

UNIVERSITY OF CALICUT
(Abstract)

B.Sc.Programme in Microbiology – under Choice-based Credit Semester System – Scheme and Syllabus – implemented w.e.f. 2009 admission onwards – approved – Orders issued –

GENERAL & ACADEMIC I – ‘J’ SECTION

No.GA.I/J1/2838/07

Dated, Calicut University P.O., 25-06-2009

Read: 1) U.O.No. GA I/J2/3601/08 Vol.II dated 19.06.09.

2) Minutes of meeting of B/S in Microbiology held on 28.04.2009.

3) Item No. 2(xvi) of the minutes of meeting of Faculty of Science held on 05.05.2009.

4) Item No. – II A.17 of the minutes of meeting of the Academic Council held on 14.05.2009.

ORDER

Choice-based Credit Semester System and Grading has been introduced for UG curriculum in all affiliated colleges under this University with effect from 2009 admission onwards and the regulations for the same implemented vide paper cited (1) above.

As per paper read as (2) above, the Board of Studies has resolved to approve the scheme and syllabus of B.Sc. programme in Microbiology under Choice-based Credit Semester System.

As per paper read as (3) & (4) above, the Faculty of Science held on 05.05.2009 endorsed the minutes of Board of Studies and the Academic Council held on 14.05.2009 approved the same.

Sanction has therefore been accorded to implement the scheme and syllabus of B.Sc. programme in Microbiology under Choice-based Credit Semester System in this University with effect from 2009 admission onwards.

Orders are issued accordingly. Scheme and syllabus appended.

Sd/-

DEPUTY REGISTRAR (G & A I)

For REGISTRAR

To

The Principals of all affiliated colleges offering B.Sc. programme
in Microbiology.

Copy to : CE/EXI/EGI/DR, B.Sc./System Administrator with a request
to upload in the University website/Tabulation Section/Enquiry/
GA I-'F' Section/SF/DF/FC.

Forwarded/ By Order

SECTION OFFICER

UNIVERSITY OF CALICUT
B.Sc. MICROBIOLOGY (CCSS)
SYLLABUS

2009

Code	Course Title	Hrs/week	Credit	Total Credits
A01	Communication skills in English	4	3	
A02	Critical Reasoning, Writing and Presentation	5	3	
A07(03)	Communication skill in the languages other than English for B.Sc alternate pattern	5	4	
MB1B01	General Microbiology	3	3	
	Elementary biochemistry-I	2	2	17
	Biochemistry Practical 2 *			
	Computer Applications Fundamentals	2	2	
	Computer Applications Practical I	2	2	*
	Total	25	17	
A03	Reading Literature in English	4	4	
A04	Indian constitution, Secularism and Sustainable Environment.	5	4	
A09(03)	Literature in languages other than english for B.Sc. Alternate pattern	5	4	
MB2B02	Microbial Taxonomy	2	3	
MB2B03(P)	Microbiology Practical I	1	21	*
	Elementary biochemistry-II	2	2	
	Biochemistry Practical 2 *			
C	Language, Data Base Management System & SQL	2	2	
	Computer Applications Practical II (Exam for practical I-II)	2	2	
	Total	25	21	
A06	History and Philosophy of Science	5	4	
A12	General informatics	5	4	
MB3B04	Molecular biology	3	3	
MB3B05(P)	Microbiology Practical II	2	15	*
	Enzymology and metabolism -I	3	2	
	Biochemistry Practical 2 *			
	Biostatistics I	3	2	
	Biostatistics Practical I	2	2	*
	Total	25	15	
A13	Basic numerical skills	5	4	
A14	Entrepreneurship development	5	4	
MB4B06	Microbial Genetics and Genetic Engineering	3	3	
MB4B07(P)	Microbiology Practical III (Exam for Microbiology practical I – III)	2	4	25
	Enzymology and metabolism -II	3	2	
	Biochemistry Practical (with exam)	2	4	
	Biostatistics II	3	2	
	Biostatistics Practical II (Exam for Biostatistics practical I-II)	2	2	
	Total	25	25	
MB5B08	Microbial Physiology	3	3	
MB5B09(P)	Microbiology Practical IV	2		
MB5B10	Medical Microbiology	3	3	
MB5B11(P)	Microbiology Practical V	2	2	*
MB5B12	Food And Agricultural Microbiology	3	3	16
MB5B13(P)	Microbiology Practical VI	2	2	*
MB5B14	Environmental and sanitation Microbiology	3	3	
MB5B15(P)	Microbiology Practical VII	2	2	*
MB B16 (Pr)	Project Work	2	2	*
MB5D01	Open course-from other departments	3	4	
	Total	25	16	
MB6B17	Industrial Microbiology	5	4	
MB6B18(P)	Microbiology Practical VIII (Exam for Microbiology practical IV & VI – VIII)	5	6	26
MB6B19	Immunology	5	4	
MB6B20(P)	Microbiology Practical IX (Exam for Microbiology practical V & IX)	5	6	
MB6B21 (E1)	Biosafety and Bioethics			
MB6B21 (E2)	Cell and Tissue culture			
MB B22 (Pr)	Project Work	2	4	
	Total	25	26	120
		3	2	
		1		

B.Sc. MICROBIOLOGY CORE COURSE SYLLAUS

SEMESTER 1**MB1B01 General Microbiology**

1. History and scope of Microbiology. Contribution of Antony van Leeuwenhoek, Pasteur, Robert Koch, Alexander Flemming, Winogradsky, Joseph Lister, Waksman, Edward Jenner to the field of Microbiology. Eukaryotes and prokaryotes.
2. Microscopy- bright field, dark field, phase contrast, fluorescent and electron microscopy. Bacterial forms- coccus, bacillus, spirals, comma, actinomycetes, kidney shaped, stalked, pleomorphic. Mold and Yeast forms, viral and bacteriophage forms.
3. Structure and function of cell wall, flagella, pili, capsule, membrane, spores, nuclear material, inclusion bodies. Staining methods- simple and differential- Grams, spore, flagella, volutin, capsule, negative and Fuchsin staining of DNA.
4. 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. Pure culture techniques- streak, spread and pour plate cultures.
5. Sterilisation techniques- Physical and chemical- flaming, boiling, autoclaving, inspissation, Heat, filtration, Radiation. Aseptic methods- laminar air flow hood. Antimicrobial chemotherapy- Penicillins, Cephalosporins, Sulfonamide, Aminoglycosides, Quinolones, Erythromycin and Macrolides, Chloramphenicol, Antifungal and antiviral drugs.

References

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

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SEMESTER II**MB2B02 Microbial Taxonomy**

1. Levels of classification; classification systems- phenetic and phylogenetic classification, numerical taxonomy.
2. Various criteria used in bacterial classification:- classical characteristics morphological characteristics, physiological and metabolic characteristics, ecological characteristics and genetic analysis.
3. Molecular characteristics- comparison of proteins, nucleic acid base composition,
4. Phage typing, serotyping, nucleic acid hybridization and nucleic acid sequencing, 16 S ribosome studies.
5. Broad treatment of Fungal, Protozoal and viral classification. Fungal classification. Bergy's Manual - general features.

References

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 M Atlas
7. Microbial Ecology by Ronald M Atlas, Richard Bartha.

MB2B03 (P) Microbiology Practical 1

1. Cleaning and sterilization of glass ware.
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. Flagella Staining.
9. Preparation of media (Nutrient broth, Nutrient agar).
10. Isolation of pure culture.
11. Enumeration of microbial cells (pour plate method).
12. Fungal staining.
13. Fungal Culture.
14. Determination of phenol coefficient.
15. Use of differential and selective media.
16. Oligodynamic action of heavy metals on microbes.
17. Categorizing bacteria from various sources (air, water, soil, food etc.) based on morphological, microscopic, cultural and biochemical and other characteristics.

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SEMESTER III

MB3B04 Molecular Biology

1. Mendelian laws, chromosomal theory of heredity, mitosis and meiosis, one gene one enzyme hypothesis. Organization of bacterial and eukaryotic chromosomes, DNA supercoiling and nucleoid structure. Histones and their function.
2. Nucleic acids: Structure of DNA and RNA, Types and forms – DNA, t-RNA, r-RNA, m-RNA – Definition and functions. DNA replication in prokaryotes and eukaryotes, D loop and rolling circle replication
3. Transcription in prokaryotes. RNA processing in prokaryotes and eukaryotes.
4. Genetic code, Protein synthesis in prokaryotes and eukaryotes. Post translational modifications.
5. Operon concept and gene regulation in prokaryotes. Lac and Trp operons. DNA binding proteins.

References:

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., R.S. Old and S.B. Primrose. 1989. Blackwell Scientific Publications, London.

MB3B05 (P) Microbiology Practical II

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 polytene chromosomes.
6. Paper chromatography.
7. Electrophoresis.
8. Preparation of gradient solutions.
6. Separation of plant pigments

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SEMESTER IV

MB4B06 Microbial Genetics and Genetic Engineering.

1. DNA as the genetic material, Experimental proof. Semiconservative replication of DNA. Replication of Prokaryotic and eukaryotic DNA. Different RNA and their role in transcription and translation. Prokaryotic and eukaryotic translation. Operon concept constitutive and inducible enzyme. Mutation, spontaneous and induced mutation, Physical and chemical mutagens. Ames test
2. Experiments to demonstrate transduction, transformation and conjugation. Extra chromosomal genetic materials. Plasmids, Different types of plasmids and their significance. Bacterial conjugation. Transduction process, role of viruses in transduction.
3. Generalised, specialized transduction, Transformation. Recombinant DNA technology, its application. Restriction endonuclease. Ligase, alkaline phosphatase and their uses. separation of DNA fragment by electrophoresis, ethidium bromide staining. Cesium chloride centrifugation. Plasmid and phage vectors. Prokaryotic and eukaryotic vectors. pBR 322, pUC vectors. Lambda phage derived vectors. Single strand vectors. Yeast, plant and animal vectors. Plant vectors Ti-plasmids, CaMV vectors
4. Construction of recombinant DNA Chimeric DNA. Different method used for introducing foreign DNA into the cell. Competent cells. Chemical transformation, electroporation, Microinjection and biolistic method. Expression vectors. Screening and selection of recombinant DNA. Different blotting technique: southern, northern and western blotting and their uses.
5. Purification of recombinant products. Cell disruption methods, sonication, chemical destruction of cells. Bioaffinity chromatography, Histidine tags. DNA sequencing methods. Amplification of DNA by PCR, Different PCR methods. Construction of DNA libraries. Genomic and cDNA libraries. Site directed mutagenesis. Gene therapy. GM foods, terminator gene technology Ethical problems associated with the use of rDNA technology.

Reference:

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. 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.
8. Genes and Genomes by Singer M, Berg P.,1991 University Science Books.

MB4B07 (P) Microbiology Practical III

1. Conjugation
2. Transformation
3. Agarose gel electrophoresis of DNA
4. Restriction digestion of DNA

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SEMESTER V

MB5B08 Microbial Physiology

1. Effect of various parameters and Environmental factors on microbial growth- Temperature, pH, O₂ requirement etc., special conditions like thermophilic, psychrophilic, halophilic, barophilic and extremophilic growth, Nutritional requirements, Mode of

nutrition, Nutritional types of bacteria.

2. Growth curve and its significance, generation time, steady state culture, synchronous culture and Diauxic culture, Aerobic and Anerobic culture methods

3. Modes of reproduction of bacteria. Quantitative measurement of bacterial growth by direct and indirect methods.

4. Microbial metabolism-Energy production by anaerobic processes, aerobic processes and photosynthesis. Transport of nutrients by bacteria- passive, active and group translocation.

5. Viral and bacteriophage nutrition, cultivation and their Quantitation methods.

References

8. Fundamentals of Bacteriology by A.J Salle

9. Microbiology by Pelczar *et al*

10. Fundamentals of Microbiology by Mertus Frobisher

11. General microbiology by Stanier *et al*

12. Text book of Microbiology by Prescott

MB5B09 (P) Microbiology Practical IV

1. Effect of temperature of growth of microorganisms.

2. Influence of pH on growth.

3. Bacterial growth curve.

4. Isolation of petit mutants of yeast.

5. Isolation of bacteriophages from sewage.

MB5B10 Medical Microbiology

1. Infection and disease. 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 – 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 prosodemic diseases. Epizootic and enzootic – definitions. Factors influencing virulence of pathogen – (briefly).

2. Diseases caused by the following pathogens with special importance to their epidemiology, symptomatology, laboratory diagnosis and treatment – *S.aureus*, *str.pyogenes*, *str.pneumoniae*, *N.gonorrhoeae*, *corynebacterium*, diphtheriae, *clostridium tetani*, *cl.botulinum*, *Mycobacterium tuberculosis*, *M.leprae*, *Salmonella typhi*, *Shigella dysenteriae*, *Treponema pallidum* and *Leptospira icterohaemorrhagiae*. Brief account on Rickettsial diseases.

3. Viral diseases -Chicken pox, influenza, mumps, measles, rubella, hepatitis, rabies and AIDS (HIV)

4. Fungal diseases – brief account on superficial, subcutaneous and deep mycoses (systemic). Protozoal diseases – amoebiasis and malaria. Helminth infections – tapeworm,

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hook worm, round worm and filariasis – very brief account.

5. Immunoprophylaxis – vaccines -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).

References:-

1. Text Book of Microbiology by Ananthanarayanan and Jayaram Panikkar.

2. Medical Microbiology by Macie and Mc Cartney.

3. Bailey and Scott's Diagnostic Microbiology by Baron *et al*

MB5B11 (P) Microbiology Practical V

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.

MB5B12 Food and Agricultural Microbiology.

1. Introduction: Importance of food and dairy Microbiology – Types of microorganisms in food – Source of contamination (primary sources) – Factors influencing microbial growth in foods (extrinsic and intrinsic)
2. Food fermentations: Cheese, bread, wine, fermented vegetables – methods and organisms used. Food and enzymes from microorganisms – single cell protein, production of enzymes.
3. 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).
4. Food Poisoning : food borne infections (a) Bacterial: Staphylococcal, Brucella, Bacillus, Clostridium, Escherichia, Salmonella (b) Fungal : Mycotoxins including aflatoxins, (c) Viral: Hepatitis, (d) Protozoa – Amoebiasis.
5. Food preservation : Principles of food preservation – methods of preservation. a. Physical (irradiation, drying, heat processing, chilling and freezing, high pressure and modification of atmosphere) b. Chemical (Sodium benzoate Class I & II) . Food Sanitation: Good manufacturing practices – HACCP, Personnel hygiene.
6. Biofertilizers. Symbiotic nitrogen fixation – (Rhizobium, Frankia) –Symbiotic nutrient mobilizers – Endomycorrhizae and Ectomycorrhizae – Non symbiotic microbes – Azotobacter – Associative Symbiosis - Azospirillum – Cyanobacteria (Nostoc. Gloeocapsa), Azola Anabena System. Microbial inoculants and their agricultural importance.
7. Plant pathology: Plant pathogenesis- plant disease resistance, morphological, functional and protoplasmic resistance, variation in disease resistance, mode of entry of pathogens and disease symptoms, physiology of parasitism, factors affecting disease incidence and a brief account of control measures. Phytophthora diseases – brief account. General account of fungal, bacterial and viral diseases.

References:

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.
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3. Modern Food Microbiology by Jay, J.M.1987. CBS Publishers and distributors, New Delhi.
4. Microbial Ecology. John Wiley & Sons, Inc., New York 2.
5. Introduction to Soil Microbiology by Alexander, M.(1977). John Wiley & Sons, Inc., New York.
6. Basic Food Microbiology by Banwart, G.J.1989. Chapman & Hall New York.
7. A Modern Introduction to Food Microbiology by Board, R.C.1983. Blackwell Scientific Publications, Oxford.
8. Dairy Microbiology by Robinson, R.K.1990. Elsevier Applied Science, London.
9. Food Poisoning and Food Hygiene, Hobbs, B.C. and Roberts, D.1993. Edward Arnold. London.
10. Introduction to Soil Microbiology by Martin Alexander Wiley. 1961 International Edn., New York

11. Agricultural microbiology, 2nd edition. Rangaswami G., Bagyaraj D. J. Prentice hall of India.

12. Ronald M. Atlas., Richard Bartha. Microbial Ecology. Benjamin Cummings. 1998.

MB5B13 (P) Microbiology Practical VI

1. Aerobic mesophilic count of fish samples and milk.
2. Isolation of constituent flora of fermentaed milk.
3. Production of wine.
4. Methylene blue reductase test.
5. Isolation of rhizobium and azotobacter.
6. Amonification and nitrification of organic compounds.

MB5B14 Environmental and Sanitation Microbiology

1. Components of Environment: Hydrosphere, lithosphere, atmosphere and biosphere – definitions with examples; Energy flow in the ecosystem- Carbon, Nitrogen, Sulfur and Phosphorous cycles.
2. Soil Microbiology: Humus, Microflora of soil, Interaction between microorganisms in soil – mutualism, commensalism, antagonism, synergism, parasitism, predation, competition, antibiosis, its significance. Plant microbe interactions- Rhizosphere and its significance, symbiotic and non symbiotic associations of microbes with plants and their usefulness in agriculture.
3. Microbiology of air: Microbiology of air – organisms in air, distribution and sources. Disease forecasting in plants. Droplet nuclei, aerosol, infectious dust and microbiological sampling of air. Brief account of air borne transmission of harmful microbes.
4. Aquatic Microbiology: Aquatic environment, Physical factors affecting aquatic life, distribution of microorganisms in aquatic environment – fresh water, estuarine and marine water systems. Factors influencing microbial 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.
5. 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.
6. Xenobiotic metabolism – Novell 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.

References:

1. Microbial Ecology by Ronald M. Atlas, Richard Bartha.
2. Microbiology concepts and applications by Pelzar *et a.l*
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.

MB5B15 (P) Microbiology Practical VII

1. Examination of microflora of soil
2. Study of antibiosis by microorganism, determination of antimicrobial spectrum.
3. Determination of water quality.
4. Determination of BOD of water.
5. Air sampling.

MB B16 (Pr): Project (work to be completed by the end of VI semester)

MB5D01/MB5D02. Open course from other departments

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SEMESTER VI

MB6B17 Industrial Microbiology

1. Basic Concepts of Fermentations:-introduction to Fermentations. Fermentor design – parts & their functions. Types of fermentors – Batch, Continuous, Dual and Multiple.
2. Design of fermentation media – Water, carbon and nitrogen source, growth factors, precursors, buffers, aeration and antifoam agents. Factors affecting fermentation process like sterilization, aeration, agitation, pH, temperature, foam and oxygen. Scale up, Product recovery methods in down stream processing.
3. Specific Fermentations: Alcohol by yeast from molasses, Penicillin by *Penicillium* species, Acetone/ butanol by *Clostridium* species, Amylase by Bacteria and fungus, Vinegar-*Acetobacter* species, steroid transformations, Vit B12.
4. Traditional use of fermentation for processing surplus food eg., bread, cheese, wine, idli and pickle making general concept of value addition using microbial fermentations.
5. Lactic acid cultures and yoghurt making ,cheese making –ripening by microbes study Production of SCP with respect to *Saccharomyces cerevisiae* ,Biogas-microorganisms used, substrates, Different types of digesters and their working, Mechanism of biogas production, Biofertilizer- applications: *Azotobacter*, *Rhizobium* and PSB, Biopesticides production and applications - *B. thuringensis* as biopesticides.

References:

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. Text book of Biotechnology by Cruger and Cruger.
5. Comprehensive Biotechnology by Murray and Moo Yung.

MB6B18 (P) Microbiology Practical VIII

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.

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MB6B19 Immunology

1. Concepts for resistance and host-parasite relationships. Types of immunity innate, acquired, active, passive– natural and artificial. Brief descriptions on mechanisms of innate immunology barriers, phagocytosis and inflammation.
2. Antigens – types – Hapten, complete antigen, epitope (antigenic determinants.). Basic structure of immunoglobulin – Ig G – Different classes of immunoglobulins and their function – brief account.

3. Antigen Antibody reaction – different types and their clinical applications (eg:- widal, VDRL, ELISA and western blot for HIV etc.)
4. Immunoresponse – humoral and cell mediated immunity – brief description of cells of immune system - leucocytes, lymphocytes – T & B, NK cells, macrophages, plasma cells and dendritic cells. Clonal selection theory. Monoclonal antibodies – Hybridoma technique (very brief account)
5. Hypersensitivity – different types -immediate and delayed – Anaphylaxis, immune complex diseases. Autoimmune diseases – mechanisms and classification Rheumatoid arthritis in detail. Complement system – functions.

References:-

1. Text Book of Microbiology by Ananthanarayanan and Jayaram Panikkar.
2. Immunology by Coleman *et al*
3. Fundamental Immunology by Paul W.E. *et al*
4. Introduction to Immunology John W Kimbal *et al*
7. Immunology by Roitt.
8. Fundamentals of Immunology by Kuby

MB6B20 (P) Microbiology Practical IX

1. Differential count of leukocytes.
2. Lymphocyte isolation.
3. Blood grouping.
4. WIDAL agglutination test.
5. ASO latex agglutination test.
6. RA latex agglutination test.
7. HBs. Ag. Latex agglutination test.
8. RPR test.

MB6B21 (E1) Biosafety and Bioethics

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. Containment – Physical containment, Biological containment, Planned introduction of genetically modified organisms.

Biosafety during industrial production using GMO's. Biosafety guidelines in India.

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.

12

References:-

11. Bioethics: An introduction for the Biosciences by Ben Mephram
12. Bioethics and Biosafety by Satheesh M.K.I.K. International publishing house, 2008.

MB6B21 (E2) Cell and Tissue culture

7. 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
8. 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.
9. 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.

10. 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.

11. 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 Characterizing stem cells.

References:-

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.

MB B22 (Pr): Project Work

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MODEL QUESTION PAPER

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University of Calicut

BSc. Microbiology- Semester III

MB3B05 Medical Microbiology

(Model Question paper)

Time 3 hrs Weightage-30

I. Answer all questions :

Choose the correct answer weightage 1x3

1. Weil's disease is caused by,
a) *Leptospira interrogans* (b) *Leptospira biflexa* (c) *Leptospira icterohaemorrhagiae* (d) *Treponema vincentii*
2. An example for a Differential medium,
a) Nutrient agar (b) MacConkey's agar (c) Chocolate agar (d) Tellurite agar
3. Modified Thayer -Martin medium is a selective medium used for ,
a) *Neisseria* (b) *Clostridium* (c) *Pneumococcus* (d) *Brucella*.
4. The shape and position of the spore in *Cl. tetani* is,
a) oval and terminal (b) spherical and terminal (c) central and oval (d) central and spherical.

Write True or False

5. Hepatitis A Virus is an enveloped virus.
6. Rocky Mountain Spotted Fever is transmitted by Flea.
7. Malchite green in the Lowenstein-Jenson medium is a selective agent.
8. *Streptococcus* is Catalase positive while *Staphylococcus* is negative.

Answer in one word:

9. Name a fungus infection of hair.
10. Which is the receptor host cell in HIV infection?
11. Name a pathogenic yeast-like fungi.
12. Which is the famous serological test for the diagnosis of Enteric Fever?

II. Comment briefly on all the following: weightage 1x9

13. Negri bodies
 14. Rubella
 15. Septicemia
 16. Weil's disease
 17. Nosocomial infection
 18. *Plasmodium falciparum*
 19. Pandemic
 20. Paradoxical carrier
 21. ELISA
- III. Write short essay on any 5 of the following: weightage 2x5**

22. Subcutaneous mycoses
 23. Type B Hepatitis
 24. Kirby-Bauer test
 25. Laboratory diagnosis of diphtheria
 26. Rickettsial diseases
 27. Varicella
 28. Filariasis
- IV. Answer any 2 of the following: weightage 4x2**
29. Explain the different methods of transmission of infection with suitable example
 30. Discuss the epidemiology and laboratory diagnosis of syphilis
 31. Explain pulmonary tuberculosis. Add a note on its treatment.

OPEN COURSES FOR OTHER DEPARTMENTS

5D01. Public Health and Emerging Microbial Diseases

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 disease-s Dengue fever, Chikungunya, Swine flu, Hand, Foot and Mouth disease. Bioterrorism.

5D02. Environmental Microbiology

1. Basic concepts of Ecology and Environment - Ecosystem - concept, components, food chains, food webs and trophic levels. Energy transfer efficiencies between trophic levels. Environmental factors influencing the growth and survival of in microorganisms. Physical factors - temperature, light, osmotic pressure and

hydrostatic pressure. Chemical factors - pH, O₂ and CO₂. Biological factors - Interactions of microbial population and community dynamics.

2. Biogeochemical cycles - Nitrogen cycle - Nitrogen fixation, nitrification, denitrification, sulphur, iron and phosphorous cycles. Rhizosphere - Rhizosphere microorganisms.
3. Faecal pollution of waters - waterborne diseases, indicator organisms. Sanitary examination of water.
4. Dispersal of airborne microorganisms. Air sampling principles and techniques. Microorganisms and sewage treatment; COD, BOD and DO, trickling filters, activated sludge process, oxidation ponds; sludge treatment (anaerobic digestion)
5. Global environmental problems: ozone depletion, green house effect and acid rain, their impacts and biotechnological approaches for management. Xenobiotic metabolism, biomagnification, release of GMO's to environment and their impact, ethical issues

1

COMPLEMENTARY COURSE BIostatISTICS AND COMPUTER APPLICATIONS

2

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)

3

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.

4

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)

Reference:

1. An Introduction to Database Systems, C. J. Date, 1994, Addison-Wesley
2. Understanding the New SQL, Jim Melton and Alan R. Simon, 1993, Morgan Kaufmann.
3. Principles of Database & Knowledge Jeffrey D. Ullman, Computer Science Press, 1988
4. 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.
5
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
6. 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.

6

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

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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.

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.

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.

1

B.SC. MICROBIOLOGY

(COMPLEMENTARY)

For other B.Sc. Programmes

2

B.SC. MICROBIOLOGY (Complementary)

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

3

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, Fielgen staining. Electron microscopy-TEM and SEM, specimen preparation .

3. Bacterial Taxonomy- Haeckel's three kingdom concept, Whittaker's five kingdom concept, Bergey's manual-brief account, Classification systems- Numerical taxonomy or Adansonian classification, 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. Brief account of fungal, protozoan, algal and viral structure.

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, quantitation of bacteria, factors affecting growth. Pure culture isolation methods, Preservation of pure culture .

6. Sterilization and disinfection -Physical and chemical agents to control microorganisms, definition of terms –sterilization, disinfectant, antiseptics, sanitization, Evaluation of chemical agents, phenol-coefficient.

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.

4

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 Photosynthesisbacterial 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.

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, Significance of air microflora –in human health, in hospitals, in industries, Airborne diseases-bacterial, fungal, viral, Air sanitation –by chemical agents, mechanical methods, U . V, electrostatic precipitation .
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.

5

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-chemical and physical. 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 . Principles of food preservation. Meat spoilage –general principles underlying meat spoilage , spoilage of different kinds of meats. Fish spoilage - factors influencing the fish spoilage, evidence of spoilage, bacteria causing the spoilage.

5. Milk spoilage -spoilage of milk, cream, condensed and dry milk. Spoilage of vegetables.

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, citric acid, vitamin B-12, alcohol 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

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.

6

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.

References:

1. Agricultural Microbiology-Rangaswamy
2. Brock biology of Microorganisms-Madigan
3. Environmental Microbiology- Joseph. C. Daniel
4. Food Microbiology, Fundamentals &Frontiers-Doyle.
5. Food Microbiology-William. C. Frazier.
6. Fundamentals of Bacteriology-A. J. Sallie
7. General Microbiology –Schlegel
8. General Microbiology-Pelczar
9. General Microbiology-Powar & Daginawala.
10. General Microbiology-Stanier, Ingraham
11. Fundamentals of Microbiology-Alcamo.
12. Fundamentals of Microbiology-Martin Frobisher
13. Genetics-Strickberger.
14. Immunology-Abbas.
15. Immunology-Janeway.
16. Immunology-Kuby.
17. Immunology-Roitt.
18. Industrial Microbiology –A. H. Patel
19. Industrial microbiology –Casida
20. Industrial Microbiology-Prescott & Dunn.
21. Introduction to Microbiology-John. L. Ingraham
22. Introductory Mycology-Alexopoulos.
23. Medical Microbiology-Brooks, Butal, Slack.
24. Medical Microbiology-Ananthanarayanan &Jayaram Panicker.
25. Microbial Ecology-Atlas &Bartha.
26. Microbiology- Jaquilini Black
27. Microbiology-Perry, Staley.
28. Microbiology-Prescott
29. Principles of fermentation technology-Stanburry&Whittacker.
30. Soil Microbiology-Mark Coyne.
31. Text Book of Microbiology –Alcamo