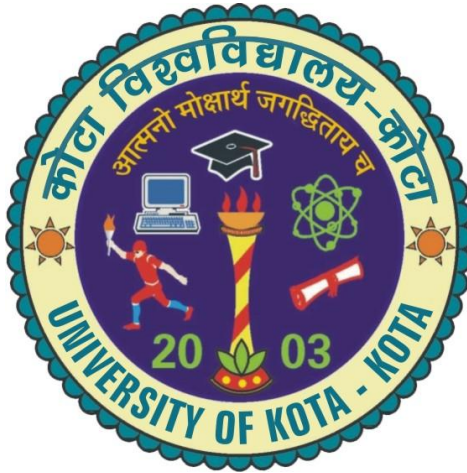


Syllabus and Course Scheme
Academic year 2018-19



B.Sc.- Microbiology
Exam.-2019

UNIVERSITY OF KOTA

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

Website: uok.ac.in

B.Sc. -Microbiology Exam. - 2019

Eligibility: 10+2 Science Biology / Agriculture **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-2019

Compulsory paper	Lec Hrs/week	Exam hrs.	Max Marks
BMB – 00 Environmental studies	3	3	50
Core paper (Theory)			
BMB – 01 Principles of microbiology	3	3	50
BMB – 02 Cell Biology and Microbial Genetics	3	3	50
BMB – 03 Biology & Diversity of Microbes	3	3	50
BMB – 04 Fundamentals of Biochemistry	3	3	50
BMB – 05 Fundamentals of Molecular Biology	3	3	50
BMB – 06 Basic Immunology	3	3	50
Total of Theory Papers			300
Core Paper (Practicals)			
BMB – 07 Principles of microbiology + Cell Biology and Microbial Genetics		3	50
BMB – 08 Biology and Diversity of Microbes + Fundamentals of Biochemistry		3	50

BMB – 09 Fundamentals of Molecular Biology + Basic Immunology	3	50
Total of Practical Papers		150
Grand Total (Theory + Practicals)		450

B.Sc. Microbiology Pt-II Examination

	Lec Hrs/week	Exam hrs.	Max Marks
Core paper (Theory)			
BMB – 10 Microbial Ecology	3	3	50
BMB – 11 Microbial Physiology and Metabolism	3	3	50
BMB – 12 Medical Microbiology	3	3	50
BMB – 13 Genetic Engineering and rDNA technology	3	3	50
BMB – 14 Food & Dairy Microbiology	3	3	50
BMB – 15 Environmental Biology	3	3	50
Total of Theory Papers			300
Core Paper (Practicals)			
BMB –16 Microbial Ecology+ Microbial Physiology & Metabolism		3	50
BMB –17 Medical Microbiology+ Genetic Engineering and rDNA technology		3	50
BMB – 18 Food & Dairy Microbiology + Environmental Biology		3	50
Total of Practical Papers			150
Grand Total (Theory + Practicals)			450

B.Sc. Microbiology Pt-III Examination

	Lec Hrs/week	Exam hrs.	Max Marks
Core paper (Theory)			
BMB – 19 Biosafety & IPR	3	3	50
BMB – 20 Soil and Agriculture Microbiology	3	3	50
BMB – 21 Tools and Techniques in Microbiology	3	3	50

BMB – 22 Computer Applications & Biostatistics	3	3	50
BMB – 23 Biophysics and Instrumentation	3	3	50
BMB – 24 Industrial Microbiology	3	3	50
Total of Theory Papers			300
Core Paper (Practicals)			
BMB –25 Biosafety & IPR + Soil and Agriculture Microbiology		3	50
BMB –26 Tools and Techniques in Microbiology+ Computer Applications and Biostatistics		3	50
BMB –27 Biophysics and Instrumentation+ Industrial Microbiology		3	50
Total of Practical Papers			150
Grand Total (Theory + Practical)			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

BMB – 01 PRINCIPLES OF 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

Contributions of the following scientists in various areas of Microbiology - Anton van Leeuwenhoek, Joseph Lister, Paul Ehrlich, Edward Jenner, Louis Pasteur, Robert Koch, Alexander Fleming, Waksman. Branches of Microbiology. Economic importance of microbes.

Microscopy –Principle, construction, operation and application.

UNIT- II

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

Microbial stains: Auxochrome , chromophores, Stains v/s Dyes, various types of stains.

Staining techniques: Simple staining, Differential (Gram and Acid fast),Special staining (Spore, capsule, negative).

UNIT-III

Sterilization – Physical Methods: Heat, Pasteurization, filtration, tyndallization, radiation.

Chemical methods: Alcohol, Halogen, Aldehyde, Ethylene Dioxide.

Determination of phenol coefficient of disinfectant.

Culture media: Simple media, Synthetic or defined media, Complex media, Enriched media, Selective media, Differential media.

UNIT- I V

Microbiology of soil and geo-chemical cycles. N₂-fixing microbes in agriculture. Industrial products of microorganisms with special reference to food and food supplements (Prebiotics and Probiotics), beverages and pharmaceuticals.

UNIT- V

Microbial interactions like symbiosis and antibiosis *etc.* Host defense mechanism against pathogens.

Symptoms, Etiology and control measures: Human diseases (Tuberculosis, HIV, candidiasis, polio, malaria) and Plant diseases (Root knot nematode galls, little leaf of brinjal, bacterial blight of rice, green ear disease of bajra, TMV).

Reference Books:

1. Microbiology, Authors- Pelczar, Chan and Kreig.
2. Microbiology- an Introduction- (8th Edn), Authors- Tortora, G.J., Funke, B.R., Case, C.L.
3. General Microbiology, Authors- Stainer, Ingharam, Wheelis and Painter.
4. Microbial Physiology, Authors- Moat and Foster.
5. A Text book of Microbiology, Authors- P. Chakraborty.
6. Textbook of Microbiology, Authors- Dubey and Maheshwari.
7. Microbiology, A Practical Approach. Authors- Patel and Phanse
8. General Microbiology, Authors- Powar and Daginawala.
9. Microbiology, Author- S.S. Purohit.
10. Microbiology, Authors- Prescott, Herley and Klein.
11. Bacteriology, Authors- Topley and Wilson.

BMB 02- CELL BIOLOGY AND MICROBIAL GENETICS

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

Ultra Structure of Prokaryotic and Eukaryotic Cell.

Structure and Function (outline) of Cell components: Cell Wall, Plasma Membrane, Endoplasmic Reticulum, Golgi apparatus, Lysosome, Peroxisome, Ribosome, Chloroplast, Mitochondria, Nucleus, cytoskeleton (Microfilament, Microtubule and Intermediate Filaments).

UNIT- II

Structure of chromosome –Prokaryotic and Eukaryotic Chromosome. Nucleosome model, euchromatin and heterochromatin, karyotype. Special types of Chromosomes (Polytene and Lampbrush Chromosome.)

UNIT- III

Cell cycle: Amitosis, mitosis and meiosis. Components of cell cycle control system, Programmed cell death (Apoptosis). Cell signalling.

UNIT- IV

Methods of genetic recombination: Conjugation, transformation, transduction and sexduction. Plasmid- Structure, properties and types. Genetic recombination and site-specific recombination.

UNIT -V

Mutation: spontaneous and induced mutation. Mutagens –Physical and chemical mutagens. DNA damage and repair. Transposable elements of prokaryotes– Types and significance.

Reference Books:

1. Molecular Biology of Cell- Bruce Alberts et al, Grand publications.
2. Cell Biology- Ambrose & Dorothy Masty, ELBS Publications.
3. Fundamentals of Cytology- Sharp, Mc Graw Hill Company.
4. Cytology- Wilson & Marrison, Reinform Publications.
5. Cell Biology and Molecular Biology- EDP Robertis and EMF robertis, Sauder College.
6. Cell Biology, Genetics and Evolution & Ecology P.S. Verma and Agarwal.
7. Cell Biology: A lab manual. Shanmucan. Mc Millan India Ltd.
8. Genetics- Strickberger, 2nd.
9. Microbial Genetics – D. Frifielder.
10. Baltimore- Molecular Biology of the Cell

BMB 03- BIOLOGY AND DIVERSITY OF MICROBES

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

Whittaker's classification system of prokaryotes. Hackel's three kingdom, Carl Woes classification. Important archaeal and eubacterial groups according to Bergey's Manual of Systematic Bacteriology.

Archaea: General characteristics, structure, metabolic character, function, reproduction and application.

Cyanobacteria: General characteristics and importance.

UNIT – II

Classification and General characteristics of algae - Occurrence, thallus organization, algae cell ultra-structure, pigments, flagella, eyespot food reserves and vegetative, asexual and sexual reproduction. Different types of life cycles in algae. Applications of algae in agriculture, industry and environment.

UNIT – III

Classification and General characteristics of fungi - habitat, nutritional requirements, ultra-structure, thallus organization, asexual reproduction, sexual reproduction, heterokaryosis, heterothallism and parasexual mechanism. Economic Importance.

Protozoa :General characteristics with special reference to *Amoeba*, *Paramecium* and *Plasmodium*.

UNIT – IV

Classification, structure and General Characteristics of viruses, viroids, virusoids, satellite viruses and Prions. Isolation, purification and cultivation of viruses. Multiplication of bacterial viruses (lytic and lysogenic cycles).

UNIT – V

Eubacteria: Cell morphology, function, reproduction of Photosynthetic eubacteria, Gram positive eubacteria (Actinomycetes), Spore forming bacteria (spore formation and germination), Sulfur bacteria, Nitrogen fixing bacteria and mycoplasma.

Reference Books:

1. Microbiology: An Introduction by Tortora GJ, Funke BR and Case CL., 9th Ed., Person Education, 2008.
2. Microbiology by Pelczar Jr MJ, Chan ECS and Krieg NR. 5th Ed. Tata McGraw Hill, 2011 (Reprint),
3. Black JG (2008) Microbiology: Principles and Explorations. 7th edition. Prentice Hall.
4. Madigan MT and Martinko JM (2006) Brock Biology of Micro-organisms. 8th edition. Parker J. Prentice Hall International, Inc.
5. Stanier RY, Ingraham JL, Wheelis ML and Painter PR. (2005) General Microbiology. 5th edition. McMillan 4.
6. Srivastava S and Srivastava PS (2003). Understanding Bacteria. Kluwer Academic Publishers, Dordrecht.

BMB-04 FUNDAMENTALS OF 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 – I

Bioenergetics: Principles of bioenergetics. First and second laws of Thermodynamics. Definition of Gibb's Free Energy, Enthalpy and Entropy and mathematical relationship among them, Standard free energy change and equilibrium constant.

Energy rich compounds: Phosphoenolpyruvate, 1, 3- Bisphosphoglycerate.

UNIT – II

Carbohydrate: Definition, classification, stereochemistry, cyclic structures and anomeric forms, Haworth projections. Monosaccharide, Disaccharides, Polysaccharides: structural and storage .

UNIT – III

Protein Structure (Primary, Secondary, Tertiary and Quaternary).

Purification(chromatographic and electrophoresis). Protein Folding. Protein Sequencing.

Properties of amino acids their nature and peptide bond.

UNIT – IV

Lipids: classification and structure of fatty acids (Palmitic and stearic acid), Properties of oils and fats. Biological functions of lipids.

Structure of nucleic acids. Nucleoside, nucleotide

UNIT – V

Enzymes: General properties, Classification. Role in metabolism, anabolism and catabolism. Coenzymes and Cofactors. Enzyme Kinetics (derivation of Michaelis–Menten constant, linear transformation of the equation). Enzyme Inhibition. Allosteric Enzymes and Isoenzymes. Mechanism of Enzyme Regulation.

References:

1. Lehninger. Principles of Biochemistry, Nelson & Cox, 4th Edition.
2. Voet & Voet Donald. 3rd Edition. Fundamentals of Biochemistry, J/W.
3. U Satyanarayan, Biochemistry, 3rd Edn, Books and Allied Pvt. Ltd.
4. Stryer – Biochemistry. W. H. Freeman & Co.
5. Price & Steven, Fundamentals of Enzymology, 3rd Edition

6. Geoffrey Cooper. The cell with CD- Rom. Sinauer Asso. Incorp.
7. Elliott & Elliot. 3rd Edition Biochemistry and molecular biology.
8. Boyer, Concepts in biochemistry. Thomson
9. Plummer. An introduction to practical Biochemistry, 3rd Edition
10. J. Jayraman. Lab Manual in Biochemistry.

BMB-05 FUNDAMENTALS OF MOLECULAR BIOLOGY

Min. pass marks: 18

Duration: 3 hours

Max. Marks: 50

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

UNIT-I

Organization of genetic material in prokaryotes and eukaryotes. Concept of gene. Evidence for the role of DNA and RNA as the genetic material.

UNIT-II

Structure of DNA. C-value, and C-value paradox. Topology of DNA. DNA replication in prokaryotes and eukaryotes, Enzymes and accessory proteins involved in DNA replication, Fidelity of DNA replication and proof reading.

UNIT-III.

Structural features of RNA (rRNA, tRNA, mRNA). Sn- RNA and HnRNA. Mechanism of transcription in Prokaryotes and Eukaryotes Post transcriptional processing: capping, tailing and splicing. Catalytic RNA.

UNIT-IV

Genetic code, anticodon, Wobble hypothesis. Translation in Prokaryotes and Eukaryotes. translational modification (phosphorylation, glycosylation, and methylation).

UNIT-V

Regulation of gene expression in prokaryotes: Operon concept, positive and negative regulation. Examples of lac and trp- operon. Regulation of gene expression in eukaryotes (In brief)

References:

1. Genes V by Benjamin Lewin, Oxford University Press, New York.
2. Principles of Genetics, Snustad and Simmons, Fourth Edition, John Wiley and Sons, Inc.
3. Molecular Cell Biology, Lodish et.al., W. H. Freeman and Company.
4. Genomes by T.A. Brown, John Wiley and sons (Asia) PTE LTD, New York.
5. Principles of Gene Manipulation and Genomics by S.B. Primrose and R. M. Twyman, Seventh edition, Blackwell Publishing, U.K.
6. Cell and Molecular Biology concepts and experiments By Gerald Karp, Third edition, John Wiley and sons, Inc., U.S.A.
7. Molecular Biology by Friefelder, David.

BMB 06- BASIC IMMUNOLOGY

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

Concept of Innate and Adaptive immunity.

Structure, Functions and Properties of Immune Cells: Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell

Immune Organs – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT.

UNIT II

Characteristics of an antigen; Haptens, Epitopes (T & B cell epitopes), T-dependent and independent antigens, Adjuvants.

Structure, Types, Functions of antibodies: Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic).

UNIT III

Antigen–Antibody Interaction: Principles of Precipitation, Agglutination, Immunodiffusion(ODD, RID), Immunoelectrophoresis, ELISA, ELISPOT, Western blotting, Immunofluorescence, Flow cytometry.

Organization of MHC locus (Mice & Human); Structure and Functions of MHC I & II molecules.

UNIT IV

Complement- Components and biological activities. Primary and Secondary Immune Response; Generation of Humoral Immune Response (Plasma and Memory cells); Generation of Cell Mediated Immune Response (Self MHC restriction, T cell activation, Co- stimulatory signals); Killing Mechanisms by CTL and NK cells.

UNIT V

Hypersensitivity – (immediate and delayed types).

Autoimmune diseases: Good pastures syndrome, Rheumatoid arthritis (RA), Multiple sclerosis, Systemic lupus erythematosus (SLE), Type 1 diabetes,, Hashimoto's thyroiditis. Transplantation immunology.

Reference Books:

1. Essentials of Immunology, Author- Roitt, I.M., ELBS. Blackwell Scientific Publishers, London.
2. Immunology II Edition, Author- Kuby, J. WH., Freeman and Company, New York.
3. Immunology. Author- Klaus D. Elgert ,Wiley-Liss. NY.
4. Text Book on Principles of Bacteriology, Virology and Immunology, IX Edition (5 volumes). Authors- Topley and Wilson's, Edward Arnold, London.
5. The Experimental Foundations of Modern Immunology. Authors- Clark, V.R., John Willey and Sons, Incl.
6. Fundamental Immunology. Author – W.E. Paul, Raven Press, New York.
7. Fundamentals of Immunology. Authors – R.M. Coleman, M.F. Lombord and R.E. Sicard. 2nd ed. C. Brown publishers.

PRACTICALS

BMB – 07 PRINCIPLES OF MICROBIOLOGY + CELL BIOLOGY AND MICROBIAL GENETICS

Max. Marks – 50

Min Marks – 18

1. Microbiology Good Laboratory Practices
2. Principles, working knowledge of Instruments like Autoclave, pH meter, Incubator, Hot air oven, Centrifuge, Microscope, Refrigerator, Colony counter,
3. Laminar Air Flow. BOD incubator used in the microbiology laboratory.
4. Cleaning and sterilization of glasswares.
5. Measurement of microorganisms.
6. Preparation of culture media: PDA, BG-11, Nutrient Agar.
7. Preparation of stains.
8. Motility of bacteria by Hanging drop method.
9. Staining procedures I- Simple staining –Negative staining.
10. Staining procedures II- Differential staining - Gram Staining and Acid Fast Staining.
11. Staining procedures III- Special / Structural staining -Capsule staining, Endospore staining.
12. Sterilization of medium using Autoclave and assessment for sterility.
13. Sterilization of glassware using Hot Air Oven and assessment for sterility.
14. Demonstration of the presence of microflora in the environment by exposing nutrient agar plates to air.
15. Study of *Rhizopus*, *Penicillium*, *Aspergillus*, *Saccharomyces* using temporary mounts.
16. Mitosis in onion root tip
17. Identification of giant chromosome in chironomous larvae
18. Cell Counting and viability
19. Blood Smear Preparation.
20. Separation of cell organelles by sucrose gradient.
21. Preparation and study of various stages of mitosis and meiosis.
22. Isolation of plasmid DNA from bacteria.
23. Preparation of competent.
24. Restriction enzyme digestions and its analysis by gel electrophoresis.
25. U.V. Induced Mutagenesis.
26. Bacterial transformation by CaCl₂ method)
27. Transduction in *E. coli*.
28. Conjugation in *E. coli*.

PRACTICALS

BMB – 08 BIOLOGY AND DIVERSITY OF MICROBES +FUNDAMENTALS OF BIOCHEMISTRY

Max. Marks – 50

Min Marks – 18

1. Study of *Rhizopus*, *Penicillium*, *Aspergillus*, *Saccharomyces* using temporary mounts.
2. Study of *Spirogyra* and *Chlamydomonas*, *Volvox* using temporary mounts
3. Study of the following protozoans using permanent mounts/photographs: *Amoeba*, *Entamoeba*, *Paramecium* and *Plasmodium*.
4. Analysis of Sugars
 - a) Monosaccharide-Glucose, Fructose, Galactose, Mannose, Pentose.
 - b) Disaccharides-Sucrose, Maltose and Lactose.
 - c) Polysaccharides-Starch and Dextrin.
5. Analysis of Amino Acids
6. Lipid Analysis [Group Experiments]
 - a) Determination of Saponification number.
 - b) Determination of Acid number.
 - c) Determination of Iodine number
7. Demonstration Experiments
 - a) Separation of amino acids by TLC.

PRACTICALS BMB – 09 FUNDAMENTALS OF MOLECULAR BIOLOGY + BASIC IMMUNOLOGY

Max. Marks – 50

Min Marks – 18

1. Preparation of genomic DNA from bacteria.
2. Isolation of genomic DNA from Blood.
3. Quantitation of DNA by spectrophotometry.
4. Isolation of plasmid DNA from bacteria.
5. Restriction enzyme digestions and its analysis by gel electrophoresis.
6. Identification of human blood groups.
7. Perform Total Leukocyte Count of the given blood sample.
8. Perform Differential Leukocyte Count of the given blood sample.
9. Separate serum from the blood sample (demonstration).
10. Perform immunodiffusion by Ouchterlony method.
11. Perform DOT ELISA.
12. Perform immunoelectrophoresis