BHARATHIAR UNIVERSITY, COIMBTORE.

M.Sc. MICROBIOLOGY

SCHEME OF EXAMINATION (CBCS PATTERN)

For the students admitted during the academic year 2012-2013 Batch onwards

Study Components	Course Title	Ins. hrs / week	Exam				Credit
			Dur. Hrs.	CIA	Uni. exam	Total	
Semester I							
Paper I	Fundamentals of Microbiology and Bioinformatics	5	3	25	75	100	4
Paper II	Microbial Physiology	5	3	25	75	100	4
Paper III	Applied Biotechniques	5	3	25	75	100	4
Paper IV	Environmental and Agricultural Microbiology	5	3	25	75	100	4
Practical	Practical I	5	-	-	-	-	-
Elective	Paper I	5	3	25	75	100	4
Semester II							
Paper V	Molecular Genetics	5	3	25	75	100	4
Paper VI	Virology and Nanotechnology	5	3	25	75	100	4
Paper VII	Bioprocess Technology	5	3	25	75	100	4
Paper VIII	Engineering of Genes and Proteins	5	3	25	75	100	4
Practical	Practical I	-	9	40	60	100	4
Practical	Practical II	5	9	40	60	100	4
Elective	Paper II	5	3	25	75	100	4
Semester III							
Paper IX	Immunology and Immunotechnology	5	3	25	75	100	4
Paper X	Medical Microbiology	5	3	25	75	100	4
Paper XI	Biotechnology and IPR	5	3	25	75	100	4
Paper XII	Microbial Food Technology	5	3	25	75	100	4
Paper XIII	Biostatistics and Research Methodology	5	3	25	75	100	4
Practical	Practical III	5	-	-	-	-	-
Semester IV							
Elective	Paper III	5	3	25	75	100	4
Practical	Practical III	5	9	40	60	100	4
Project+	Project and viva voce	-	-	-	-	250*	10
Elective	Paper IV -Practical	5	9	40	60	100	4
	Total					2250	90

***** Project Report – 200 Marks, Viva voce- 50 Marks

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

	GROUP A	GROUP B	GROUP C
Paper I/Sem I	Principles of Quality Assuarance	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 Managemer (TQM)	Health care of the community	Molecular Cytology and Tissu Engineering
Paper IV/Sem IV	Practical	Practical	Practical

Guidelines for the Project Work:

Two reviews be conducted with all the students & staff members in the month of Jan. & Feb.
2nd review if necessary an external expert may be called.

Note :
Revised syllabi for the papers are furnished below. The remaining papers will be the same as prescribed for the academic year 2009-10.

Semester I : Paper I - Fundamentals of Microbiology & Bioinformatics
Semester I : Paper IV -Environmental and Agricultural Microbiology
Semester II : Paper VI - Virology and Nanotechnology
Semester III : Paper X - Medical Microbiology
Semester III: Paper XII - Microbial Food Technology
Elective Group A - Paper II - Quality Assessment in Pharmaceuticals

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 –Filteration – 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 – Outline classification and general characterization of Eubacteria and Archaebacterium

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: Mcrobiology 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 Applilcations.

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, Mycorhizzae-Symbiotic and free-living nitrogen fixers (Rhizobium, Azotobacter, Azospirillum, Frankia, BGA and Azolla - Phosphate solubilizers (Phosphobacterium and Aspergillus)- Biofertilizers – Preparation and Applications. 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

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, Satellite viruses. Double stranded DNA viruses – CaM Viruses, Single stranded DNA viruses – Gemini virus.

UNIT III

Animal viruses – RNA viruses – Picorna virus - Polio, Rabies, Herpes virus – HSV I & II, RNA tumor viruses – Retro viruses - HIV. DNA viruses – Vaccinia virus, DNA tumor virues – SV 40, Adeno viruses and 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 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. Antibiogram.

UNIT II

Bacteriology: Gram positive organisms - Morphology, cultural characteristics, pathogenicity and laboratory diagnosis of *Staphylococcus aureus, Streptococccus pyogenes, Pneumococcus, Bacillus anthracis*, *Corynebacterium diphteriae, Clostridium welchii, Cl.,tetani, Clostridium botulinum. Mycobacteria, Spirochaetes – Treponema pallidium,* and *Leptospira icterohaemorrhagiae.*

UNIT III

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

UNIT V

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

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.

PAPER XII : MICROBIAL FOOD TECHNOLOGY

UNIT I

Food as a substrate – types of microorganisms in food – Preparation of Fermented foods - Meat and fishery products – Country cured hams, Dry sausages, Katsuobushi - Fermented milk products – Butter, Butter milk, Sour cream, Youghurt, Cheese, Kefir, Koumiss.

UNIT II

Food Spoilage – Microorganisms involved - Spoilage of Meat, Poultry, Sea foods, Vegetables and Fruits. Food poisoning – Food borne diseases- Bacterial and Fungi.

UNIT III

Food Preservation - Principles and Methods – Physical and Chemical Methods. Internal Microbial Quality control Policy, ISO standards - definitions, principles and use of HACCP in Food Industry .

UNIT IV

Indicator organisms – Direct examination – culture techniques – enumeration methods – plate – Viable & Total Count – Dye reduction tests, Screening of carriers in food handlers, Food adulteration, Laboratory accreditation.

UNIT V

Food laws and regulations

National – PFA Essential Commodités Act (FPO, MPO etc.)

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.

ELECTIVE GROUP A - 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

Pharmaceutical products – Contamination – sources – mode of contamination, Assessment of Microbial Contamination

UNIT III

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

UNIT IV

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, 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 & Vol II: tandards & 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