

B.Sc. (Pt-I) -Microbiology - 2013

Eligibility: 10+2 Science Biology / Agriculture

Selection: Common Entrance Test to be conducted by University of Kota

Scheme of Examination and Courses of Study

The number of papers and maximum marks for each paper together with the minimum marks required for a pass are shown against each paper separately. It will be necessary for a candidate to pass in the theory papers as well as in practical separately.

First Division 60% of the maximum marks prescribed at part

Second Division 48% I, II and III Examination, taken together.

Rest of the candidates shall be declared to have passed the examination, if they obtain the minimum pass marks in each paper viz 36%. No division shall be awarded at Part I and Part II Examination.

A candidate may be allowed to appear at the Supplementary examination upto a maximum of two theory papers, provided that she/he has passed in all the practical examination.

A candidate may be allowed grace marks in two theory papers upto the extent of 1% of the total marks prescribed for the examination.

TEACHING AND EXAMINATION SCHEME FOR B.Sc. Microbiology Pt-I

Compulsory paper	Lec Hrs/week	Exam hrs.	Max Marks
MB – 00 Environmental studies	3	3	50
Core paper (Theory)			
MB – 01 General Microbiology	3	3	50
MB – 02 Computers and Biostatistics	3	3	50
MB – 03 Fundamentals of Food Microbiology		3	50
MB – 04 General Microbiology and Basic Biochemistry	3	3	50
MB – 05 Inorganic, Organic and Physical Chemistry	3	3	50
MB – 06 Biochemistry	3	3	50
Total of theory papers		300	
Core Paper (Practicals)			
MB – 07 General microbiology Computer and Biostatistics		3	50
MB – 08 Fundamentals of Food Microbiology & General Microbiology and Basic Biochemistry		3	50
MB – 09 Inorganic, Organic and Physical Chemistry & Bio Chemistry		3	50
Total of Practical Papers			150
Grand Total (Theory + Practicals)			450

The marks secured in the Compulsory paper of Environmental Studies shall not be counted in awarding the division to a candidate.

Maximum of three chances will be given to a candidate to pass compulsory paper.
 Non appearing or absent in the Examination of compulsory paper will be counted a chance.
 A candidate shall be eligible to appear in supplementary examination in maximum of two Core theory papers as per University Rules.
 One percent of the maximum marks may be awarded as Grace Marks to the candidates in accordance to the University Rules as applicable to all other Under Graduate examinations.
 Minimum requirement of lectures completing each core theory and compulsory paper shall be 78 hours, and for each practical 156 hours.

MICROBIOLOGY PRACTICALS – (I, II, III)

Min. pass marks: 18	Distribution of Marks	Max. Marks: 50
	REGULAR	EX-STUDENT
1. Major Exercise	12	12
2. Minor Exercise	10	10
3. Preparation	8	8
4. Spots (5)	10	10
5. Record	5	-
6. Viva-voce	5	10
TOTAL	50	50

B.Sc.(Pt-I) Microbiology- 2013

MB - 01 GENERAL MICROBIOLOGY

Duration: 3 hrs

Max.Marks 50

Note - The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit. All questions carry equal marks.

Unit I

Introduction: Definition, scope and history of microbiology. Contributions of pioneers. Introduction to major groups of microorganisms and fields of Microbiology. Spontaneous generation versus biogenesis hypothesis. Taxonomy and Classification: History of microbiology- (Haeckel's three kingdom concept, Whittaker's five kingdom concept). Difference between the prokaryotic and eukaryotic microorganisms. Scope of Microbiology, Microbes and origin of life. Branches of Microbiology.

Unit II

Microbial Diversity: General characters and classification of Bacteria, Algae, fungi, Viruses, Protozoans. Classification according to Bergey's manual of determinative and systematic classification. Bacterial nomenclature.

Unit III

Morphology of Bacteria :Size, shape and arrangement of bacterial cells. Ultrastructure of bacteria: Cell wall, cell membrane, capsule, pili, flagella, slime, capsule, cell inclusions, biosynthesis of bacteria cell wall, Biomembrane, liposomes. Membrane transportation – diffusion, active and passive transport and osmoregulation.

Unit IV

Microscopy: Bright Field, Dark Field, Phase Contrast, Fluorescence and Scanning and Transmission Electron Microscopy. Stains and staining techniques- Stains and Dyes: Types of staining- Simple (Monochrome, Negative), Differential (Gram and Acid fast).

Unit V

Sterilization: Principles and methods- Physical and chemical methods(Moist Heat, Dry Heat, Filtration, Pasteurization, tyndallization, radiations and Alcohols, aldehydes, phenols, halogens, hypochlorites), Antimicrobials with mode of actions.

Culture techniques: Types of media; simple, defined, enriched and transport media with specific examples. Methods of maintenance and preservation of cultures. Isolation and cultivation techniques.

Text Book Recommended:

1. Alexopoulos, C.J and Mims, C.W. (1979), Introductory Mycology, 3rd ed. Wiley, New York.
2. Pelezar Jr. M.J. Chan E.C.S., and Kreig N.R. (1993). Microbiology – McGraw Hill, Inc., New York.
3. Stainer R.Y., Ingraham J.L., Wheelis M.L., and Painter P.R. (1986), General Microbiology macMillan Education Ltd., London.
4. Starr, M.P. Stolp, H., Truper, H.C. Balows, A and Schegel, H.C. (1991). The Prokaryotes. A hand book of Habitats, Isolation and Identification of Bacteria. Springer Verlag.

MB – 02 Computers and Bio-Statistics

Duration : 3 hrs

Max.Marks 50

Note - The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit. All questions carry equal marks.

Unit – 1

Introduction to computers – classification of computers – computer generation – low, medium and high level languages – software and hardware – operating systems – compilers and interpreters – personal, mini, main frame and super computers, their characteristics and application, BIT, BYTE, WORD, computer memory and its types; data representation and storage binary codes, binary system and its relationship to Boolean Operations.

Unit – 2

Microsoft Excel – Data Entry – graphs – aggregate functions – formula and functions. Different number systems and conversions input-output devices, secondary storage media.

Unit-3

Nature and scope of statistical methods and their limitations, Graphical representation. Measures of average and dispersion stem and leaf plots; Box and whisker plots, : coplots. Introduction to probability theory and distributions (concepts without derivations) binomial, Poisson and normal (only definition and problems).

Unit-4

Correlation:Types, Karl pearsons. Regression: types, simple linear regression
Tests of significance based on t, chi-square and F for means, proportions, variances, theory of attributes

Unit-5

Concepts of sampling and sampling distribution: Sampling methods: Simple, Random, stratified, systematic and cluster sampling procedures, sampling and non-sampling errors,
Analysis of variance – one way and two way classification – CRD, RBD and Latin Square Designs.

Note: The emphasis is solely upon the application, understanding the practice of statistical methods with specific References to problems in microbiology.

Reference:

1. Snedecar, G.W. and Cochran WG. (1967) Statistical Methods, Oxford Press.
2. Danial, W.W. (1995) : Biostatistics : A Foundation for analysis in Health Sciences (6th Ed.) John Wiley. 780pp
3. Cotton T. (1974); Statistics in Medicine, Little Brown, Boston.
4. Compbell, R.C. (1989): Statistics for Biologists, Cambridge University Press. 464 pp.
5. Bland. M. (1989). An introduction to Medical Science. Oxford Medical Publication.

MB – 03 Fundamentals of Food Microbiology

Duration: 3 hrs

Max. Marks 50

Note - The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit. All questions carry equal marks.

Unit-I

Introduction and history of food microbiology. Nature and properties of prokaryotic and eukaryotic micro-organisms. Brief discussion on taxonomy of microorganisms associated with food. Growth of microorganism in Food – growth curve of microbial cultures.

Effect of microorganisms –pH, water activity, oxidation – reduction potential, nutritional requirements, temperature, relative humidity, gaseous environment.

Unit-II

Microorganisms associated with food. Environmental microbiology and sources of contamination of food, water, air, soil, sewage, animal products, handling and processing.

Unit-III

Spoilage: General principles, Chemical changes, Role of microbes -cereals and cereal products, fish and other seafood, eggs and poultry, milk products, canned foods and other foods.

Prevention of spoilage of food-principles and common techniques.

Unit – IV

Food and enzymes produced by microorganisms : bread, malt, beverages, fermented vegetables, fermented food, Single cell protein, fats, amino acids and enzymes from microorganism.

Food borne infections and intoxications: disease, foods involved, prevention, food borne disease.

Other food hazards – chemicals, antibiotics, metal contaminants, poisonous food.

Unit – V

Sanitation and Hygiene in food Industries: Microbiology in Food plant Sanitation – bacteriology of water, sewage and waste treatment and disposal, test of contamination, methods of rendering water potable.

Microbiological standard of food and water. Quality control during food processing and storage. Enforcement and Control agencies.

Personal hygiene, Safety, storage, Cleaning methods – sterilization and disinfection; maintenance of clean environment in Food Industry.

Reference:

1. Pelozar, M.J.: Chan, ECS and Krieg. N.R. Microbiology. Fifth edition.
2. Frazier, W.C. and West haff, D.C. Food Microbiology. Tata Mc Graw Publishing Co. Ltd. N.B.
3. Jay J.N. Modern Food Microbiology, CBS Publishing N.
4. Hobbs, B.C. and Roberts, D. Food Poisoning and Food Hygiene Fifth edition, Edward Arnold, London.
5. Longree, K. Blanker, G.G. Sanitary techniques in food Service 2nd edition, John Wiley & Sons.
6. Chrlistie A.B. and Christie M.C. Food Hygiene and Food Hazards for all who handle food, Faber and Faber Ltd.
7. Banwart G.J. Basic Food Microbiology, CBS Publishers and Distributors.
8. Kanawat, K. Environmental sanitation in India, Lucknow Publishers House.
9. Jacob, M (1989) Safe food Handling – A training guide for Manager W.H.O. Geneva.
10. Principles of Food sanitation –II Edition, AV Book Van Nostrand Reinhold, N.Y.
11. Minor, L.J. (1983), Sanitation, Safety and Environmental Standards, AVI Publishing Co. Westport, Connecticut.

MB – 04 General Microbiology and Basic Biochemistry

Duration : 3 hrs

Max.Marks 50

Note - The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit. All questions carry equal marks.

Unit – 1

Unity of microbial world, Microbiology and Human health, Beneficial and Harmful microbes. Fungi – Ultrastructure of fungal cell. Salient features, classification, reproduction and significance of major groups of fungi (phycomycetes, Ascomycetes, Basidiomycetes, and Deuteromycetes). Protozoa-General features, classification and significance.

Unit – 2

Diversity of microbial world : Comparison of the three domains of organisms: Bacteria, Archaea, Eucarya (tabular and diagrammatic), Classification, Morphology, Cultivation, Reproduction and significance of: Rickettsia, Chlamydia, Mycoplasma, Actinomycetes, Cyanobacteria, Multiplication in bacteria-binary fission, budding and fragmentation.

Unit –3

Biological nitrogen fixation, microbiology of geochemical cycles. Study of Viruses: Early developments of virology, General structure and properties of viruses, Virus Purification and assay, Principles of Viral Taxonomy, Structure, reproduction, cultivation and significance of Bacteriophage. Prions and Virioids – Nature and significance

Unit – 4

Biochemistry of microbes : Chemical elements, Structure of atoms, Molecules and Chemical bonds, Chemical reactions, Molecules of living systems, pH and pK, Buffers, Carbohydrates, Lipids, Proteins, DNA & RNA.

Unit 5

Microbial growth, Nutritional requirements of microorganisms-Macronutrients, micronutrients and growth factors. Nutritional types of microorganisms: Autotroph and heterotrophy, phototrophs and chemotrophism. Physical factors affecting growth of microorganisms: Temperature, pH and Oxygen. Continuous cultivation-chemo stat and turbid stat, Counting of bacteria-Viable count- SPC, Total count-DMC and turbidometric estimation.

Text Books :

1. Ronald M. Alfred. Alfred E. Brown, Kenneth W. Dobra, Llonas Miller (1986). Basic Experimental Microbiology, Prentice Hall. 361pp
2. Robert F. Boyd. (1984). General Microbiology. Times Mirror/Mosby college Pub. 22pp.
3. Berg et al. Biochemistry 5th ed. Freeman Publication.
4. Mathews, Van Holde Ahern Biochemistry 3rd ed. Pearsen Education

MB – 05 Inorganic, Organic & Physical Chemistry

Duration : 3 hrs

Max.Marks 50

Note - The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit. All questions carry equal marks.

Unit – 1

- a) **Hydrogen** : Isotopes of hydrogen, separation of the isotopes, properties and uses of heavy hydrogen, position of hydrogen in the Periodic table, ortho and para hydrogen – separation, difference in structure and properties, hydrides – definition, classification, preparation and properties.
- b) **Oxides** : Definition, classification, properties.
- c) **Water** : Hardness of water, types of hardness, removal of hardness, industrial implications of hardness in water, estimation of hardness by EDTA method (outline only) , units for hardness of water.

Unit - 2

- a) **Hydrogen peroxide** : Manufacture, properties, structure and uses of hydrogen peroxide, estimation of hydrogen peroxide by permanganimetry, strength of hydrogen peroxide in volume, strength, normality and percentage, calculation of strength on these different terms.
- b) **Ozone** : Manufacture, composition, structure and properties.

- c) Detection and estimation of nitrogen and halogens in organic compounds: empirical formula, molecular formula, structural formula, calculation of E.F. and M.F. from percentage composition.

Unit-3

- a) Nature of valency of carbon in organic compounds: brief outline hybridizations sp^3 , sp^2 and sp (with one example for each), tetrahedral arrangement of valency of carbon. Bond, breaking and bond forming in organic reactions, homolytic cleavage, heterolytic cleavage reaction intermediates, formation, stability and reactions of carbonium ion, carbanion and free radicals.
- b) Nucleophiles and Electrophiles, definition, types and examples (specific reactions involving these)
- c) Types of reactions, substitution, addition, elimination, rearrangements and polymerization, illustration with specific examples.

Unit – 4

- a) Gaseous state, Postulates of kinetic theory of gases, derivation of expression for pressure of gas on the basis of kinetic theory, deducing the basic gas laws, derivation of real gases from ideal behaviour, reasons for deviation. derivation of Vander Waal gas equation – explanation of behaviour of real gases on the basis of Vander Waal gas equation.
- b) Average, RMS and most probable velocities (equations only – no derivation), relationship between these different velocities, Liquifaction of gases – critical phenomenon, modern methods, Joule – Thomson effect, inversion temperature.

Unit – 5

- a) Structure of atom : Rutherford model of the atom, defects of Rutherford model, Bohr model of an atom, merits and demerits, Sommerfeld modification, wave theory, de Broglie's concept, dual nature, Heisenberg's uncertainty principle, difference between orbit and orbital, shapes of atomic orbitals.
- b) **Bonding** : (i) V.B. theory: Postulates of V.B. theory, application to the formation of simple molecules like H_2 , and He, Overlap of atomic orbitals – s-s, s-p, and p-p overlap, principle of hybridization (ii) M.O. theory : Formation of M.O.s, bonding and antibonding and non bonding M.O.s, M.O diagram for H_2 , He and F_2 .

MB – 06 Biochemistry

Duration : 3 hrs

Max.Marks 50

Note - The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit. All questions carry equal marks.

Unit – 1

Protein and nucleic acid structure and conformation, allosteric proteins, enzymes structure and kinetics, biological membrane.

Unit – 2

Metabolism: Basic concepts, carbohydrate, lipid and nucleic acid metabolism, photosynthesis.

Unit – 3

Biosynthesis of macromolecules, lipids, hormones, aminoacids and nucleotides.

Unit – 4

DNA transactions, gene concepts, DNA replication repair and recombination, protein synthesis control of gene expression.

Unit – 5

Membrane transport, cell walls, hormone action, muscle contraction, clinical applications of Biochemistry.

Reference :

Stryer, (1995), Biochemistry, W.H. Freeman & Co. 1064pp.

PRACTICAL

MB – 07 General microbiology + Computer and Biostatistics

Max. Marks – 50

Min Marks – 18

1. Gram staining and endospore staining.
2. Physical & chemical sterilization.
3. Micrometry : Calibration of micro organism and measurement of size of microbes
4. Study of algae fungi viruses & bacteria.
5. Preparation of culture media.
6. Creating charts in excel using different data.
7. Design a worksheet for numeric entries and perform required calculation.
8. Design a worksheet enter required data and perform aggregate function like sum, average, count etc.
9. Perform segremic analysis and calculate future value.
10. Changing settings of keyboard, mouse and display.
11. Perform file operation like copy, save, rename, delete using window explore.
12. Calculate mean, mode and median of following data :
13. Calculate correlation & regression of following data.
14. Principles & application of instruments – Autoclave, Oven, Incubators & Spectrophotometer.

PRACTICAL

MB – 08 Fundamentals of Food Microbiology & General Microbiology and Basic Biochemistry

Max. Marks – 50

Min Marks – 18

1. Cleaning and sterilization procedure of glassware.
2. Preparation of nutrient Media.

3. Basic light microscopic techniques-
 - (a) Preparing slides of staining – gram, spore, acid fast and other using oil immersion count, Direct microscopic count.
4. Agar plating, SPC; most probable-count, streaking of plate.
5. Isolation of microorganisms obtaining pure cultures.
6. Study of morphological and biochemical characteristics of isolated cultures.
7. Microbiological analysis of water, milk, butter & fruit and vegetables using selected standard methods.
8. Microbiological examination of sterility of table ware containers and equipment.
9. Microbiological examination of food handler, skin.
10. Qualitative estimation of lipid, carbohydrates & proteins.
11. Reducing sugar estimation by benedicts method.
12. Specification of fats.
13. Principles & applications of Laminar air flow, Incubator, Light & phase contrast microscope.

PRACTICAL
MB – 09 Inorganic, Organic and Physical Chemistry
& Bio-Chemistry

Max. Marks – 50

Min Marks – 18

1. Estimation of hardness of water by EDTA.
2. Determination of acetic acid in commercial vinegar using NaOH.
3. Preparation of solution & buffers.
4. Acid base titration morality, molality, normality, sensitivity.
5. Viscosity measurement.
6. Enzyme assays.
7. Demonstration and estimation of proteins (Lowry's methods)
8. Measurement of amylase and invertase activities.
9. Chemical test of Carbohydrates, amino acids, nucleic acid (R.N.A. & D.N.A.)
10. Demonstration of presence of secondary metabolites: Gum, tannins, anthocyanin, crystals of calcium and calcium oxalate.
11. Principles & application of pH meter, colorimeter.