



M.Sc.- Microbiology

Exam.-2017

UNIVERSITY OF KOTA

***MBS Marg, Swami Vivekanand Nagar,
Kota - 324 005, Rajasthan, India***

Website: uok.ac.in

M.Sc. (P/F) MICROBIOLOGY -2017

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.

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 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 –2017
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 2017

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. (P) Microbiology Exam-2017

Paper- I General Microbiology & Bacteriology

Min. pass marks: 36

Duration: 3 hours

Max. marks: 100

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

Unit I

History-**Contribution of Antonie Von Leeuwenhoek, Joseph Lister, Paul Ehrlich, Edward Jenner, Louis Pasteur, Robert Koch, Martinus Beijerinck, Sergei Winogradsky, Alexander Fleming, Selman Waksman; the spontaneous generation controversy**; Scope of Microbiology. Microbial diversity (functional and genetic) Classification upto class level and distinctive characters of major groups : Viruses, Bacteria, Fungi, Algae and Protozoa.

Principles, **Function & application** of Microscopy: **Light**, dark field, phase contrast, fluorescence interference, confocal and **electron (transmission and scanning)** microscopy.

Stains and Staining techniques: **Simple, Gram, Capsule, Endospore, Flagella, Acid fast staining.**

Determination of biomass, growth and microbial activity.

Unit II

Culture Disinfection, Sterilization: **Principles and Methods of sterilization- Physical and Chemical methods.**

Isolation Techniques: **Streak plate, pour plate and spread plate method.** Enrichment and Selection techniques, single cell isolation, bait techniques, trophic grouping and types of media.

Methods of anaerobic cultivation, Maintenance and methods of preservation of pure microbial culture.

Growth Curve -Environmental factors affecting growth and Nutrition: Types of bacteria on the basis of energy and nutritional requirement.

Unit III

Past and present state of bacterial taxonomy: Phylogenetic and phenetic approaches. Numerical taxonomy, Chemotaxonomy, Molecular or Genetic basis.

Prostheca: Functional role, morphogenesis, growth, differentiation and cell cycle in prosthecate bacteria.

Morphology, Fine structure, elementary chemistry and functions of bacterial processes of their formation.

Morphology, physiology and diversity of bacterial endospores and the processes of their formation.

Major characteristics of bacteria. Morphological, Biochemical, Cultural, Physiological. Metabolic, antigenic, genetic and ecological.

Unit IV

Characters, **Classification, Adaptations and Physiology** of Archaeobacteria: Methanogens, Extreme Halophiles, Thermoacidophiles. Parasitic association of bacteria. Bdellovibrio and its interperiplasmic growth cycle.

Characteristics of important genera and salient aspects of the physiology of photosynthetic eubacteria :

Anoxygenic and oxygenic photosynthesis. Sulphur and nonsulphur photosynthetic bacteria .

Cyanobacteria: **General characters their ultrastructure, reproduction and economic importance.**

Unit V

Characteristics of important genera and salient aspects of the physiology of: Chemoautotrophs, Methophilic eubacteria, Gram negative eubacteria (Spirochaetes, Rickettsia, Chlamydiae) Mycobacteria, Enteric group and related eubacteria. Gram negative anaerobic eubacteria

Characteristics of important genera and salient aspects of the physiology of: Unicellular endospore forming eubacteria, Mollicutes, Gilding bacteria (Myxobacteria), Gram positive fermentative eubacteria, Actinomycetes

Recommended Books

1. Prescott, L.M., J.P Harley and D.A Klein, 2007. Microbiology VII Ed. Mc Grow Hill,
2. Davis R.Y. E.A. Adeberg and J.L. Ingram, 1991 General Microbiology
3. Stainer .General Microbiology, V Ed., Printice Hall of India Pvt, Ltd. New Delhi
4. Ronald M. Atlas 1997. Principles of Microbiology. II Ed. Mc Graw Hill Pub.
5. Alexopoulos CJ et al, Introductory Mycology 4th Edition
6. Woese, C.R 1981 Archeabacteria , *Sci. Am.* 244:98-122
7. Salle A.J., Fundamental Principles of Bacteriology.
8. Pelczar M.J., Chan E.C.S. & Kreig N.R., Microbiology: Concepts and Application, Tata McGraw Hill.
9. Stainer RY, Ingraham JL, Wheelis ML & Painter PR General Microbiology. Publisher: MacMillan.
10. Madigan M.T., Martinko J.M. and Parker J., Brock Biology of Microorganisms: Prentice-Hall, Inc USA.
11. Atlas R.M., Principles of Microbiology, Wm C. Brown Publishers.

Paper- II Microbial Physiology and Biochemistry

Min. pass marks: 36

Duration: 3 hours

Max. marks: 100

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

Unit-I

Cellular environment, Structure of water and its properties; Acid base concept and buffers; pH and pH indicators, Solutions, Redox, potential, **Hydrogen bonding; Hydrophobic, Electrostatic and Vander Waal forces. Scope and importance of biochemistry.**

Microbial growth and growth synchronization: cell membrane and cell wall, their structure, synthesis and regulation in bacteria, transport mechanisms in microbial cells. Microbial metabolism and fuelling reactions. Biochemistry of bioluminescence, chemotaxy and magnetotaxy in bacteria.

Unit- II

Optical methods: Colorimetry, photometry, nephelometry, VIS, UV VIS and infra red spectrophotometry. Flame photometry, Photo spectrofluorimetry, Mossebauer spectroscopy, ESR and NMR.

Basic principles and applications of Chromatography (paper, thin layer, column, gel filtration, **ion-exchange and affinity chromatography**); GLC, HPLC. Centrifugation techniques.

Principles and applications of electrophoresis for protein and DNA; **Iso-electric focusing and 2D gel electrophoresis.**

Unit- III

Biological nitrogen fixation, nitrogen fixing organisms, difference in symbiotic and nonsymbiotic fixation. The enzyme. Alternative nitrogenases. Oxygen protection mechanisms. Sources of energy and reducing power, nif gene organization and regulation.

Biochemistry of enzymes : Classification, nomenclature and general properties of enzymes, mechanism of enzyme action, enzyme inhibition, enzyme kinetics, Coenzyme, Allosteric and other regulations of enzyme activity.

Unit- IV

Biochemistry of proteins : Classification, structure of proteins and methods to determine the structure. Structure- function relationship of proteins.

Important physiological proteins. Amino-acids, their structure and common pathways of synthesis (Aspartate family, branched chain and aromatic amino acids).
Structure, types and metabolism of nucleotides.

Unit- V

Biochemistry of Carbohydrates: Structure, function and classification. Glycolysis, HMP, TCA. Fermentation. Gluconeogenesis, ETC in bacteria as compared to higher forms.

Biochemistry of lipids and fat metabolism. Recapitulation of structure and classification, fatty acid classification, biosynthesis and catabolism.

Recommended Books:

1. Wilson K. and Walker J. (2008). Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press.
2. Nelson D and Cox MM. (2009). Principles of Biochemistry. W.H. Freeman and Company, New York.
3. Talaro K. P. & Talaro A. (2006). Foundations in Microbiology. McGraw-Hill College Dimensi.
4. Potter GWH and Potter GW (1995). Analysis of Biological Molecules: An Introduction to Principles, Instrumentation and Techniques, Kluwer Academic Publishers.
5. Voet D and Voet JG. (2003). Biochemistry. John Wiley and sons New York.
6. White A, Handler P, Smith El, Hill R and Lehman J. (1983). Principles of Biochemistry. Tata McGraw Hill.
7. Zubay G (2000). Biochemistry. W. C. Brown, New York.
8. Berg J, Tymoczko J, Stryer L (2001). Biochemistry. W. H. Freeman, New York.
9. Moat AG and Foster J W (2003). Microbial Physiology. John Wiley and Sons, New York.
10. Robert K., Murray M.D., Granner D.K., Mayes P.A. and Rodwell V.I. Harper's Biochemistry. McGraw-Hill/Appleton and Lange.

Paper- III Microbial Genetics & Molecular Biology

Min. pass marks: 36

Duration: 3 hours

Max. marks: 100

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

Unit-I

Introduction to Molecular Biology, Structure and organization of genomes. Law of DNA constancy, Cot curve and C value paradox, DNA renaturation kinetics and Tm value determination and interpretation, Repetitive DNA, Satellite DNA, Selfish DNA.

Nucleic Acids : Types and topology. DNA replication; Mechanism and enzymology. Differences in prokaryotes and eukaryotes.

Unit-II

Techniques in molecular biology: Methods of DNA –sequencing, DNA finger printing, Nucleic Acid hybridization, Southern and Northern Hybridization, PCR, c-DNA and genomic Library.

Protoplast fusion techniques, Fusion proteins: Method, Application and Problems in expression of fusion proteins.

Unit-III

Central Dogma : Mechanism and regulation of transcription and reverse of mRNA. Translation regulation of transcription. Difference in transcription and translation in prokaryotes and eukaryotes.

Mutations : Types of Mutations and mutagens. Molecular mechanisms of induced mutation : DNA repair mechanisms. SOS and mismatch repair. Repair of UV mutations.

Unit-IV

Molecular mechanisms of recombination in bacteria. Conjugation. Transformation, transduction, sexduction. Gene expression in prokaryotes : Operon concept. Induction and repression. Negative and positive controls. Attenuation regulation and relaxed controls, Lac. His. Operons.

Gene Mapping : Molecular aspects of recombination, complementation and hetrozygotic analysis.

Unit-V

Genetic Engineering : **Principle and basic tools.**

Gene cloning vectors: Plasmids (Types, structure and functions with special reference to F1 col E), Bacteriophages, Phagemids, Cosmids, shuttle vectors, Artificial chromosomes (BAC, YAC, HAC), Ti plasmid and viruses (Vaccinia. Herpes simplex and others) as vectors in plant and human genetic engineering.

Application of genetic engineering.

Reference Books:

1. Concepts of genetics by klug and cummings
2. Genetics: From Genes to Genomes by Leland Hartwell, Leroy E. Hood, Michael L. Goldberg
3. Genetics: Analysis and Principles (3rd Edition) by Brooker
4. Gene cloning by T.A.Brown
5. Genetic Engineering by Nicoll

Paper- IV Biostatistics & Computer Applications

Min. pass marks: 36

Duration: 3 hours

Max. marks: 100

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

Unit-I

Definition of statistics and scope of statistics in bioresearch.

Symbols, notations and terminology of statistics, mathematics and computer applications.

Sampling Techniques : Quantity, frequency and number of samples, type of samplers, place and time of sampling, choice of analytical methods, precision and accuracy.

Sampling and estimation of population parameters: Random sampling. Sampling size in random sampling stratified two stage Cluster and Sequential sampling. Bias in sampling. Presentation of research results. Graphic presentation and methods of least squares.

Unit-II

Summarizing data: Central tendency and dispersion.

Variance and coefficient of variation, Standard deviation, Standard error.

Confidence intervals. Normal distribution and its properties.

Testing of hypothesis: Some basic concepts, Errors in hypothesis testing; critical region, Students t-test for the significance of population mean and the difference between two population means; Paired t-test.

The analysis of variance. One way and nested ANOVA, Assumptions of ANOVA.

Unit-III

Probability: **Mathematical, Statistical and Axiomatic Definitions; Addition and multiplication. Theorems; Probability Distribution Function-Binomial, Poisson and Normal; Area under Normal Probability Distribution Curve.**

Regression and Correlation; Simple linear regression.

Coefficient of determination. Brief introduction to the need and application of curvilinear and multiple regression. Searching for the best regression. Common misuses of the technique. Correlation coefficient and the tests of its significance.

Use of partial correlation and partial covariance. Detecting association between a pair of species. Cole's measure of association and point correlation coefficient.

Unit-IV

Stochastic models of exponential growth. Verhulst's logistic equation. Population growth in a limited environment.

Estimate of Error. Control of Error. Proper interpretation of results. Parametric and non-parametric tests of significance. Chi square F, t, H and U test.

Experimental Designs: **Principles of experimental designs, completely randomized, randomized block and Latin square designs.**

Unit-V

Computer Application: Computers and their organization. Hardware software. Operating system (command line and WIMP) Elementary ideas about programming languages and application packages for microbiologists. LIMS.

Clinical microbiology, Fermentation technology. Imaging simulation and mathematical modeling. Use of computer as audio visual aid.

Introduction in MS Office software concerning Word processing, spreadsheets and presentation software.

Recommended Books:

1. Biostatistics-A foundation for Health Science, Daniel WW, John Wiley (1983).
2. Statistical Methods, Medhi J, Willey Eastern Limited, (1992).

M.Sc. Microbiology (P) Practical List

Major Exercise

1. Techniques of pure culture isolation-pour plate, spread plate, streaking.
2. Determination of blood group.
3. Determination of Rh factor.
4. Estimation of haemoglobin content.
5. Triple Sugar Iron Test.
6. IMVIC Test
7. H₂S Production
8. MR – VP test
9. Measurement of bacterial growth by colony counting.
10. Antibiotic sensitivity test by disc diffusion
11. MPN of Coli form MacConkey lactose bile broth.
12. Characterization of (Enterobacter) Organism with the help of IMVIC Test.
13. Determination of the quality of milk samples by methylene blue reduction test.
14. Estimation of protein by Lowry's method.
15. Estimation of chlorophyll.
16. Isolation of DNA from goat liver.

17. Isolation of plasmid DNA from E.coli.
18. Estimation of DNA by diphenyl amine method.
19. TLC separation of amino acids.

Minor Exercise

1. Gram Staining of bacteria.
2. Simple staining of bacteria.
3. Negative staining of bacteria.
4. Differential staining of bacteria.
5. Staining of endospore.
6. Litmus Milk Test
7. Catalase Milk Test
8. Isolation of Microbial colony from Soil
9. Isolation of Microbial colony from Water
10. Isolation of Microbial colony from Air
11. Isolation of Microbial colony from Milk
12. Isolation of Microbial colony from food Samples
13. Isolation of Microbial colony from rhizosphere.
14. Isolation of Microbial colony from Phyloplanes.
15. Isolation of Microbial colony from water
16. Isolation of staphylococcus from skin.
17. Isolation of azotobacter from soil
18. Isolation of rhizobia from root nodule.
19. Isolation of E. Coli from sewage water.
20. Snyder agar test for dental caries.
21. Calibration of an ocular micrometry.
22. Measurement of microorganism by ocular micrometry
23. Electrophoresis of isolated DNA sample.
24. Preparation of buffer.
25. Titration curve of Glycine.

Preparations

1. Preparation of Basic Liquid Medium (Broth)
2. Preparation of Basic Potato Dextrose Agar
3. Preparation of Basic Nutrient Agar.
4. Preparation of Basic Peptone Water.

M.Sc. (F) Microbiology Exam.-2017
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 unit. 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 sulfhydroxyl 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, food-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 unit. 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 (Gause'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.

Beneficial interactions of microorganisms with animals; Symbiosis of roaches and bacteriodes, bacteria and protozoa, 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, 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, Trickling 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 unit. Each question carries equal marks.

Unit- I

Origin of microbial life. Early earth, chemical evolution and primeval soup. Evidence against primeval soup. Self organization. Proteinoid formation. Non equilibrium thermodynamics and RNA catalysis. Information theory and molecular evolution. 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. 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 saccharitication.

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, 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.

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

Microbial pesticides organisms and their targets, 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 unit. 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,

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 culture.
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)