

University of Kota, Kota

M.Sc. (P/F) MICROBIOLOGY -2013

Eligibility: B.Sc. under the 10+2+3 scheme with Chemistry, Zoology, Botany/Microbiology/Biotechnology/Medicine/Pharmacy/Agriculture with a minimum of 50 % marks.

(45% for candidates belonging to the reserved category SC/ST/OBC)

Selection: Common Entrance Test to be conducted by Scheme of Examination and Courses of Study

1. The number of papers and the maximum marks for each paper/practical are shown in the syllabus. It will be necessary for a candidate to pass in the theory part as well as in the practical part (wherever prescribed) separately.
2. A candidate for a pass at each of the Previous and the Final Examinations shall be required to obtain (i) at least 36% marks in the aggregate of all the papers prescribed for the examination and (ii) at least 36% marks in practical(s) / wherever prescribed at the examination, provided that if a candidate fails to secure at least 25% marks in each individual paper at the examination and also in the Test / Dissertation/ Survey Report / Field Works, wherever prescribed, he shall be deemed to have failed at the examination notwithstanding his having obtained the minimum percentage of marks required in the aggregate for that examination.
No division will be awarded at the previous Examination. Division shall be awarded at the end of the Final Examination on the combined marks obtained at the Previous and the Final Examinations taken together, as noted below:

First Division 60%

On the aggregate mark taken together in the Prev. & Final Exam.

Second Division 48%

3. If a candidate clears any paper(s) prescribed at the Previous and/ or Final Examination after a continuous period of three years, then for the purpose of working out his division the minimum pass marks only viz. 25% (36% in the case of Practical) shall be taken into account in respect of such paper(s)/Practical(s) are cleared after the expiry of the aforesaid period of three years; provided that in case where a candidate requires more than 25% marks in order to reach the minimum aggregate as many marks out of those actually secured by him will be taken into account as would enable him to make up the deficiency in the requisite minimum aggregate.
4. A total of eight theory papers (3 hours duration each) are prescribed (4 in previous and 4 in final). A combined Practical Examination (10 hrs. duration in two days) shall be conducted each year. Paper setter shall be asked to set total 9 questions for each theory paper (which have been divided into three sections) or 10 questions for each theory paper (which have no sections) out of which the examinee shall be asked to attempt any five questions. The list of papers is as below:

A candidate failing at M.Sc. Previous examination may be provisionally admitted to the M. Sc. Final Class, provided that he passes in at least 50% papers as per Provisions of 0.235 (i)

A candidate may be allowed grace marks in only one theory papers up to the extent of 1 % of the total marks prescribed for that examination.

Teaching & Examination Scheme –2013
M.Sc. (P) Microbiology

A. Theory Papers	Max. Marks
1. General Microbiology & Bacteriology	100
2. Microbial Physiology & Biochemistry	100
3. Microbial Genetics & Molecular Biology	100
4. Biostatistics & Computer Application	100
Combined Practical	200
I Experimental Work	120
II Project Work & Record	50
III Viva-Voce	30
TOTAL	600

M.Sc. (F) Microbiology

B. Theory Papers	Max. Marks
5. Microbial Technology	100
6. Microbial Ecology & Environmental Biotechnology	100
7. Geomicrobiology, Soil & Agriculture Microbiology	100
8. Medical Microbiology, Immunology & Virology	100
Combined Practical	200
I Experimental Work	120
II Project Work & Record	50
III Viva-Voce	30
TOTAL	600
GRAND TOTAL	1200

M.Sc. Microbiology (P/F) Practical Examination 2013

Skeleton Paper

Max. Marks –200	Time - 3 hrs
Major Exercise	40
Minor Exercise (Two)	40 (2*20)
Preparations	10
Spotting (10) 2 marks each	20
Project / Experimental study / Review / Seminar	50
Record	20
Viva-voce	20
Total	200

M.Sc. (F) Microbiology Exam.-2013
Paper- V Microbial Technology

Min. pass marks: 36

Duration: 3 hours

Max. marks: 100

Note: Attempt any five questions, taking atleast one question from each section. Each question carries equal marks.

Unit- I

Industrial micro organisms: isolation, preservation, screening and strain improvement and maintenance. An overview of fermentation technology, primary and secondary metabolites.

Fermentation media: Input economizing, carbon, nitrogen, mineral sources, buffers, precursors, inhibitors, inducers and antifoam agents.

Basic design of a microbial fermenter, Inoculation and sampling devices. Types of Fermenters and **physico-chemical standards used in Fermenters, Fermenter and media sterilization.**

Types of Fermentations: **batch, continuous, fed-batch, solid state, sub-merged, aerobic and anaerobic, dual and multiple fermentations, their advantages and disadvantages.**

Unit-II

Downstream processing: Biomass separation by **centrifugation, filtration, flocculation and other recent developments.** Cell disintegration: **Physical, chemical and enzymatic methods.** Extraction: Solvent, two phase, liquid extraction, supercritical fluid extraction, whole broth, aqueous multiphase extraction. Purification by different methods. **Concentration by precipitation, ultra-filtration, reverse osmosis.** Drying and crystallization.

Unit-III

Microbial products of commercial use: Primary metabolites: Citric acid, lactic acid, Vinegar; Glutamic acid, L – lysine; **Acetone.**

Secondary metabolites: Streptomycin, penicillin, Vitamin B12, steroid transformation.

Production process for yeast (baker's food and fodder) SCP, SCO.

Alcoholic Fermentation : Industrial alcohol, alcoholic beverages : Beer, Wine and Whisky.

Vaccines : Types, production, therapeutic use and precautions in use.

Unit- IV

Tannases, Proteases, Amylases, Biogums, Bioplastics, Biochips, Biosensors, Nanotechnology, Nonmicrobial products through GEMs: Insulin, Interferons, Cell growth factors, Tissue plasminogen activator, HGH. Biohazards and their regulation

Protein Engineering : Adding disulphur bonds, Amino acid substitution, Reducing sulphhydroxyl residues, Increasing enzyme activity and modifying specificity.

Protein pharmaceuticals.

Unit- V

Fermented microbial foods (Therapeutic and nutritional value). Production of Sauerkraut, Idli. Dosa, Bread, Butter, Milk, Cream, Yoghurt, Keffir, Cheese, Acidophilous Milk and Kumiss. Microbiology of raw milk. Food preservation: Chemical, physical and biological methods. Food-borne diseases: food-borne

infections and toxicoses - **Salmonellosis, Botulism, Cholera, Mycotoxicosis, E.coli -poisoning**. Food hygiene and control. Microbial contamination and spoilage of food and food products. Sanitization in food manufacture and in retail trade. Food control agencies and their regulations.

Recommended Books:

1. Adams (2004). Food Microbiology.
2. Prajapati (2007). Fundamentals of Dairy Microbiology.
3. John C, Ayres OM, William ES (2004). .Microbiology of Foods. W. H. Freeman and Co.
4. Robinson (2001). Dairy Microbiology.
5. Frazer WC and Westhoff DC (2001). Food Microbiology. Mcgraw Hill, New York.
6. Jay JM (2000). Modern Food Microbiology. Van Nostraaand Reinhold Co., New York.
7. Reed G (2004). Industrial Microbiology. CBS Publishers (AVI Publishing Co.)
8. Stanbury PF, Whitekar A. and Hall (2006). Principles of Fermentation Technology. Pergaman. McNeul and Harvey.
9. Creuger and Creuger (2004). Biotechnology- A textbook of Industrial Microbiology, Sinaeur Associates.
10. Casida LE (2001). Industrial Microbiology, Wiley Eastern.
11. Atlas RM (1999). Petroleum Microbiology. Macmillan Publishing Co.

Paper- VI Microbial Ecology & Environmental Biotechnology

Min. pass marks: 36

Duration: 3 hours

Max. marks: 100

Note: Attempt any five questions, taking atleast one question from each section. Each question carries equal marks.

Unit- I

Introduction to ecosystems. Abiotic and biotic components. Food chains, trophic levels, niche, succession and biodiversity. Diversity indices. Biomass productivity and their measurement. Biotic interactions, antagonism, competition (Contact and Scramble. Gausse's and hardin's principles of competition), commensalisms, amensalism, mutualism, synergism, syntropism, symbiosis, associative symbiosis. Parasitism and predation.

Unit- II

Defence mechanisms (specific and non specific) of microorganisms and invertebrates.

Beneficial interactions of microorganisms with animals; Symbiosis of roaches and bacteriodes, bacteria and protozoa, algae and invertebrates, endosymbionts of insects. Symbiosis and cellulose digestion. Endosymbiogenesis.

Rumen "Microorganisms; their metabolism and ecological behaviour. Bacterial and protozoan fermentation of carbohydrates. Dietary proteins and other nitrogenous substances. Influence of minerals on rumen microbes. Ruman dysfunction and detoxification mechanisms.

Unit- III

Aerobiology: droplet nuclei, aerosol, assessment of air quality- Anderson ,Rotorod,Burkard, solid and liquid impingement method and filters. Brief account of transmission of air borne microbes- Viruses ,Bacteria and Fungi. Microbiology of indoor and outdoor environments, disease caused by air borne microbes and allergens (Infections, their detection and enumeration). Biohazards caused by endotoxin.

Microbiology of air and space: Droplet nuclei and aerosols. Altitudinal change, structure and dynamics of micro flora in air, air borne transmission of microbes. Assessment of air quality.

Microbial denizens of aquatic ecosystems: distribution and population : dynamics. Algae and productivity of aquatic ecosystems. Water pollution. Chemistry and microbiology of waste water. Methods of treatment and disposal.

Self purification of water bodies, oxidation ditches. WSP,HRABP, ASP, Tricking filters. Fluidized bed and Rotary contractor method. Anerobic fermenter. Removal of phosphorus and nitrogen. Biofilms and their importance. Purification of water and sanitary qualities of potable water. Water in swimming pools, its microbiology and treatment.

Unit- IV

Microbes as pollutants and pollution indicators. Biosensors and biomarkers. Concept of biomagnification.

Stress Microbiology: Stress and Strain. Environmental stresses (Density dependent and density independent) and microbial response. Law of limiting factors, stress sequestration in halophiles, osmophiles, thermophiles, xerophiles and heavy metal detoxificants (Metal microbe detoxical biosorption bioaccumulations and metal scavenging by microbes).

Unit- V

Biodeterioration and biodegradation : Microbial degradation of paints, lubricants, plastic, rubber, glass, cosmetics, pharmaceuticals, leather, wool and building material, petroleum and petroleum products principal methods for their protection.

Degradation of recalcitrants and xenobiotics : Synthetic polymers, pesticides, alkyl-benzyl sulfonates. Techniques of testing biodeterioration. Ecology and control of biodeteriogens. Determination of the efficacy of the preservative system.

Recommended Books:

1. Alexander, M. 1997. Introduction to soil Microbiology. John Wiley and sons Inc., New York

Paper- VII Geomicrobiology, Soil & Agriculture Microbiology

Min. pass marks: 36

Duration: 3 hours

Max. marks: 100

Note: Attempt any five questions, taking atleast one question from each section. Each question carries equal marks.

Unit- I

Origin of microbial life. Early earth, chemical evolution and primeval soup. Evidence against primeval soup. Charice emergence of life. Self organization. Proteinoid formation. Eigen's hypercycles and World Game Model. Non equilibrium thermodynamics and RNA catalysis. Error theories of aging. Information theory and molecular evolution. Non ergodic Markov chains. Precambrian evolution. Theories and sequences of evolution till first eukaryotic cell.

Unit- II

Geomicrobial Agent: Types and activities, Lithification. Mineral formation. Authigenic production, diagenesis rock weathering sedimentation microbially catalysed oxidation of geological significance, detection and isolation of geomicrobially active organisms. Studying past and on going activity. Distinguishing enzymatic and non enzymatic activity.

Soils : origin and evolution soil profiles. Major physicochemical and biological characteristics, phases of soil. Microorganisms in various soil types. Role of microorganisms, Water activity Water potential.

Unit- III

Decomposition of plant litter. Microbes involved. Fermentation of plant litter. Composts (Agricultural / urban waste compost, vermicompost, mushroom composts). Silage, Methane, Biogas plants, Industrial fermentations of litter. Protein production, liquid fields from plant biomass. Hydrogen generation, pyrolysis and saccharification.

Microbial decomposition of cellulose, hemicellulose, lignin, starch, chitin and keratin.

Biogeochemical cycles.

Carbon cycle: Fixation of organic and inorganic carbon compounds, immobilization, mineralization and primary effect, biological deposition and degradation of carbonates, role of microbes in carbon cycle

Nitrogen cycle - mechanism of biological nitrogen fixation - ammonification -nitrification-denitrification and microorganisms involved in such processes.

Unit- IV

Phosphorus cycle : Biological importance and occurrence. Interconversion of various forms. PSM, mechanism of solubilization, microbial reduction of Oxidised P and oxidation of reduced P.

Sulphur cycle : Occurrence, biological importance, sulphur oxidizing and reducing bacteria, microbial oxidation and reduction of sulphur, sulphid and uranite ores, formation of acid and coal mine drainage. Theory and practice of microbial mining. Desulphurization.

Geomicrobiology of iron and manganese: Occurrence and biological, importance. Microbial precipitation and mobilization.

Geomicrobiology of fossil fuels: Origin of fossil fuels, Microflora of fossil fuels, MEOR: Role of microorganisms in petroleum migration to reservoir, Oil prospecting by microbes. Microbial oxidation of methane.

Unit- V

Host parasite relationship and control measures, symptomatology of various diseases.

Viral: TMV Bhindi Yellow Mosaic.

Bacterial : Citrus canker, crown gall.

Fungal : Green Ear Cotton wilt, Tikka groundnut and wheat rusts Mycoplasmal diseases.

Biofertilizers:-Types, production technology, storage and application- PGPR, Azotobacter, Rhizobium, Azospirillum, Cyanobacteria, Phosphate solubilising bacteria, carrier based inoculants. Mycorrhiza and its types, methods of application and agronomic importance.

Microbial pesticides organisms and their targets, ideal candidate, biology, of commercialized microbiopesticides, chemistry of the biocidal component, effect on target pests and production technology.

Recommended Books:

1. Alexander M. (1977) Introduction to soil microbiology. John Wiley & Sons, Inc., New York.
2. P.D.Sharma.2006. Plant pathology. Alpha Science International.19.
3. Sharma.P.G. 2006. Plant Pathology. Rastogi Publication.

Paper- VIII -Medical Microbiology, Immunology & Virology

Min. pass marks: 36

Duration: 3 hours

Max. marks: 100

Note: Attempt any five questions, taking atleast one question from each section. Each question carries equal marks.

UNIT I

Microbial ecology of infectious diseases of animal and human beings (Comparative account of gut, skin and urinogenital tract). Microbiology of man and animals. Acquaintance with the body components involved in pathogenesis Pathogenicity, virulence, invasion and factors affecting them.

UNIT II

Common Microbial Diseases: Pathogens, disease symptoms, prevention and control-

Bacterial - Tuberculosis, Leprosy, Tetanus, Cholera, Typhoid, Diphtheria

Viral – Polio, Hepatitis, Measles, Mumps, Small Pox, Chicken pox, Influenza.

Protozoan -Malaria, Amoebiasis

Sexually transmitted diseases: Gonorrhoea and syphilis, AIDS

Diagnosis, symptoms, toxic components, etiology and disease development in animals/fowls with specific reference of New castle (Ranikhet) disease of poults, Salmonellosis of eggs, Fowl pox, Fowl spirochetosis, brucellosis, Rinderpest, Haemorrhagic septicemia, Black quarter, Foot and mouth disease, Mastitis, Tymparry, Contagious abortion of cattle and Hog cholera.

UNIT III

Chemotherapy and antimicrobial drugs. Classification and mode of attack of antibiotics and microbial resistance to antibiotic.

Historical background of immunology, immunity, cellular and humoral immunity. Determination of antigenicity. Antigenic specificity, antigens.

Complements : Complement proteins, Reaction sequence leading to cell lysis. Complements and inflammation. Antibody mediated (Immediate type) hypersensitivity and cell mediated hypersensitivity.

UNIT IV

Immunoglobulins : Basic structure and terminology and **Types**. Cellular basis of immune response.

Cells and Organs of Immune System: **Hematopoietic stem cells**, Lymphoid cells; **B and T Lymphocytes**, **Natural killer cells**, **Mononuclear phagocytes**, **Granulocytic cells**.

Thymus, Bone Marrow, Lymphatic system, Lymph nodes, Spleen.

Monoclonal antibodies and hybridoma technology.

Antigen-Antibody Interaction:-**Precipitation reaction**, **Immunoelectrophoresis**, **Agglutination reactions**, **Radioimmunoassay**, **ELISA**

Major Histocompatibility Complex: General structure and function of MHC class I & class II Antigen Processing and presentation.

Factors affecting antibody production B-cell development, immunodeficiency diseases involving B cells and serum immunoglobulin.

UNIT V

Virology: origin, evolution and Classification of viruses based on the nucleic acid content, General characteristics of viruses, Components of viruses, sizes and shapes of different viruses, host range and specificity, Viroids, Virusoids, Prions

Methodology of virus investigation: Isolation, purification and characterization.

Viral replication: General characteristics of replication, Replication of T4 phage, Phage growth and the estimation of phage numbers, Lytic and lysogenic life cycle of bacteriophage lambda; mechanism(s) that determines lytic and lysogenic life cycle.

Plant viruses: Multiplication and transmission of plant viruses.

Viral disease of plants and their control: Tobacco mosaic, Papaya leaf curl, Bean leafcurl, Cucumber Mosaic and Tobacco Necrosis.

Recommended Books:

1. Kuby, J. 2004 Immunology VI Ed. W.H. Freeman and Company New York.
2. Riott I M (2003). Essentials of Immunology. Blackwell Scientific Publishers, London.
3. Kindt, Goldsby and d Osborne (2007). Kuby Immunology. Freeman and Co. New York.
4. Abbas (2004). Cellular and Molecular Immunology.
5. Benjamin (2004). Immunology- A short Course.
6. Greenwood D (2007). Medical Microbiology. I.K. International.

- Murray PR, Pfaller MA, Tenover FC and Tenover RH (2007). Clinical Microbiology. ASM Press.
7. Atlas RM (1997). Principles of Microbiology. McGraw Hill.
 8. Ananthanarayanan R. and C.K. Jayaram Panicker Orient Longman Text of Microbiology,
 9. 1997.
 10. Mackie and McCartney Medical Microbiology Vol.1: Microbial Infection.Vol.2: Practical Medical Microbiology Churchill Livingstone, 1996.
 11. Dimmock NJ, Primrose SB (1994). Introduction to Modern Virology, IV Edition, Blackwell Scientific Publications, Oxford

M.Sc. Microbiology (F) Practical List

Max. Marks –200

Time - 3 hrs

Major Exercise

40

1. To study effect of dusting and sweeping on the indoor microbial population of lab.
2. To observe the effect of pH on bacterial culture.
3. To observe the effect of salt concentration on bacterial culture.
4. To observe the effect of temperature on bacterial culture.
5. To observe the effect of UV radiation on bacterial cultural.
6. To isolate antibiotic resistant bacteria population by gradient plate method.
7. To detect glycogen in liver tissue.
8. To carry out thin layer chromatography(lipids, mixture of dyes).
9. To isolate DNA from animal tissue.
10. To determine the chemical oxygen demand of effluent water
11. To determine of dental caries susceptibility
12. To determine the biological oxygen demand of effluent water

Minor Exercise

40 (20*2)

1. To estimate hemoglobin contents of human blood by hemoglobinometer.
2. To conduct serum preparation.
3. To detect clotting time of human blood sample.
4. To detect bleeding time human blood sample.
5. To carry out differential leukocyte of human blood sample.
6. To determine the ABO blood group by slide agglutination.
7. To conduct ELISA.
8. To conduct radio immuno diffusion.
9. To conduct ouchterlony double immuno diffusion.
10. To demonstrate the indole production by microorganism.
11. To demonstrate the methyl red and voges proskauer test by microorganism.
12. To demonstrate the citrate utilization by bacteria.
13. To determine the alkalinity of given water sample.
14. Determination of dissolved oxygen in water samples.

Preparation

10

1. To prepare broth cultural media for general cultivation of bacteria.
2. To prepare solidified media for general cultivation of bacteria.
3. To prepare selective and differential media for general cultivation of bacteria.
4. To carry out red blood cell count of human blood sample.
5. To carry out white blood cell count of human blood sample.
6. To demonstrate bacterial movement by hanging drop method.

7. To prepare buffer solutions.

Spotting	20
Vaccines, Antibiotic, Cheese, Penicillin, RBC, WBC, Slide, Bacteriophage, ASP, Fermentor	
Project	50
Record	20
Viva-voce	20
(Internal)	(External)