundamentals of Microbiology by Mertus Frobisher.
5. Hand book 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
9. Microbial Ecology. John Wiley & Sons.
10. Campbell RE. (1983). *Microbial Ecology*. Blackwell Scientific Publication, Oxford, England.

11. Maier RM, Pepper IL and Gerba CP. (2009). *Environmental Microbiology*. 2nd edition, Academic Press.
12. Stolp H. (1988). *Microbial Ecology: Organisms Habitats Activities*. Cambridge University Press, Cambridge, England.

MODEL QUESTION PAPER-1

University of calicut

First Semester Examination (CBCSSUG) January 2014
MB1B01(Core) -General Microbiology

Time : 3 Hours

Max: 80 Marks

Section A- Answer *all* questions, each carries ½ marks

- 1.
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12

Objective type/fill in the blanks/One word answer questions

Section B-Answer *all* questions, each carries 2 marks

- 13.
- 14
- 15
- 16
- 17
- 18
- 19
- 20
- 21
- 22

Very short answers
4 points preferred in the answer

Section C- Answer *any six* questions, each carries 5 marks

- 23.
- 24
- 25
- 26
- 27
- 28
- 29
- 30

Short essay type questions
Minimum 10 points/1 sheet preferred in the answer

Section D- Answer *any two*, each carries 12 marks

- 31.
- 32
- 33

Essay type questions
Minimum 2 sheets / 25 points preferred in the answer

MODEL QUESTION PAPER-2

University of Calicut
First Semester Examination (CBCSSUG) January 2014
MB1B01 -General Microbiology

Time : 3 Hours

Max: 80 Marks

Section A- Answer *all* questions, each carries ½ marks

1. A bright image can be viewed through
 - a. Dark field Microscope
 - b. Transmission electron Microscope
 - b. Binocular Microscope
 - c. Confocal Microscope
2. A chemical that will reduce the microbial population to safe levels is called
 - a. Sterilant
 - b. Sanitizer
 - c. Disinfectant
 - d. Germicide
3. Which of the following can survive an extreme environmental condition
 - a. Cyanobacteria
 - b. Fungus
 - c. Archaeobacteria
 - d. E coli
4. ----- is removed during decolourization of bacteria by alcohol in Gram staining.
 - a. Crystal Violet
 - b. Grams Iodine
 - c. CV-I Complex
 - d. Safranin
5. Mixture of Iodine and PVP is called-----
6. First vaccination was performed by-----
7. Mycobacterium tuberculosis when stained with auramine O will appear-----coloured.
8. Example for an acidic stain
9. Give examples for a Gram negative bacilli
10. Who discovered *E. coli*
11. Time and temperature for autoclave
12. Define Virus

Section B-Answer *all* questions, each carries 2 marks

13. Martinus W. Beijerinck
14. Fuchsen staining
15. Phenol coefficient
16. Cyanobacteria
17. Pasteurization
18. HEPA filters
19. Negative staining for light microscopy
20. Resolving power
21. Endospore staining
22. Actinomycetes

Section C- Answer *any six* questions, each carries 5 marks

23. What are the Contributions of Robert Koch and Selman A. Waksman.
24. What role scientists have done for the disproval of spontaneous generation.
25. Differentiate between eubacteria and archeobacteria
26. Write a note on phase contrast microscopy

27. What are the contributions of Luis Pasteur for the development of Microbiology
28. Explain the methods of sterilization by high temperature
29. Write on differential staining.
30. Describe the principle and specimen preparation for SEM.

Section D- Answer *any two*, each carries 12 marks

31. Describe the different microscopic techniques used in Microbiological studies
32. Why the period between 1857 and 1914 is considered as the golden age of Microbiology.
33. Explain the principle, application and mode of action for various chemical agents used for sterilization

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

1. History of Microbiology-Contributions of Antony van Leeuwenhoek, Robert Koch, Louis Pasteur, Alexander Fleming, Winogradsky, Beijerinck, Scope of 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.
4. Ultra structure of bacterial cell –Cell membranes, Cytoplasmic inclusions, Ribosome, Nuclear material, Cell wall –gram-positive and gram-negative, Capsule, Slime layers, Pili, Fimbriae, Flagella and motility, Endospore.
5. Cultivation of bacteria-nutritional requirements, nutritional types of bacteria, Bacteriological media –types of media, Cultivation of aerobic and anaerobic bacteria. Microbial growth –growth curve, Pure culture isolation methods,
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.
3. Microscope and its maintenance.
4. Simple Staining.
5. Grams staining.
6. Capsule 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*
5. Text book of Microbiology by Prescott.
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.
9. *Brock Biology of Micro-organisms*.
10. LIPPINCOTTS ILLUSTRATED REVIEWS MICROBIOLOGY by HARVEY
11. ALCAMOS FUNDAMENTALS OF MICROBIOLOGY
12. Gottschalk G. (1986). *Bacterial Metabolism*. 2nd edition. Springer Verlag Madigan MT, Martinko JM and Parker J. (2003)
13. Moat AG and Foster JW. (2002). *Microbial Physiology*. 4th edition. John Wiley & Sons.
14. Reddy SR and Reddy SM. (2005). *Microbial Physiology*. Scientific Publishers India.

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.
2. Metabolism-Energy production-aerobic and anaerobic process. Respiration, Glycolysis, TCA-cycle, pentose phosphate pathway, Fermentation, Brief account of catabolism of carbohydrates, lipids, proteins and amino acids Photosynthesis bacterial and cyanobacterial.
3. Structure and functions of genetic material, DNA and chromosome, RNA structure, Genetic code, Regulation of gene expression-repression, induction, attenuation. Mutation-types of mutation, replica plating, Ames test .
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
3. Genetics-Strickberger.
4. Genetics- Pierce
5. Text book of Biochemistry by Satyanarayana
6. Text book of Biochemistry by DM. Vasudeven
7. Molecular Biology of the Gene by Watson, JD, Hopkins NH, Roberts JW, Steitz JA, Weiner AAM, 1987. The Benjamin/Cummings publishing company.
8. Genes V by Lewin B, 1994. Oxford University press.
9. Molecular Cell Biology by Lodish, H, Baltimore D, Berk A, Zipursky SL, Matsudaira P, Darnell J., 1995. Scientific American Books.
10. Molecular Biology by Freifelder D., 1991 Narosa Publishing Home.
11. Principles of Gene Manipulation, 4th Ed., by R.S.Old and S.B.Primrose. 1989. Blackwell Scientific Publications, London

MB2C04 (P) MICROBIOLOGY PRACTICAL II

1. Preparation buffers.
2. Protein Estimation using Lowry's method
3. Folin - Ciocalteu 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
9. Demonstration of mitosis and meiosis.
10. Extraction and estimation of DNA.
11. Electrophoresis.
12. Preparation of gradient solutions.
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,
2. Soil Microbiology: Microflora of soil, sources of soil organisms, Rhizosphere and rhizosphere effect, Interaction among soil microorganisms-positive, neutral, negative associations, Role of microorganisms in biogeochemical cycles-Carbon and nitrogen. Nitrogen fixation.
3. Water Microbiology: Factors affecting microbial population in natural waters – temperature, light, hydrogen concentration, pressure, salinity, nutrients, turbidity, Microbiology of drinking water. Purification of water-aeration, sedimentation, coagulation, flocculation, sand filtration . Disinfection of drinking water Indicator organisms, bacteriological techniques for examination of water. B . O. D.

4. Food Microbiology: Food as a substrate for microorganisms . Microorganisms important in food microbiology –molds, yeast, bacteria. Contamination of foods. Spoilage of food –chemical changes caused by microorganisms . Methods of food preservation. Spoilage of milk , meat and fish.
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. Down stream 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.
8. Cell disruption techniques.
9. Isoelectric focusing.
10. Salting out.
11. Bioassay.
12. Demonstration of antibiosis

Suggested Readings

1. Industrial Microbiology –A. H. Patel
2. Industrial microbiology –Casida
3. Industrial Microbiology-Prescott & Dunn.
4. Agricultural Microbiology-Rangaswamy
5. Brock biology of Microorganisms-Madigan
6. Environmental Microbiology- Joseph. C. Daniel
7. Food Microbiology, Fundamentals &Frontiers-Doyle.
8. Food Microbiology-William. C. Frazier.
9. Microbial Ecology by Atlas and Bartha

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.
2. Viral diseases – Rabies, AIDS, Hepatitis, Rubella, Fungal diseases- Candidiasis, Ringworm, Protozoan diseases- Amoebiasis, Malaria .
3. Types of immunity-innate and acquired, Hematopoiesis, Cells and organs of immune system, humoral and cell mediated immunity.

4. Antigens-types, epitopes, haptens, Basic structure of immunoglobulin, IgG, Polyclonal and monoclonal antibodies, clonal selection theory, Antigen – antibody reactions-agglutination and precipitation reactions, complement pathways, immunological tolerance in brief.
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.
3. Blood grouping.
4. WIDAL agglutination test.
5. RPR test.
6. AFB staining.
7. Biochemical reactions for identification of various groups of bacteria.
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
6. Introductory Mycology-Alexopoulos.
7. Medical Microbiology-Brooks, Butal, Slack.
8. Medical Microbiology-Ananthanarayanan & Jayaram Panicker.

MODEL QUESTION PAPER

University of Calicut

First Semester Examination (CBCSSUG) January 2014
MB1C01(Complementary) -General Microbiology

Time : 3 Hours

Max: 80 Marks

Section A- Answer *all* questions, each carries ½ marks

- 1.
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12

Objective type/fill in the blanks/One word answer questions

Section B-Answer *all* questions, each carries 2 marks

- 13.
- 14
- 15
- 16
- 17
- 18
- 19
- 20
- 21
- 22

Very short answers
4 points preferred in the answer

Section C- Answer *any six* questions, each carries 5 marks

- 23.
- 24
- 25
- 26
- 27
- 28
- 29
- 30

Short essay type questions
Minimum 10 points/1 sheet preferred in the answer

Section D- Answer *any two*, each carries 12 marks

- 31.
- 32
- 33

Essay type questions
Minimum 2 sheets / 25 points preferred in the answer

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

1. Computer Fundamentals and Organization: Central Processing Unit-Control Unit, Arithmetic Unit, Instruction Set, Register, Processor Speed, Memory Units, Storage Evolution Criteria, Memory Organization, Capacity, RAM, ROM, Secondary Storage Devices: Magnetic Disk, Input. Devices: Keyboard, Mouse, Trackball, Joystick, Scanner, OMR, Barcode Reader, MLCR Digitizer. Card Reader, Voice Recognition, Web cam, Video cameras. Output Devices Monitors, Printers, Dot matrix, Ink jet, Laser, Plotters, Computer Output Microfilm, Multimedia Projector. Speech Synthesizer, Dumb, Smart and Intelligent Terminal. Multimedia, Text, Graphics, Animation, Audio. Images, Video, Multimedia Application in education. entertainment and marketing. Computer Software — Relationship between hardware and software, System software, Application Software, Compiler, Names of some High Level Languages, Free Domain Software. Operating Systems – DOS, Linux, Windows
2. Word Processing: Word Processing Concepts - Saving, Closing, Opening an existing document, Selecting text, Editing Text, Finding and Replacing Text, Printing documents. Creating and Printing merged documents Character and Paragraph design and tab and correcting spellings, Handling – Graphics, Tables, Charts, Page Borders, Columns. Mail Merging.
3. Spreadsheet Package: Spreadsheet Concepts, Creating, Saving and Editing a Work book, Inserting, Deleting work sheets, Entering data in a Cell/Formula, Copying and moving data from selected Cells. Handling Operators in Formula. functions : Mathematical, Logical. Statistical. Text, Financial, Date and Time Functions, Using Function Wizard. Formatting a Worksheet: Formatting Cells, Changing data alignments. Changing date. Character, Number, Currency format, Changing font. Adding borders and colors, Printing Worksheets, Charts and graphs, creating previewing and modifying charts. Conditional Formatting and Filters.
4. Presentation Package: Creating, Opening and Saving Presentations, Views. Slides,

Adding and formatting text. Formatting paragraphs. Spell check, Drawing Objects, Adding Clipart and other pictures, Transitions, Templates and effects on slides.

Reference Books:

1. P. K. Sinha and P. Sinha, "Foundations of Computing". BPB Publication.
2. S. Sagman. "Microsoft Office 2000 for Windows". Pearson Education.
3. Turban, Mclean and Wetherbe. "Information Technology and Management John Wiley and Sons.

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 type 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.
7. Relational Model:Definition:Field and Record,Entity And Attribute,Relation,Domain, Tuple. Relational Algebra-Union, Intersection, Difference, product, Projection, Selection, Join.
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

1. Data Base Concept 3rd edition Abraham Silberschatz, Henry f Korth McGraw Hill
2. A Guide to the SQL Standard, C. J. Date and Hugh Darwen, 1997,

Addison-Wesley.

3. Programming in Ansi C E.balagurusamy (3rd edition Mc Graw Hill)
4. An Introduction to Database Systems, C. J. Date, 1994, Addison-Wesley
5. Understanding the New SQL, Jim Melton and Alan R. Simon, 1993, Morgan Kaufmann.
6. Principles of Database & Knowledge Jeffrey D. Ullman, Computer Science Press, 1988
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 character 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

1. Scope of biostatistics – Types of Biological data – Data on Ratio scale – data on interval scale – data on ordinal scale – continuous and discrete data – accuracy and precision. Frequency distribution for a data – Histogram – Frequency Polygon – Cumulative frequency distributions – Ogives. Population and sample – Random sampling – Parameter and Statistics.
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.
3. Probability – Random experiment, sample space, events. Probability of events – mathematical definition – addition theorem and multiplication theorem (No proof expected, only problem solving).
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

Zar, J. H. Biostatistical Analysis, Fourth Edition (1999), Pearson Education Inc.
Gupta and Kapur. Introduction to Mathematical statistics, Sulthan Chand Publications, New-Delhi.

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 given discrete data and frequency distribution
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

1. Testing of hypotheses: Statistical hypothesis – Null hypothesis – alternative hypothesis – simple and composite hypothesis. Type I and Type II error. General test procedure - Tests for goodness of fit – contingency table – tests for independence of attributes.
2. Analysis of Variance : One – way and two –way classified data – their mathematical model – analysis of variance – significance testing
3. Regression Analysis: simple linear regression – regression equations –regression coefficients – prediction values of Y – testing the significance of regression – confidence interval in regression - Analysis of variance.
4. Simple Correlation: Simple correlation – calculation of simple correlation from raw data- calculation of correlation from regression coefficients - Testing the presence of correlation - Applications of correlation - Spearman’s Rank correlation.
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

Zar, J. H. Biostatistical Analysis, Fourth Edition (1999), Pearson Education Inc.
Gupta and Kapur. Introduction to Mathematical statistics, Sulthan Chand Publications, New-Delhi.

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.
3. Fitting regression equations for given data set. Testing the significance of regression

coefficients.

4. Calculating simple partial and multiple correlation coefficients. Testing the significance of simple correlation.