B.Sc. -Microbiology Exam. - 2014

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 Examination

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)

Distribution of Marks

Min. pass marks: 18	**Duration: 3 hours**	**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 –III Microbiology Exam.- 2014

MB-19-Microbial Culture, Growth and 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

Microbial culture: Disinfection, Sterilization, Isolation, Screening and maintenance of micro organism, bait technique, trophic grouping

Microbial culture media (artificial natural), physical chemistry of culture medium, pH, buffer. Methods of anaerobic cultivation.Inoculation, Incubation and measurement of growth of micro organism.

Physical factors of controlling growth of microorganism (temperature gaseous)

Unit-II

Microbial growth kinetics: Definition, brief description of different type of microbial culture (batch, fed batch and synchronous), growth phases, growth kinetics, growth field, method of growth determination.

Environmental factors affecting microbial growth temperature, pH, Osmotic pressure and nutrient concentration per cell.

Unit-III

Food product: Microbial mass as food -single cell protein (Algae-*Chlorella, Spirulina, Scenedesmus*)

Mushroom cultivation: Agaricus bisporus, Pleurotus spp.

Fungi: Filamentous fungi, yeast, Candida, members of *Saccharomyces* and Torulopsis Fermented food- Bread, Cheese, Vinegar, dairy products, Kinema, Fermented Beverages (Beer, wine)

Bio Conversions: Alcohol production, steroid conversion, production of enzyme-amylases, proteinases, cellulases.

Amino acid production-glutamic acid and lysine

Unit-IV

Microbial contamination and spoilage-contamination of Sugar products, Vegetable, Fruit, meat, meat product, dairy products, Fish, Sea food and Poultry.

Spoilage and canned foods, Detection of spoilage and characterization.

Food Preservations: Pasteurization, appertization, aseptic packaging, use of high temperature, freezing, dehydration, Osmotic pressure, use of chemicals, organic acid, esters, sulphur di-oxide, salt and high sugar concentration.

Unit-V

Food borne infections and intoxications: Bacterial and non bacterial infective and toxic types – *Vibrio, Bacillus, Clostridium, Escherichia, Salmonella, Shigella*, Nematodes, Protozoa, Algae, Fungi Virus.

Infections and toxicosis: Botulism, Cholera, Mycotoxicosis, Salmonellosis *E coli*-poisoning, preventive measures. Food sanitation in manufacture and retail trade, food control agencies, role of fruit product certifying agencies and related regulations, waste treatment, disposal and quality control.

MB-20-Fermentation Technology and Government rules

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

Bioreactors/Fementers: Design, components and operation of fermenters, stirred tank, bubble columns airlift, bioreactors, static submerged and agitated fermentation.

Physicochemical standards used in fermentors /Bioreactor, Limitations of Bioreactors.

Unit-II

Fermentation process: Media formulations, sterilization, solid substrate fermentation, steps of fermentation process.

Advantage and disadvantages of solid substrate and liquid substrate fermentation.

In-situ recovery of fermentation products, fermentation monitoring, Bioprocess calculations based on material and energy balance.

Unit-III

Fermentation in batch culture: Microbial growth kinetics, measurement of growth (cell number direct and indirect method)

Nutrients product formation, heat evolution, effect of environment (temperature, pH, high nutrient concentration)

Continuous culture system, Aeration, Agitation, Oxygen transfer kinetics.

Concept of Newtonian and non Newtonian fluids plastic fluids apparent viscosity foam and antifoam.

Unit-IV

Downstream processing: Filteration, Precipitation ultrafilteration, Ultra ceutrifugation, cell disintegration solvent extraction, chromatographic separation, membrane filter.

Biotransformation: Development of inoculum, Incubation production of ethyl alcohol, acetic acid, antibiotics and vitamin B_{12} with reference to easily available raw materials.

Scale up, instrumentation control, physical, chemical, environmental sensors.

Unit-V

Biosafety: Objective, rules and regulation, procedure of biosafety, containment (Physical and biological)

Risk assessment of genetically modified food.

Public opinion and ethical issues against the microbial technologies.

Patent practice and problem-patentability of micro-organisms patenting laws in India and its limits.

Rules and procedure for use of genetically modified organisms and environmental protection act 1986.

MB-21-Soil & Agriculture 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

Soil-definition, types, physical and chemical characters, soil profile, soil micro organisms Bacteria, fungi, Actinomycetes, algal, protozoa and viruses.

Unit-II

Interactions between plants and microorganisms-types of interactions (Symbiosis, mutalism, commensalisms, competition, amensalism, synergism, parasitism, predation, microorganisms of rhizosphere, rhizoplane and phylloplane. Mycorrhiza- Types and its application.

Unit-III

Microorganisms and biogeochemical cycles- Nitrogen, phosphorous, sulphur and carbon. Biodegradation. (cellulose, plastic and pesticides)

Unit-IV

Biofertilizers :-definition, types, kind of association, mode of application and merits. Biochemistry, genetics and physiology of nitrogen fixation-symbiotic, non symbiotic and associative symbiotic. Nitrogen fixation by blue green algae.

Unit-V

Biopesticides-introduction, types, mode of action and factors influencing, target pests. A brief account of the symptoms, etiology, life cycle and management of bacterial (citrus canker, blight of paddy), mycoplasmal (little leaf of brinzal), Viral (TMV, tomato leaf curl) and fungal (white rust of crucifers and stem rust of wheat) diseases.

MB-22-Medical 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, brief history, types of medically important microbes, host-parasite relationship.

Normal microflora of human body: normal microflora of skin, conjunctive (eye), nose, mouth and upper respiratory tract, intestinal tract, urinogenital tract, blood & tissues.

Unit-II

Pathogenicity, reservoirs of infections, infections, virulence, communicability of disease/ pathogenic microbes.

Microbial ecology of pathogens of animals and birds. Effects of pathogenic microbes.

Unit-III

Diagnosis, symptoms, Toxic components, etiology and epidemiology and disease development in animals and fowls.

Fowls pox, fowl spirochetosis, infections bronchitis.

Diseases of silkworm, livestock and pets (dogs & cats)

Unit-IV

Diseases of human beings-I: Diagnosis, symptoms, toxic components, etiology and disease development in human body-bacterial diseases (Diphtheria, Tuberculosis, Leprosy, Cholera, Typhoid, Gonorrhoea, Syphilis, Tetanus, Streptococcal infection of the skin, Dysentery, Salmonellosis, Botulism and Scarlet fever). Control, treatment and management of bacterial diseases.

Unit-V

Diseases of human beings-II: Diagnosis, symptoms, toxic components, etiology and disease development in human body-viral and fungal disease.

Viral-Aids, Poliomyelites, Mumps, Influenza, Viral Hepatitis, Small pox, Chicken pox, Common cold and Rabbies.

Fungal: Superficial mycoses, cutaneous mycoses, sub-cutaneons mycoses and systemic mycoses.

Control, treatment and management of viral & fungal diseases.

MB-23-Genetic Engineering and rDNA Technology

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 historical background of genetic engineering. Isolation and purification of DNA from bacterial, plant and animal cells. Vectors: Plasmids, cosmids and phages. Restriction enzymes, ligases, S1 nucleases, DNA polymerases. Reverse transcriptase.

Unit-II

C-DNA synthesis and cloning: mRNA enrichment, reverse transcription, Linkers, adapters, blunt end ligation, homopolymer tailing. C-DNA library construction and screening. Genomic library construction and screening. PCR and DNA sequencing.

Unit-III

Cloning and expression of foreign genes in prokaryotes (E.coli). Cloning and expression of foreign genes in eukaryotes (eg. yeast). Solid phase automated synthesis of DNA, Applications of transposons in gene tagging

Unit-IV

Using yeast to study eukaryotic gene function Therapeutic products produced by genetic engineering-blood proteins, human hormones, vaccines. Transgenic animals.

Unit-V

Gene transfer-microinjection, electroporation, microprojectile, shot gun method ultra - sonication, Liposome fusion, microlasers. Use of *Agrobacterium tumefaciens* and *A.rhizogenes*, Ti plasmids, Transgenic plants.

MB-24-Tools and Techniques

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

Microscopy: General, magnification, microscopes types, use of techniques of preparing specimens, resolving power, optical microscope-Basic idea of light microscopy, Types- bright field, dark field, ultra-violet, fluorescence and phase-contrast microscopes.

Electron microscope-Basic idea of structure and functioning of E.M., Preparation of material for electron microscopy, Types-TEM, SEM, Scanning probe microscope, scanning tunnel microscope atomic force microscope.

Techniques in light microscopy-wet mount, hanging drop preparations.

Unit-II

Microbial stains: Stains V/s Dyes, various types of stains, nature of stains, uses of stains.

Staining techniques: Simple, differential negative, gram-stain, mechanism of gram stain, Ziehl Nelson (acid fast) stain, special stains.

Sterilization techniques: sterilization of glassware and culture media.

Unit-III

Micro analytical Techniques: Disintegration of microorganisms- Mechanical & non-mechanical methods.

Separation of sub cellular structures and organelles- Differential, gradient, zonal or band and equilibrium or isopycnic density gradient centrifugation.

Unit-IV

Cyto chemical Analysis: Cytochemistry of microbes, cytochemical staining methods, radio autography (autoradiography) principles and procedure of radio autography.

Chromatography: principle and procedure of absorption, column, thin layer (TLC), partition, and gas-liquid ion-exchange chromatography.

Electrophoresis: Principle, equipment and procedure of various types (vertical & horizontal) electrophoresis, SDS-PAGE electrophoresis.

Unit-V

Culture of microbes: Preparation of culture media, aseptic transfer of bacteria, pure culture, serial dilution technique, preservation and maintenance of cultures, concept of stock culture.

B.Sc- Pt-III (Microbiology)
Practicals

Practical No.	Paper No.	Max. Marks	Min. Marks	Paper Titles
Practical -01	MB-25	50	18	Microbial Culture, Growth and food Microbiology + Fermentation Technology and Government role
Practical -02	MB-26	50	18	Soil and Agricultural Microbiology + Medical Microbiology
Practical -03	MB-27	50	18	Genetic Engineering and R-DNA Technology +Tools and Techniques

Practical- Paper- I
Microbial Culture, Growth & Food Microbiology

1. Principles and application of light and phase contrast microscope, Incubator, Colorimeter, Centrifuge, Spectrophotometer (Visible and UV).
2. Preparation of liquid and solid nutrient media for growth of micro-organism, cleaning, sterilization, culturing methods, dilution technique in microbiology.
3. Isolation and maintenance of organisms by plating, streaking and serial dilution methods, slant and stab cultures, storage of micro organisms.
4. Staining techniques in microbiology-
   a. Simple staining b. Negative staining c. Differential staining d. Spore staining
5. Microscopic examination of bacteria, yeast and moulds. Study of micro organisms by Gram stain, Acid fast stain.
6. Identification of micro organisms by biochemical tests.
7. Growth, Bacterial growth curve, measurement of bacterial population by turbidometry and serial dilution method.
   Effect of physiological factors (physical and chemical) on growth of micro-organisms e.g. temperature, pH, Carbon and nitrogen sources.
8. Microbial examination of food.
9. Effect of antibiotics on microbes.
10. Microbial production of citric acid using Aspergillus niger.
11. Detection of number of bacteria in milk by standard plate count.
12. Isolation of microbes from natural sources using specific media.
    a. Nutrient agar b. Potato dextrose agar c. BG-11
13. Microbial analysis of water, milk, butter, fruit and vegetables using selective standard method.
14. Isolation of Microbes from rhizosphere and rhizoplane.
15. To perform microbial activity in composting.

Practical- Paper- II
Fermentation Technology and Government Role

1. Isolation of industrially imported micro-organism for microbial processes.
2. Determination of thermal death point (TDP) and thermal death time (TDT) of microorganism for design of a sterilizer.
3. a. Determination of growth curve of a supplied microorganism and also determine substrate
   b. Compute specific growth rate (m), growth yield (y) from the above experiment.
4. Comparative studies of ethanol production using different substrates.
5. Production and estimation of Alkaline Protease.
6. Saurkraut fermentation.
7. Use of alginate for cell immobilization.
8. Determination of mixing time in bioreactors.
9. Visit to dairy, Bakery, distillery and sugar factory and submission of visit report.

Practical- Paper- III
Soil and Agricultural Microbiology

1. Analysis of soil: Texture, pH, moisture content, water holding capacity, percolation and capillary action.
2. Isolation and study of microbes (bacteria and fungi) from Rhizosphere and Rhizoplane
3. Isolation of Rhizobium from root modules of legumes (Trigonella / Cicer / Soybean)
4. Isolation of free nitrogen fixers ((Azotobactor, Azospirillum) from soil
5. Study of plant pathogens based on theory

Practical- Paper- IV
Medical Microbiology

1. Isolation of Pathogenic bacteria from natural sources: Cough, skin-wash, blood, tissue, stool etc.
2. Culture and identification of pathogenic bacteria using specific media
3. Isolation and identification of fungi causing diseases in animals and human beings.
4. Study of causative viruses of pathogenetic importance with the help of slide, **model, election micrograph or computer simulation :**
   a. HIV b. Hepatitis B Virus c. T phage d. Polioviruses
   e. Rabies
5. Field trip or visit to a microbiological laboratory of any advanced medical college or institute of medical science to study various activities and exposure to the research being done there.
6. Study of diseases (bacterial & viral) of pets and their causative agents. (Help of veterinary hospital / college may be taken.

Practical- Paper- V
Genetic Engineering and rDNA Technology

1. Isolation of DNA from : a) Bacteria (genomic) b. Plants
2. Digestion of DNA with restriction enzymes.
3. Quantitation of nucleic acids.
4. Bacterial culture and antibiotic selection media
5. Protoplast fusion, Anthers culture and haploid production
6. Charts on genetic engineering –
    a. pBR 322
    b. pUC 180 and 19
    c. SV 40
    d. Bacteriophage
    e. Gene Cloning
    f. Selection of recombinants by replica plate technique

Practical- Paper- VI
Tools and Techniques

1. Study of organization and working of microscopes :
    a. Optical Microscopes : dissecting and compound
    b. Exposure to organization and working of phase contrast microscope and electron microscopes.
2. Preparation of various microbial stains and their use.
3. Use of staining techniques –
    a. Single and differential, negative
    b. Gram's stain
4. Sterilization of glassware and media (use of autoclave). Aseptic transfer.
5. Study and use of micro analytical techniques.
6. Separation of sub- cellular organelles (use of centrifuge and other techniques)
7. Separation of cell organelles by sucrose gradient.
8. Electrophoresis : SDS – PAGE
9. Thin layer chromatography
10. Paper chromatography : circular and vertical
11. Culture of microbes using specific media and techniques.
12. Measurement of microbes using micrometer (Ocular and stage)
13. Visit to microbiological laboratory for exposure of various advanced tools and techniques.