

BHARATHIAR UNIVERSITY, COIMBATORE – 641 046
M Sc MICROBIOLOGY WITH ONE COMPULSORY DIPLOMA
(AFFILIATED COLLEGES)
(Effective from the academic Year 2009-2010)
SCHEME OF EXAMINATIONS – CBCS PATTERN

Semester	Study Components	Course Title	Ins.Hrs/W	Exam				Credit
				Dur.H	CIA	Marks	Total Marks	
I	Paper - I	Fundamentals of Microbiology and Bioinformatics	5	3	25	75	100	5
	Paper – II	Microbial Physiology	5	3	25	75	100	5
	Paper – III	Applied Biotechniques	5	3	25	75	100	5
	Paper - IV	Environmental & Agricultural Microbiology	5	3	25	75	100	5
	Elect./Dip.	Paper I	5	3	25	75	100	3
	Practical	Practical - I	5	-	-	-	-	-
II	Paper – V	Molecular Genetics	5	3	25	75	100	5
	Paper – VI	Virology and Nanotechnology	5	3	25	75	100	5
	Paper – VII	Bio-Process Technology	5	3	25	75	100	5
	Paper - VIII	Engineering of Genes and Proteins	5	3	25	75	100	5
	Elect./Dip.	Paper II	5	3	25	75	100	3
	Practical	Practical - I	-	9	40	60	100	3
III	Paper – IX	Immunology and Immunotechnology	5	3	25	75	100	5
	Paper – X	Medical Microbiology	5	3	25	75	100	5
	Paper – XI	Biotechnology and IPR	5	3	25	75	100	5
	Paper - XII	Microbial Food Technology	5	3	25	75	100	5
	Elect./Dip.	Paper III	5	3	25	75	100	3
	Practical	Practical - III	5	-	-	-	-	-
IV	Paper - XIII	Biostatistics and Research Methodology	5	3	25	75	100	3
	Project	Project and Viva - Voce	-	-	-	-	200*	6
	Elect./Dip.	Paper IV - Practical	5	9	40	60	100	3
	Practical	Practical - III	5	9	40	60	100	3
Total							2200	90

* Project Report – 160 Marks; Viva –voce- 40 Marks.

List of Group Elective/Diploma papers (Colleges can choose any one of the Group/Diploma papers as electives)

	GROUP A Diploma in Quality Assurance in Microbiology	GROUP B Diploma in Community Health	GROUP C Diploma in Life Science
Paper I/ Sem I	Principles of Quality Assurance	Environment and Health	Basic Biological Sciences
Paper II/ Sem II	Quality Assessment in Pharmaceuticals	Communicable and Non-Communicable Diseases	Biophysics And Biochemistry
Paper III/ Sem III	Total Quality Management (TQM)	Health Care of The Community	Molecular Cytology and Tissue Engineering
Paper IV/ Sem IV	Practical	Practical	Practical

SEMESTER I : PAPER I : FUNDAMENTALS OF MICROBIOLOGY & BIOINFORMATICS

UNIT I

Basic concepts – Spontaneous generation- Germ theory of diseases – Cell theory – Contributions of Antony van leuwenhoek – Joseph Lister – Robert Koch – Louis Pasteur – Edward Jenner – John Tyndall – Sergei N. Winogradsky – Salmon Awaksman – Alexander Flemming- Paul Erlich – Fannie Hessie – Elie Metchnikoff - Kary Mullis. Development of pure culture methods.

UNIT II

Sterilisation and disinfection – Definitions – Principles – Methods of sterilization -: Physical methods – Heat – Filtration – Radiation and Chemical methods. Control of sterilization and Testing of sterility. Microscopy – Principles, Light microscope, Phase Contrast, Dark field, Bright field, Fluorescent – Interference microscope (Stereo microscope), Con focal scanning microscope – Inverted microscope - Electron microscope – TEM, SEM. and Micrometry. Staining : Simple, Gram staining, Negative staining, Capsule staining, Spore staining, Flagellar staining, Nuclear staining and Acid fast staining.

UNIT III

Taxonomy – Principle and its types (Classical approach – Numerical, Chemical, Serological and Genetic). Bacterial taxonomy – Bergey's manual of Systematic Bacteriology (Eubacteria and Archaeobacterium)

UNIT IV

Fungal taxonomy – Alexopolus, Algal taxonomy – Classes, Ultra structure and general characteristics. Outline classification of Protozoa – general characters and importance. Economic importance of algae and fungi.

UNIT V

Introduction to bioinformatics – Classification of Biological data bases – Biological data formats – Applications of Bioinformatics in various fields – Data retrieval – Entrez and SRS. Introduction to sequence alignment. Data base search for similar sequences using FASTA and BLAST programmes.

References:

- Pelczar. M.J. Jr, E.C.S. Chan Moel: Microbiology Mc Graw Hill Book R Kreig, 1986.
Prescott. L.M. J.P. Harley and C.A. Klein, 2004. Microbiology VI edition.
Atlas R.M. 1997. Principles of Microbiology. II ed. WCB, Mc Graw Hill.
Black, J.G. 1999. Microbiology. Principles and explorations, 4th ed, Hall International, inc.
Brook T.D., 1995, Biology of Microorganisms VI ed,
S.C. Rastogi, Namita Mendiratta,, Bioinformatics – Concepts, Skills and Applications.

SEMESTER I : PAPER II - MICROBIAL PHYSIOLOGY

UNIT I

Microbial cell – Ultra structure of Prokaryotic and Eukaryotic cell. Sub cellular structures and cell envelope, Slime layer, Capsules, Cell wall, Pili, Flagella, Cell - inclusions, Endospores, Cell membrane – Liposomes – Uptake of nutrients by the cell – Facilitated diffusion – Active transport – Group translocation , Iron uptake. Pinocytosis and Phagocytosis.

UNIT II

Microbial nutrition – Nutritional groups, Common nutrient requirements, Growth factors – Microbial growth – Growth curve – Measurement of microbial growth . Growth kinetics – Batch, Continuous and Synchronous cultures. Factors influencing the growth of microorganisms.

UNIT III

Carbohydrate metabolism – EMP, HMP and ED pathway – Kreb's Cycle – Glyoxylate cycle – Aerobic respiration – Substrate level and Oxidative phosphorylation – ATP generation. Lipid catabolism – β -oxidation. Anaerobic respiration – Sulphur compounds – Nitrate and Carbon -di -oxide as electron acceptors. Fermentation.

UNIT IV

Enzymes – Kinetics – Enzyme regulation – Protein structures. Biosynthesis – Aminoacids: Aspartic and serine families. Fatty acid synthesis. Nucleotide biosynthesis.

UNIT V

Autotrophs – Photoautotrophs – Oxygenic and Anoxygenic. Photosynthesis – Assimilation of CO_2 . Chemoautotrophs, Bioluminescence. Archaeobacteria – Adaptations to extreme environments.

References:

- Caldwell. D.R. 1995. Microbial Physiology and metabolism, Wm C. Brown Publishers.
Moat. A.G. and Foster. J.W. 1988. Microbial Physiology, John Wiley sons.
White J.D. Motteshead. D.W. Harrison S.J. Environmental system 2 ed. 1992.
Stainier R.Y. Ingraham, J.L. Wheelis, H.H. and Painter. P.R. 1986. Microbiology.

SEMESTER I : PAPER III : APPLIED BIOTECHNIQUES

UNIT I

Fundamental building blocks – Atoms – Bonds and molecules. Macromolecules – Chemical nature and functions of Carbohydrate, Lipids, Proteins and Nucleic acids. Radioisotopes – Measurement, uses and safety aspects. Autoradiography, GM counter, Scintillation – Instrumentation and applications.

UNIT II

Colorimetry - Principles, Instrumentation and Applications– Beer Lambert's law and deviation – Analysis – Qualitative and Quantitative. Spectrophotometry: -UV – VIS and IR, Fluorometry, Flame photometry, NMR, ESR - Principles, Instrumentation and Applications. Analysis – Qualitative and Quantitative.

UNIT III

Centrifugation: Principles – Instrumentation – Types – Methods and Factors affecting sedimentation coefficient - Applications.

UNIT IV

Chromatography: Principles, Instrumentation, Types and Detection methods – Paper, TLC, HPLC, GC, Ion-exchange, Column, Gel permeation, Chiral, Hydroxyapatite, Immuno adsorption and Affinity Chromatography – Applications.

UNIT V

Electrophoresis – Principles, Instrumentation, Types. Staining and Detection methods – Isoelectrophoresis – isoelectric focusing – Applications.

References:

Physical Biochemistry: David Freifelder.

Practical Biochemistry, Boyer.

Practical Biochemistry, Keith Wilson and John Walker, 4 ed 1994.

Foundation in Microbiology, Kathleen Talaro and Arthur Talaro, WCB Publishers 1993.

SEMESTER I : PAPER IV

ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY

UNIT I

Aerobiology-Microbial contamination of air-Sources of contamination-Biological indicators of air pollution. Enumeration of bacteria from air, Air sampling devices. Significance of air Microflora, Outline of Airborne diseases (Bacterial, Fungal and Viral), Air sanitation. Effect of Air pollution of plants and Humans.

UNIT II

Soil Microbiology-Structure, Types, Physical and Chemical properties-Soil microbes (Types and Enumeration)-Weathering and Humus formation, Soil pollution-Sources. Biogeochemical cycling-Nitrogen, Carbon, Phosphorous, Sulphur, Iron cycles and its importance.

UNIT III

Aquatic Microbiology-Microbiology of water (Aquatic environment-Fresh and Marine)-Water Pollution and Waterborne Pathogens. Assessment of water quality (Chemical and Microbial) Bacteriological examination of water-Indicator organisms. Microbiology of Sewage-Waste water treatment –BOD and COD.

UNIT IV

Microbial interaction-among microbes, with plants, Phyllosphere, Rhizosphere, Mycorrhizae-Symbiotic and free-living nitrogen fixers (Rhizobium, Azotobacter, Azospirillum, Frankia, BGA and Azolla -Phosphate solubilizers (Phosphobacterium and Aspergillus)-Phytopathogens-Bacterial, Fungal, Viral diseases (Wilt, Blight, Canker, Mosaic)-Control measures.

UNIT V

Recycling of Liquid and Solid wastes-Composting-Biogas, Mushroom and SCP production from Waste. Biodegradation of Complex Polymers (Cellulose, Hemicellulose, Lignin, Chitin and Pectin), Bioremediation (In-situ, Ex-situ, Intrinsic, Engineered, Solid phase, Slurry phase, Mobilization and Immobilization systems) Bioaugmentation and Biostimulation, Bioleaching (Copper and Uranium) -Xenobiotics degradation (Heavy metals, Radionuclides, Recalcitrants, Halogenated compounds). GMOS and Environment. Applications of GIS and RS techniques in Environmental monitoring.

REFERENCES:

- Mitchell. R. 1974. Introduction to environmental microbiology.
Atlas R.N. and Bartha. R. 1993. Microbial Ecology-Fundamentals and Applications, 3 ed.
Campbell. R. 1983. Microbial Ecology, 2 ed.
Reiheimer. G. 1991. Aquatic Microbiology, 4 ed.
Dart. R.K. and Shettron R.J. 1980. Microbiological aspects of pollution control. 2 ed.
Martin Alexander, 1997. Introduction to Soil Microbiology.
Subbha Rao, M.S. 1995. Soil microorganisms and plant growth

M.Sc MICROBIOLOGY

PRACTICAL I

1. Sterilization – Principles and methods.
2. Media preparation – Liquid and Solid media, Agar deep , slant and plate.
3. Pure culture techniques – Streak plate, pour plate, spread plate, decimal dilution.
4. Microscopy – Bright field
5. Micrometry – measurement of microorganisms.
6. Motility determination- Hanging drop and soft agar inoculation.
7. Enumeration of microorganisms from soil: Bacteria, Fungi and Actinomycetes.
8. Morphology of fungi: Yeast and Algae.
9. Staining: Smear fixation, simple, gram, acid fast, spore, capsule and negative.
10. Growth curve: Direct microscopic (Haemocytometer, Viable count)
11. Effect of various intrinsic factors on the growth of bacterium and fungi – pH, Temperature, Osmotic pressure and nutrients.
12. Anaerobic culture techniques; RCM (*Clostridium* sp). Mc Intosh Fildes anaerobic jar (Total anaerobes) , Wright's tube method.
13. Phenol Co-efficient test.
14. IMViC test
15. Hydrogen sulphite test
16. Oxidase test
17. Calalase test
18. Urease test
19. Nitrate reduction test
20. Polymer degradation – Starch, Gelatin, Casein.
21. Carbohydrate fermentation.

SEMESTER II : PAPER V : MOLECULAR GENETICS

UNIT I

Genetics – Historical introduction – Mendelian principles – DNA as a genetic material – Diplex DNA. Chemical composition, Physical structures of DNA, Circular and Superhelical DNA.

UNIT II

DNA replication – Enzymes of replication – Rolling circle model – DNA damage and Repair. Mutation- Spontaneous – Origin of bacterial mutations – Mutagenesis – Spontaneous and Induced mutations – Physical and chemical agents. Mutant selection – Carcinogenicity testing.

UNIT III

Genetic transfers in bacteria – Transformation – Transduction and Conjugation. Linkage and genetic maps. Phage genetics, Phage T mutants, Genetic recombination, Genetic mapping of T-4 Phage .

UNIT IV

Genetic code – Relation between genes and proteins – DNA transcription – RNA translation – Polypeptide synthesis.

UNIT V

Regulation of gene activity – Operan model (Lac, Tryp), Autoregulation – translational regulation.

References:

- Freifelder. D. 1995, Molecular Biology
Maloy, S.R. Cronan. J.E. Jr and David Freidfelder, Microbial genetics, 2 ed.
Benjamin Lewin. Genes VII. 1996.
Tamarin. R.H. 1996. Principles of Genetics. 5 ed.
Klug, W.S. and Cummings. M.R. 1996. Essentials of Genetics.

SEMESTER II : PAPER VI ; VIROLOGY AND NANOTECHNOLOGY

UNIT I

History and scope of Virology. Viruses – Definitions – Structures – General properties and Classifications. Bacterial Viruses – Introduction – taxonomy of bacterial viruses – DNA containing Viruses – Structure – Replication and Growth kinetics of T phages (Lytic and Lysogeny). Filamentous phages – RNA containing viruses – Structure, Replication and growth kinetics of ϕ x 174 .

UNIT II

Plant viruses – RNA viruses, TMV, Cowpea, Mosaic viruses, Bromo mosaic viruses, Satellite viruses. Double stranded DNA viruses – CaM Viruses, Single stranded DNA viruses – Gemini virus.

UNIT III

Animal viruses – RNA viruses – Picorna virus, Herpes virus, Toga virus. RNA tumor viruses – Retro viruses. DNA viruses – Vaccinia virus, DNA tumor viruses – SV 40, Adeno viruses, emerging viruses, Slow viruses, Prions.

UNIT IV

Techniques in virology – Cultivation of viruses – Isolation and Purification of Viruses. Characterization and Enumeration of viruses – Quantitative assay.

UNIT V

Introduction to Nanotechnology – Scientific revolutions – Types of nanotechnology and Nanomachines. Definition of Nanosystem- dimensionality and size dependant phenomenon; Quantum Dots, Nanowires and Nanotubes, 2D films.

References:

- Luria. S.E. Darnall. J.E. Baltimore. D. and Compare. A. 1978. General Virology, 3 ed.
Freidfelder ,D. 1995. Microbial genetics.
Grierson. D. and S.Convey, 1989. Plant Molecular Biology, 2 ed.
Hayes. W. 1968. The Genetics of Bacteria and their Viruses.
Mundahar. C.L. 1987. Introduction to plant viruses. 2 ed.
Nanotechnology: Basic science and emerging technologies- Mick Wilson, Kamali Kannangara *et al.*, Overseas Press (2005).
Introduction to nanotechnology , Charles. P. Poole, Frank.J.Owens (2003).
www.nanonet.rice.edu/intronanosci/
Nanotechnology: A gentle introduction to the Next Big Idea, Mark.A.Ratner *et al.*,(2002)

SEMESTER II: PAPER VII - BIOPROCESS TECHNOLOGY

UNIT I

An introduction to Fermentation Process. The range of Fermentation Process (Microbial biomass, Enzymes, Metabolites, Recombinant products, Transformation processes). Chronological development-Component parts of Fermentation process-Fermentation Economics.

UNIT II

Industrially important Microorganisms. Isolation (Primary and Secondary screening), Preservation and Improvement of Industrially important Strains (Mutation, Recombination, Regulation, Gene technology and Use of Genetic methods). Upstream processing-Development of Inoculum for Fermentation process- Media for Industrial Fermentation – Formulation, Optimization and Sterilization, Various stages in Upstream (Inoculum preservation, Growth of the inoculum, Fermenter preculture and Production fermentation).

UNIT III

Fermentation Types and Cultures –Batch, Continuous, Fed-batch, -Basic Growth Kinetics- Submerged and Solid state Fermentation -Downstream Processing-Recovery and Purification of Intracellular and Extracellular Products (Flocculation, Flotation, Filter systems, Centrifugation, Disintegration, Chromatography, Extraction, Crystallization, Precipitation and Drying).

UNIT IV

Fermentor Design and Construction, Fermentor types – For Microbial and Animal cell culture-Bioreactors for Aerobic fermentation, Stirred bioreactors, Reactors for immobilized cells, Productivity, Yield coefficients, Heat production, Stirring and Mixing, Gas exchange and Mass transfer. Instrumentation and Computer applications in Fermenter technology.

UNIT V

Microbial production of Organic acids (Citric and Acetic) Enzymes (Amylase and Protease) Aminoacids (Lysine and Glutamic acid), Antibiotics (Penicillin, Streptomycin and Griseofulvin), Vitamins (Riboflavin, Cyanocobalamine and Ascorbic acid)-Biosynthesis of Ergot alkaloids-Microbial transformation-Steroids and Sterols, Non-steroid compounds, Antibiotics and Pesticides.

REFERENCES:

1. Stanbury P.F.A. Whitaker S.J. Hall, 1995 Principles of Fermentation Techniques 2 ed.
2. Cruger and Cruger. A. Textbook of Industrial Microbiology 2 ed.
3. Cassida, J.E. 1968. Industrial Microbiology.
4. Prescott and Dunns, Industrial Microbiology.
5. Pepler. H.J. 1979. Microbial Technology. Vol I & II.
6. Demain A.J. and Solomon INA, 1986. Manual of Industrial Microbiology and Biotechnology.

SEMESTER II: PAPER VIII : ENGINEERING OF GENES AND PROTEINS

UNIT I

Gene analysis techniques – Isolation of DNA and RNA – Handling and Quantification of nucleic acids – Radiolabelling of nucleic acids – Gel Electrophoresis – Probing for a specific gene – Southern blotting, Northern blotting. Dot blotting, Western blotting. Chromosome walking – Heteroduplex analysis.

UNIT II

Enzymes – Nucleases: Restriction endonucleases – DNA cloning – Hybrid vectors – Restriction cloning – selection for hybrid vectors – Methods of cloning – Synthesis of cDNA – Cloning from genomic DNA – Genomic libraries – Selection and screening methods.

UNIT III

Biology of genetic engineering – Plasmids used for *E.coli* vectors, based on bacteriophage and M-13 phage vectors. Eukaryotic vectors – Yeast vectors, animal vectors, plant vectors. Prokaryotic and Eukaryotic hosts.

UNIT IV

Restriction mapping : Restriction map construction – Double digest. RFLP – PCR. Site directed mutagenesis, Protein engineering.

UNIT V

DNA sequencing – Dideoxy method, Maxam Gilbert method – Mapping and sequencing the Human genome.

References:

- Old ..R. W. and Primrose S.B. 1995. Principles of gene manipulations – An introduction to genetic engineering , 5 ed.
Winnacker E.L, 1987, From Genes to Clones. – Introduction to gene technology.
Nicholl. D.S.T, 1994. An introduction to genetic engineering.
Brown. T.A. 1995. Gene Cloning.
Pinler. A. 1993. Genetic engineering of microorganisms.

MSc MICROBIOLOGY

PRACTICAL II

1. Wine production
2. Organic acid production – Citric acid – Solid state and Submerged fermentation.
3. Amino acid production – Glutamic acid.
4. Production of Extra cellular enzymes – Protease by submerged fermentation – Cellulose by solid state fermentation.
5. Isolation of nitrogen fixers – free living, symbiotic, ammonification, nitrification, denitrification.
6. Isolation of Phosphate solubilizers.
7. Isolation of Coliphage.
8. Decolorisation of dyes and dye containing effluents.
9. Phage titration.
10. TMV transformation
11. Isolation of mutants: Induced - Auxotrophic, Antibiotic resistant and Replica plating technique. Spontaneous - Gradient plate technique.
12. Isolation of Plasmids and chromosomal DNA from microbes.
13. Size determination and fractionation of nucleic acids and proteins – Agarose gel electrophoresis, SDS – PAGE.
14. Gradient Gel electrophoresis.
15. Restriction mapping of γ of Vector DNA.

SEMESTER III PAPER IX - IMMUNOLOGY & IMMUNOTECHNOLOGY

UNIT I

Historical background and scope of immunology, Immunohaematology -ABO and Rh factor. Cells and organs of immune system. Non immunological defence mechanism - Barriers, Phagocytosis, inflammation, fever . Types of immunity - HI and CMI.

UNIT - II

Antigens - properties, Epitopes, haptens, adjuvant, cross reactivity. Antibodies - properties, structure (primary & secondary) and isotypes. Diversity and specificity. Anti antibodies.

UNIT - III

Serology - Introduction and classification of antigens and antibody reactions - Agglutination and precipitation reaction. Strength of antigen and antibody bindings - affinity & avidity. Complement pathway and complement fixation reaction. Immunofluorescence RIA, RAST, ELISA and Flowcytometry. Monoclonal antibodies & its applications. (Hybridoma technique)

UNIT - IV

MHC antigens - types and functions. Regulation and response of immune system. Response of B Cell to antigens. T cell products. Immunity to infectious diseases - Viral, bacterial and protozoan . Hyper sensitivity reactions .

UNIT V

Transplantation immunology - Tissue transplantation and grafting . Mechanism of graft acceptance and rejection. HLA typing Tumor immunology. Immunodeficiency diseases and auto immunity. Vaccines - Types and vaccination methods.

REFERENCE :

Coleman, R.M. , Lourbard, M.F and Sicard, R.E., 1992 Fundamental immunology, 2nd
Kuby, J. 1997 , Immunology, W.H Freeman and co., New York.
Roitt, I.M 1988 Essential of Immunology, Black Well Scientific Publishers.
Tizard , R.I. 1983. Immunology - An introduction , Saunder's College publishers Philadelphia.

SEMESTER III PAPER – X - MEDICAL MICROBIOLOGY

UNIT I

Introduction to medical microbiology - Infectious Diseases process – Diagnosis – Process of sample collection, transport and examinations of the specimens. Antibigram.

UNIT II

Bacteriology: Gram positive organisms - Morphology, cultural characteristics, pathogenicity and laboratory diagnosis of *Staphylococcus aureus*, *Streptococcus pyogenes*, *Pneumococcus*, *Bacillus anthracis*, *Corynebacterium diphtheriae*, *Clostridium welchii*, *Cl.,tetani*, *Clostridium botulinum*. *Mycobacteria*, *Spirochaetes* – *Treponema pallidum*, and *Leptospira icterohaemorrhagiae* and Elementary knowledge on *Chlamydiae*, *Rickettsiae* and *Mycoplasma*.

UNIT III

Bacteriology: Gram negative organisms:- Morphology, cultural characteristics, pathogenicity and laboratory diagnosis of *E.coli*, *Klebsiella sp*, *Enterobacter sp*, *Salmonella sp*, *Shigella sp*, *Pseudomonas sp*, *Vibrio cholerae*, *Aeromonas hydrophila*, *Bordetella pertusis*, *Yersinia pestis*, *Bacteroides* and *Neisseria spp*.

UNIT IV

Virology: Basic concepts of virology - General properties of Human viruses, Approaches to viral diagnosis- Serological and Molecular techniques. Pathogenicity and Laboratory diagnosis of viral infections - Hepatitis, Polio, Rabies, Influenza, Measles, Mumps, Rubella, Dengue virus, HIV and Ebola virus.

UNIT V

Mycology : General properties and approaches to laboratory diagnosis. Mycosis –Superficial, Subcutaneous and Systemic infections – Cryptococcosis, Madura mycosis, Histoplasmosis, *Candida albicans*.

Parasitology: Pathogenicity and laboratory diagnosis of *Entamoeba histolytica*, *Taenia solium*, *Plasmodium vivax*, *Wucheraria bancrofti* and *Enterobius vermicularis*. *Trichomonas vaginalis*.

References:

Textbook of Microbiology – Ananthanarayanan and Jayaram Panicker.
Essentials of Diagnostic Microbiology – Lisa Anne Shimeld, Anne T. Rodgers,
Manual of Clinical Microbiology – Lenetle,E, BalowsH.A.
Textbook of Medical Parasitology – Subash.C.Parija.
Medical Microbiology - Geo. F. Brooks.s
Medical Mycology – Jagadesh Chander.

SEMESTER III PAPER XI - BIOTECHNOLOGY AND IPR

UNIT I

Microbial synthesis of commercial products: Protein pharmaceuticals: interferons and growth hormones – Antibiotics: novel antibiotics – Biopolymers: gum, melanin, PHB, adhesives-
Molecular diagnostic system of genetic disease – PCR/OLA assay

UNIT II

Vaccines – submit vaccines – live recombinant vaccines – attenuated vaccines- vector vaccines-
anti idiotypic vaccines – Monoclonal antibodies, Bioremediation and Biomass utilization –
Microbial degradation of Xenobiotics – Utilization of starch and sugars, cellulose

Unit III

Plant growth promoting bacteria – N₂ fixation- nitrogenase – Hydrogenase. Nodulation
Siderophores – Microbial insecticides - Insecticidal toxin of BT. Mode of action - genetic
engineering of B.T. strains – Baculovirus as biocontrol agents.

Unit IV

Transgenic plants and animals – Ti.Plasmid – Derived Vector systems – methods of transferring
genetic plants – Developing plant strains by genetic engineering. Insect resistant, virus resistant,
herbicide resistant. Transgenic animals methods – The human somatic cell gene therapy –
invitro gene therapy – Invivo gene therapy – Antisense therapy.

Unit V

Intellectual Property Rights (IPR)- different types of IPRs, studies on patents granted in India
and other countries, special studies on technology evaluation, analyses of patent applications
filed in India in various technology areas, international treaties and conventions and patent laws
in other countries - Regulating the use of biotechnology – rDNA technology – Food and
Agricultural ingredients – patenting Biotechnology invention.

Reference:

1. Glick, B R and J J Pasternak 1994. Molecular biotechnology – Principles and applications of recombinant DNA. ASM press Washington D.C.
2. Winnacker E.L. 1987 from Genes to Clones – Introduction to Gene Technology. VCH Weinherm
3. Old R W and Primrose S B 1995 Principles of Gene Manipulation - An introduction to genetic engineering. 5th edition Blackwell scientific publications London.
4. Intellectual Property Rights (IPR) bulletin
5. http://www.indianembassy.org/policy/ipr/ipr_2000.htm

PAPER XII : MICROBIAL FOOD TECHNOLOGY

UNIT I

Food as a substrate – Incidence and types of microorganisms in food – Contamination and Spoilage of Meat, Poultry, Sea foods, Vegetables, Fruits. Principles of food preservations: Asepsis, Preservation by use of High temperature, Low temperature, Canning, Drying, Radiation and Food additives.

UNIT II

Food poisoning – Food borne diseases- Bacterial and Non- Bacterial. Fermented foods - Meat and fishery products – Country cured hams, Dry sausages, Katsuobushi. Fermented milk products – Butter, Butter milk, Sour cream, Youghurt, Cheese, Kefir, Koumiss, Taette and Tarhama.

UNIT III

In house Committee for quality assurance, Persons involved, Internal Microbial Quality control Policy, Quality Check at every step from collection of raw materials till it reaches the customer , Implementation of ISO standards and history, definitions, principles and use of HACCP in Food Industry .

UNIT IV

Indicator organisms – Direct examination – culture techniques – enumeration methods – plate – Viable & Total Count; Alternative methods – Dye reduction tests , electrical methods , ATP determination: Rapid methods, immunological methods – DNA / RNA methodology – Laboratory accreditation.

UNIT V

Food laws and regulations

- A. National – PFA Essential Commodities Act (FPO, MPO etc.)
- B. International – Codex Alimentarius, ISO – 9000 series , ISO 22000 & BS 5750.
- C. Regulatory Agencies – WTO

Consumer Protection Act - Relevance of Microbiological standards & criteria for food safety – Sampling plans – Microbiological guidelines

Hygiene and sanitation in food sector

General Principles of Food Hygiene, GHP for commodities, equipment, work area and personnel, cleaning and disinfection (Methods and agents commonly used in the hospitality industry), Safety aspects of processing water (uses & standards) and Waste Water & Waste disposal

References:

- James. M. Jay, 1992, Modern food microbiology 4ed.
Frazier, W. C. and Westhoff D.C. 1989. Food Microbiology 8 ed.
Dubey. R.C. and Maheswari. D.K. A Textbook of Microbiology, 1999. 1 ed.
Water Analysis – A practical guide to Physico – Chemical & Microbiological water examination and Quality assurance – W.Schneider, W.Fresenius & K.E. Quentin Springer – Verlag Pub. Heidelberg.
Food Microbiology. 2 nd Edition – M.R.Adams & M.O.Moss – Panima Publishers.

PAPER XIII - BIOSTATISTICS AND RESEARCH METHODOLOGY

UNIT I

Defenition – Scope of Biostatistics,Probability analysis ,Variables in Biology- Collection,Classification and Tabulation of data.Graphical and diagrammatical representation – Scale diagram-Histogram- frequency curve.

UNIT II

Measures of central tendency- Arithmetic mean , Median,Mode.Calulation of Mean,median,Mode in series of individual observatios,discrete series,continous, open end classes,measure of dispersion,standard deviation,standard error.

UNIT III

Simple correlation coefficient of correlate regression- simple and linear regression.

UNIT IV

Basic ideas of significant test-Hypothesis testing,Level of significant test,test based on studies-t-test- chi square , Goodness of fit.

UNIT V

Problem selection and project designing. Review of literature, source of collection, processing of data, presentation of data, error, editing the final draft, presentation of research project.

References:

- 1.S.P.Guptha-Statistical Methods
- 2.Palanisamy and Manoharan-Statistical methods of Biology
- 3.Khan and Khan- Fundamentals of Biostatistics
- 4.Kothari-Research Methodology

MSc MICROBIOLOGY PRACTICAL III

1. Diagnostic microbiology: Isolation and interpretation of clinical specimens from the following systems: – Respiratory tract, Gastrointestinal tract, Urinary tract, Skin infections, Circulatory system, Central nervous system and from organs like eye, ear and nose. Tuberculosis and anaerobic infections.
2. Isolation and identification of clinically important fungi- *Candida albicans*, *Aspergillus sp*, *Cryptococcus neoformans*
3. Antibiotic susceptibility test. - Kirby Bauer technique
4. Identification and enumeration of Lymphocytes.
5. Examination of blood smear study for *Plasmodium sp*
6. Isolation and characterization of antigens
7. Development of polyclonal antibodies
8. Purification of immunoglobulins and their sub units.
9. Serological tests: Blood grouping, Widal, VDRL, RA, ASO, CRP, ELISA
10. Immunoelectrophoresis
11. Ouchterlony's immunodiffusion
12. Separation techniques: Chromatography- Paper, TLC and Column.
13. Virus cultivation – Egg inoculation.

GROUP A - DIPLOMA IN QUALITY ASSURANCE IN MICROBIOLOGY DIPLOMA PAPER I : PRINCIPLES OF QUALITY ASSURANCE

UNIT I

Quality assurance – Introduction and overview – Definition. Designing of microbiology laboratory – Control of quality – Applications.

UNIT II

Quality assessment of Equipments, chemicals, glass wares and laboratory environments – Variance – Quality control calculations – Quality management – Maintenance of records and reports.

UNIT III

Quality assurance in sterilization and disinfection - Preservation of stock cultures, media and diagnostic kits – Quality control of media and stains.

UNIT IV

Quality assessment of disposal – decontaminated matters and other biological effluents – Quality management in transportations of cultures. National control of biologicals – Biological references and standards.

UNIT V

Good laboratory practices – Management of laboratory hazards and knowledge in First aid procedures.

References:

Rajesh Bhatia and Rattan Lal Ichhpujani. 1995. I ed. “Quality assurance in Microbiology”

GROUP A - DIPLOMA IN QUALITY ASSURANCE IN MICROBIOLOGY DIPLOMA PAPER II - QUALITY ASSESSMENT IN PHARMACEUTICALS

UNIT I

An introduction to pharmaceutical microbiology. Chemical growth control. Chemical antimicrobial agents for external use, synthetic antimicrobial drugs, naturally occurring antimicrobial drugs: Antibiotics. Antibiotics from prokaryotes, antiviral drugs, antifungal drugs, antimicrobial drug resistance, the search for new antimicrobial drugs.

UNIT II

Types of spoilage, Factors affecting microbial spoilage – assessment of microbial spoilage – preservation. Ecology of microorganisms as it affects the pharmaceutical industry – Sterile pharmaceutical products – injections, Non injectable sterile fluids, Ophthalmic preparations, dressings & implants.

UNIT III

Sterilization control- methods of sterility testing- sterilization monitors and Quality assurance of products . The microbiological quality and regulatory requirements for natural and nutraceutical products, The regulatory control and quality assurance of immunological products, Containment system integrity – sterile products, Regulatory guidelines (microbiology) for veterinary antimicrobial products.

UNIT IV

The role of the Qualified Person in microbiological quality assurance, Safety in microbiology, Rapid enumeration and identification methods, Selection and use of cleaning and disinfection agents in pharmaceutical manufacturing, Prevention and elimination of microbial biofilms in the manufacturing environment using Clean-in-Place, Cleanroom design, operation and regulatory standards.

UNIT V

Microbiological quality assurance. Validation of aseptic processing and media fills, International disinfectant testing protocols, Measurement of biocide effectiveness, Microbiological quality and regulatory requirements for biotherapeutics and manufactured products, The role of the microbiologist in HACCP, Auditing the pharmaceutical microbiology department.

References:

1. Pharmaceutical Microbiology – W.B.Hugo & A.D.Russel, 4 th Ed, Blackwell Scientific Publications.
2. INDUSTRIAL PHARMACEUTICAL MICROBIOLOGY – Vol I & Vol II: standards & Controls Editors – Dr Norman Hodges and Professor Geoff Hanlon (University of Brighton) ,(REF ; www.euromed.uk.com)
3. Biology of Microorganisms – BROCK-Madigan M.T. 11th Edition (2006) Pearson-Prentice Hall, USA

**GROUP A - DIPLOMA IN QUALITY ASSURANCE IN MICROBIOLOGY
PAPER III -TOTAL QUALITY MANAGEMENT (TQM)**

UNIT – I

Concepts in TQM- Tools & techniques of TQM – Requirements for implementing TQM – Steps for implementing TQM – Questionnaire, Assessment through questionnaire – Mission statement – Benefits of TQM – Check list for implementing TQM – Case study.

UNIT -II

Types of Data , tabular and **Graphical summarization of numeric data** : - Histograms & Stem and Leaf displays : **Graphs for categorical data** – Bar, Pie charts & Pareto diagrams.

UNIT – III

Graphs for time ordered data – Run charts , Cause effect diagrams – Check Sheets

UNIT –IV

Numeric data summarization - The mean, mode & Median ; The Standard deviation , Variance , Range & Percentiles.

UNIT -V

Graphic display of numeric summaries:-The box plot and the scatter diagram .

Skewness, T – test, Anova,

Reference:

1. Twelve Management skills for success – Ram Narain , Viva books private limited – Chennai.
2. A cross functional perspective Total Quality Management – Rao, Carr, Dambolena and Kopp- John Wiley & Sons, New York .

GROUP A
DIPLOMA IN QUALITY ASSURANCE IN MICROBIOLOGY
PAPER IV - PRACTICAL

1. Microbiological laboratory safety- General rules & Regulations.
2. Staining Techniques (Grams and LPCB)–Food samples- vegetables and packed foods.
3. Sterility tests for Instruments – Autoclave & Hot Air Oven
4. Disinfection of selected instruments & Equipments
5. Sterility of Air and its relationship to Laboratory & Hospital sepsis.
6. Sterility testing of Microbiological media
7. Sterility testing of Pharmaceutical products –Antibiotics, Vaccines & fluids
8. Standard qualitative analysis of water.
9. Quantitative analysis of water – Membrane filter method
10. Analysis of food samples for Mycotoxins (Afla toxins)
11. Enumeration of microbes from industrial effluents.
12. Evaluation of Drug potency by MIC.
13. Isolation & characterization of Bacteria from wood and Paints.
14. Assay of microorganisms from biomedical waste.
15. Water quality analysis – MPN.
16. Estimation of BOD and COD.
17. Isolation of microorganisms from spoiled foods – Meat, milk, Cereals and Bread.
18. Milk quality – Dye reduction test.
19. Thermal death point and thermal death time.

Reference

- Microbiology - A laboratory manual, Cappuccino & Sherman , 6 th Ed, Pearson Education
- Manual of diagnostic microbiology, Dr.B.J.Wadher & Dr.G.L.Bhoosreddy, First .Ed ., Himalaya publishing house, Nagpur.
- Pharmaceutical Microbiology – W.B. Hugo
- Pharmaceutical Microbiology – Purohit
- Laboratory Exercises in Microbiology, George.A.Wistreich & Max.D.Lechtman, 3 rd Ed, Glencoe press, London.

GROUP B - DIPLOMA IN COMMUNITY HEALTH

DIPLOMA PAPER 1 - ENVIRONMENT AND HEALTH

UNIT I

Water pollutants – Purification – Mechanical and Chemical methods.

UNIT II

Air pollutants – Control of air pollution – Disinfection of air – Ventilation, UV radiation.

UNIT III

Noise pollution – Control measures, Radiations – Causes and Control

UNIT IV

Medical entomology: Vector control – Flies, flees and Rodent Control

UNIT V

Environmental sanitation – Waste disposal – Sewage, Sullage and Hospital waste disposal

REFERENCES

1. Park's Text book of Preventive and social medicine by Dr. Jahan Evertt Rark
2. Environmental Biology by S. K. Dubey
3. Environment Pollutants and Women's Health by Mahendra Pandey
4. Waste water Treatment by Sheela Sanghvi
5. Environment and Pollution by N. Arumugam and V. Kumerasan
6. Ecology and Ethology by V. K. Agarwal & Usha Gupta

GROUP B - DIPLOMA IN COMMUNITY HEALTH

DIPLOMA PAPER II - COMMUNICABLE AND NON-COMMUNICABLE DISEASES

UNIT I

Respiratory infections – Influenza, Mumps, Measles, Rubella, Acute respiratory infections and TB.

UNIT II

Intestinal infections – Polio, Cholera, Acute diarrhea diseases, Food poisoning, Typhoid, Amoebiasis Ascariasis, Hook worm, Tapeworm, Pinworm infections.

UNIT III

Vector borne Infections – Leprosy, STD – AIDS – Diagnostic Techniques and Treatment.

UNIT IV

Superficial mycoses – Dermatophytoses – Opportunistic fungal infections – Candidiasis – Diagnostics Techniques and Treatment.

UNIT V

Non-communicable diseases – Hyper Tension – Diabetes – Coronary Heart diseases – Cancer, Obesity, Blindness, Accidents – Preventive measures.

REFERENCES

1. Park's Text Book of preventive and social medicine
2. Medical Microbiology by K.C.Sawant
3. Virology by K.C.Sawant
4. Bacteriology by Subrata Bhattacharjee
5. Text book Microbiology by Ananthanarayan
6. Medical Microbiology by Panicker
7. A Text book of Microbiology by R.c.Dubey and D.K.Maheswari

GROUP B - DIPLOMA IN COMMUNITY HEALTH

DIPLOMA PAPER III - HEALTH CARE OF THE COMMUNITY

UNIT I

Nutrition and health - Balanced Diet, food surveillance, food fortifications- addition of vitamins and minerals - Adulteration and preventive steps

UNIT II

Physical health-care of skin,hair,teeth,eyes.ears,hands and feet-physical exercises and their importance - Walking and jogging – Yoga and meditation – stress Relief.

UNIT III

Health Programmes and health education – Malaria control – TB control – AIDS control programmes Immunization programmes –

UNIT IV

Social sciences and mental health – Sociology; Social structure, culture and customs – social problems-Mental health – cases of mental illness Alcoholism and drug dependence – prevention Rahabilitation.

UNIT V

Family planning, Maternal and child health – Antenatal and Postnatal care – Reproductive and child Health programme. (RCH).

REFERENCES

1. Park's Text books of preventive and social medicine
2. Immune – biotechnology by Naha & Narain
3. Immunology by Dulsy Fatima & N.Arumugam
4. Food and Nutrition by L.Swaminathan
5. Dietics by Srilakshmi
6. Practice of fertility control & Comprehensive manual 6th edition by S.K.Choudhary

GROUP B - DIPLOMA IN COMMUNITY HEALTH - PRACTICAL

1. Water Analysis : Physicochemical parameters
2. Bacteriology: Hanging drop method, Gram's staining, and pasteurization of milk.
3. Diagnostic test : Diabetic test, Hypertension test, Widal test, VDRL test
4. Sterilization techniques: Autoclave, Hot Air oven
5. Food Adulteration Any four Food Stuffs
6. ELISA test, RIA test (Demonstration only)
7. Microscopic examination of Infectious Agents- Entamoeba, Ascaris, Hook worm, Pinworm, Tape worm, malarial parasite and Filarial parasite.

GROUP C - DIPLOMA IN LIFE SCIENCES

SEMESTER I- DIPLOMA PAPER I - BASIC BIOLOGICAL SCIENCES

UNIT-I

Cell Biology - Structure and function of cells and intracellular organelles (of both prokaryotes and eukaryotes): mechanism of cell division including (mitosis and meiosis) and cell differentiation: Cell-cell interaction; Dosage compensation and mechanism of sex determination.

UNIT-II

Biochemistry: Structure of atoms, molecules and chemical bonds; Principles of physical chemistry: Thermodynamics, Kinetics, dissociation and association constants; Nucleic acid structure, genetic code, replication, transcription and translation: Structure, function and metabolism of carbohydrates, lipids and proteins; Enzymes and coenzyme; Respiration and photosynthesis.

UNIT-III

Physiology: Response to stress: Active transport across membranes; Plant and animal hormones: Nutrition (including vitamins); Reproduction in plants, microbes and animals.

UNIT-IV

Evolutionary Biology: Origin of life (including aspects of prebiotic environment and molecular evolution); Concepts of evolution; Theories of organic evolution; Mechanisms of speciation; Hardyweineberg genetic equilibrium, genetic polymorphism and selection; Origin and evolution of economically important microbes, plants and animals.

UNIT-V

Environmental Biology: Concept and dynamics or ecosystem, components, food chain and energy flow, productivity and biogeochemical cycles; Types of ecosystems, Population ecology and biological control; Community structure and organisation; Environmental pollution; Sustainable development; Economic importance of microbes, plants and animals.

GROUP C - DIPLOMA IN LIFE SCIENCES

SEMESTER II - DIPLOMA PAPER II – BIOPHYSICS AND BIOCHEMISTRY

UNIT-I

Principles of biophysical methods used for analysis of biopolymer structure, X-ray diffraction, Hydrodynamic methods; plasma emission spectroscopy.

UNIT-II

Principles and techniques of nucleic acid hybridization and Cot curves; Sequencing of Proteins and nucleic acids; Methods for measuring nucleic acid and protein interactions. Structural polymorphism of DNA, RNA and three dimensional structure of tRNA;

UNIT-III

Principles and applications of tracer techniques in biology; Radiation dosimetry; Radioactive isotopes and half life of isotopes; Effect of radiation on biological system.

UNIT-IV

Interconversion of hexoses and pentoses; Amino acid metabolism; Coordinated control of metabolism; Oxidation of lipids; Biosynthesis of fatty acids; Triglycerides; Phospholipids; Sterols, Group transfer and Coupled reactions

UNIT-V

Biochemistry and molecular biology of cancer; Oncogenes; Chemical carcinogenesis; Genetic and metabolic disorders; Hormonal imbalances; Drug metabolism and detoxification.

GROUP C - DIPLOMA IN LIFE SCIENCES

SEMESTER III - DIPLOMA PAPER III MOLECULAR CYTOLOGY AND TISSUE ENGINEERING

UNIT-I

Molecular basis of signal transduction in bacteria, plants and animals; Model membranes; proteinsorting, secretory and endocytic pathways, cell cycle; Dosage compensation and sex determination and sex-linked inheritance

UNIT-II

The law of DNA constancy and C-value paradox; Numerical, and structural changes in chromosomes; Molecular basis of spontaneous and induced mutations and their role in evolution; polypoidy; Environmental mutagenesis and toxicity testing; Population genetics. Environmental regulation of gene expression

UNIT-III

Cell and tissue culture in plants and animals; Primary culture; Cell line; Cell clones; Callus cultures; Somaclonal variation; Micropropagation; Somatic embryogenesis; Haploidy; Protoplast fusion and somatic hybridization; Cybrides;

UNIT-IV

Genetransfer methods in plants and in animals; Transgenic biology; Allopheny; Artificial seeds; Gene targeting. Applications of genetic engineering in agriculture, health and industry .

UNIT-V

Histology –Basics of mammalian systems, nutrition, digestion and absorption; Circulation (open and closed circular, lymphatic systems, blood composition and function); Excretion and osmoregulation: Homeostatis (neural and hormonal); Bioluminescence.

GROUP C - DIPLOMA IN LIFE SCIENCES

SEMESTER IV – PRACTICAL

Stages of cell division-mitosis and meiosis

1. Estimation of total carbohydrates and proteins
2. CS of dicot and monocot root and stem
3. Physical mutation with UV
4. Antagonistic activity of any one biocontrol agent.
5. Agarose gel electrophoresis
6. Agglutination-Blood grouping, Precipitation-ODD
7. Callus induction
8. Auxin production
9. Phenomenon of Bioluminescence.