



*B.Sc.- Biotechnology
Exam.-2021*

UNIVERSITY OF KOTA

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

Website: uok.ac.in

B.Sc. Biotechnology
Eligibility: 10+2 Science Biology/ Agriculture
Scheme of Examination and Course of Study

The number of paper and maximum marks of 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 paper as well as in practicals separately.

First Division 60% of the maximum marks prescribed at part I, II & III
 Second Division 48% Examinations, 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 he has passed in all the practical examinations.

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

TEACHING AND EXAMINATION SCHEME FOR
B.Sc. Biotechnology Pt-I Examination-2021

Compulsory paper	Lec Hrs/week	Exam hrs.	Max Marks
BBT – 00 Environmental studies	3	3	50
Core paper (Theory)			
BBT – 01 Plant Diversity	3	3	50
BBT – 02 Fundamentals of Biochemistry	3	3	50
BBT – 03 Animal Diversity	3	3	50
BBT – 04 Cell Biology and Genetics	3	3	50
BBT – 05 Basics of Biostatistics	3	3	50
BBT – 06 Principles of Microbiology	3	3	50
Total of Theory Papers			300
Core Paper (Practicals)			
BBT – 07 Plant Diversity + Fundamental of Biochemistry		3	50
BBT – 08 Animal Diversity + Cell Biology and Genetics		3	50
BBT – 09 Basics of Biostatistics		3	50

+ Principles of Microbiology	
Total of Practical Papers	150
Grand Total (Theory + Practicals)	450

B.Sc. Biotechnology Pt-II Examination-2021

	Lec Hrs/week	Exam hrs.	Max Marks
Core paper (Theory)			
BBT – 10 Fundamentals of Molecular Biology	3	3	50
BBT – 11 Biophysics and Instrumentation	3	3	50
BBT – 12 Basics of Plants Physiology	3	3	50
BBT – 13 Plant Cell, Tissue and Organ Culture	3	3	50
BBT – 14 Basics of Animal Physiology	3	3	50
BBT – 15 Fundamentals of Immunology and Animal Cell Culture	3	3	50
Total of Theory Papers			300
Core Paper (Practicals)			
BBT – 16 Fundamentals of Molecular Biology + Biophysics and Instrumentation		3	50
BBT – 17 Basics of Plants Physiology + Plant Cell, Tissue and Organ Culture		3	50
BBT – 18 Basics of Animal Physiology+ Fundamentals of Immunology and Animal Cell Culture		3	50
Total of Practical Papers		150	
Grand Total (Theory + Practicals)		450	

**B.Sc. Biotechnology Part-III Examination -
2021**

	Lec Hrs/week	Exam hrs	Max Marks
Core paper (Theory)			
BBT-19 Genetic Engineering and Recombinant DNA Technology	3	3	50
BBT-20 Applied Plant Biotechnology	3	3	50
BBT-21 Applied Animal Biotechnology	3	3	50
BBT-22 Industrial Biotechnology	3	3	50
BBT-23 Environmental Biotechnology	3	3	50
BBT-24 Computational Biology and IPR	3	3	50
Total of theory papers			300
Core paper (Practicals)			
BBT-25 Genetic Engineering and Recombinant DNA Technology+ Applied Plant Biotechnology		3	50
		3	50
BBT-26 Applied Animal Biotechnology+ Industrial Biotechnology		3	50
BBT-27 Environmental Biotechnology + Computational Biology and IPR			
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 appearance or absence 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 candidate 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.

BIOTECH PRACTICALS – (I, II, III)

Distribution of Marks

Min. pass marks: 18	Duration: 3 hours	Max. Marks: 50
	<u>REGULAR</u>	<u>EX-STUDENT</u>
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

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BBT 00 : Compulsory paper: Environmental studies

BBT-01 PLANT DIVERSITY

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-1

Biodiversity of plant kingdom. Salient features and classification up to the level of order of different plant groups ; Algae (*Volvox*, *Oscillatoria*, *Chara*, *Vaucheria*, *Ectocarpus*, *Polysiphonia*). Fungi (*Albugo*, *Saccharomyces*, *Peziza*, *Puccinia*, *Alternaria*). Lichens.

UNIT-II

Salient features and classification up to the level of classes of different plant groups; Bryophytes (*Riccia*, *Anthoceros*, *Polytrichum*). Pteridophytes (*Lycopodium*, *Equisetum*, *Marsilea*, *Rhynia*). Gymnosperm (*Cycas*, *Pinus*, *Ephedra*). Paleobotany: Definition and importance, Geological time scale.

UNIT-III

Angiosperm – monocot (Wheat), dicot (Sunflower)
Anatomy-Internal structure of stem, leaf and root of Angiosperm and Gymnosperm. Differences in Angiosperm and Gymnosperm. Differences in dicot and monocot. Tissue system, structure and function of different cells (parenchyma, collenchyma, sclerenchyma). Xylem and phloem.

UNIT-IV

The concept of annual and perennials. Secondary growth, annual ring and wood formation. Morphology of seed plants, General organization of plant body such as aerial and under ground parts.

UNIT-V

Inflorescence. Flower and function of each part of flower. Fruit – Types of fruits, formation of fruits, parthenocarpy. Seed - Formation of seed, seed germination and dormancy.

Reference Books:

1. Singh, Pande-Jain, A Text Book of Botany, Rastogi Publication
2. Dube H.C. Text of fungi, Bacteria and Viruses.
3. Bold H.C. The Plant Kingdom, Prentice - Hall India
4. Singh, Pandey and Jain. Diversity of microbes and cryptogams-Rastogi Publisher

BBT-02 FUNDAMENTALS OF BIOCHEMISTRY

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-1

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: storage and structural.

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.

Structures, characteristics and functions of nucleotides; Three dimensional structure of nucleic acids; DNA as a double helical structure; Unusual nucleotides and unusual structures of nucleic acids.

UNIT-V

Enzymes: - General properties, Classification. Role in metabolism, Anabolism and catabolism. Coenzymes and Cofactors. Catalytic Mechanism. 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. Plumner. An introduction to practical Biochemistry, 3rd Edition
10. J.Jayraman. Lab Manual in Biochemistry.

BBT-03 Animal Diversity

Min. pass marks: 18

Duration: 3 hours

Max. Marks: 50

UNIT –I

Taxonomy: - Definition and meaning of Taxonomy, Bases and importance of taxonomy. Outline classification of Invertebrates. Fundamentals of body organization emphasizing symmetry, metamerism, coelome and levels of structural organization. Classification of Protozoa, Porifera, Coelenterata, Platyhelminthes, Nematoda and Annelida (up to class with examples).

UNIT –II

Protozoa: - Study of structural organization and life history of Trypanosoma and Paramecium. Study of locomotion, osmoregulation, nutrition and reproduction in protozoa. Parasitism, pathogenicity and its control in protozoans with special reference to Entamoeba, Leishmania and Trichomonas.

UNIT-III

Porifera: - Habit, habitat, structure and physiology of Scypha. Types of canal system in the phylum Porifera.

Coelenterata: - Habit, habitat, structure, function and life history of Aurelia. Polymorphism in coelenterata, coral reef.

UNIT IV

Platyhelminthes: - Structure, physiology and life history of Dugesia and Fasciola. Parasitic adaptation in Helminthes.

Nematyhelminthes: - Study of structure and life history of Dracunculus medinensis. Nematode parasites and human diseases.

UNIT-V

Annelida:- General Charecteristics of Annelida. Metamerism and coelom. Structure, physiology and life history of Pheretima and Hirudinaria. Trochophore larva.

References:

1. Ganguli, B.B., Sinha, A.K. and Adhikari, S. 2001. Biology of Animals. (Vol. I and III). New Central Book Agency, Calcutta.
2. Jordan, E.L. and Verma, P.S. 2001. Invertebrate Zoology. S. Chand and Co., New Delhi.

BBT 04- CELL BIOLOGY AND GENETICS

Min. pass marks: 18

Duration: 3 hours

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 of Cell components: Cell Wall, Plasma Membrane, Endoplasmic Reticulum, Golgi apparatus, Lysosome, Peroxisome, Ribosome. Chloroplast, Mitochondria, Nucleus

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: General strategy of cell cycle, Interphase (Different stages) and Mitosis; Generation time; Cell cycle regulation.

The Mechanics of Cell division; Introduction, An overview of different stages in Mitosis, meiosis and cytokinesis; Cell differentiation and its implications

Cell Senescence: Difference between aging and necrosis; Programmed Cell Death

UNIT-IV

Mendelian Laws and physical basis of inheritance, dominance and its molecular basis Basics of gene interaction. lethal genes, polygenic traits, linkage and gene maps. Sex linked inheritance . Determination of sex. cytoplasmic inheritance, pleiotrophy (multiple alleles), Hardy Weinberg law (population genetics).

UNIT-V

Transformation, Conjugation, Transduction: generalized transduction, specialized transduction.

Site specific recombination: transposable elements- classes of transposable elements, element insertion sequences (IS element), mechanism of transposition and genetic transposition.

References:

1. Molecular Biology of Cell- Bruce Alberts et al, Grand publications.
2. Cell Biology- Ambrose & Dorothy Mast, ELBS Publications.
3. Fundamentals of Cytology- Sharp, Mc Graw Hill Company.
4. Cytology- Wilson & Morrison, Reinhold 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. Shanmugan. Mc Millan India Ltd.
8. Genetics- Strickberger, 2 nd.
9. Microbial Genetics – D. Frifielder.
10. Baltimore- Molecular Biology of the Cell.

BBT - 05 Basics of Biostatistics

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

Introduction to biostatistics and its scope. Sampling techniques. Collection of data, Frequency distribution, tabulation, graphical representation of data by histogram, frequency polygon curve and cumulative frequency curve.

UNIT-II

Measure of central tendency : mean, median, mode .

Measure of dispersion, Mean deviation, Standard deviation and standard error, variance. Analysis of variance.

UNIT-III

Correlation: Introduction, definition and types of correlation between two variables. Scatter diagram, Karl Pearson's coefficient of correlation and Spearman's rank correlation coefficient.

UNIT-IV

Regression analysis, multiple linear regression.

Hypothesis: null and alternate hypothesis. Test for significance, chi-square test, student t-test (single sample mean and two sample mean), F-test.

UNIT-V

Designing and methodology of an experiment: Introduction, Definition of the problem, Aims and Objectives, Review of Literature, Hypothesis, Plan of Action, Analysis of Data, Conclusion.

Probability: Concept, calculation and theories.

Reference Books:

1. Statistical Methods by S.P.Gupta, Publisher S.Chand & Co, New Delhi
2. Statistics by R.S.N. Pillai & V. Bagavathi, Publisher S.Chand & Co, New Delhi
3. S. C. Gupta and V. K. Kapoor : Mathematical Statistics, Sultan Chand & Sons
4. B. K. Mahajan : Bio Statistics, Jaypee Publications
5. G. C. Beri : Business Statistics, TM

BBT – 06 PRINCIPLES OF MICROBIOLOGY

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

History of Microbiology with special reference to contribution of the following A. Leewenhock, L. Pasteur, R. Koch, J. Lister, J. Tyndall.

Biogenesis vs abiogenesis, Koch postulates, discovery of antibiotics.

Principle of microscopy: Bright field, dark field, phase contrast, fluorescent, electron microscopy.

UNIT-II

Microbial classification, Morphology of bacteria with major emphasis on bacterial structure and cells wall. Gram positive and Gram negative bacteria. Microbial spores, sporulation/ germination process.

Structure, growth, nutrition, metabolism, physiology, genetics of viruses. Mycoplasma.

UNIT-III

Classification and General characteristics of algae, fungi and protozoa. Microbial growth, nutritional biodiversity, phases of growth, generation time, growth rate, monoauxic, diauxic and synchronous growth. Microbes in extreme environment. Physical and chemical factors affecting growth: temperature, light, pH, oxygen and saline requirements.

UNIT-IV

Sterilization – Principle and methods: Physical and Chemical Methods

.Microbiology of soil and bio geo-chemical cycles. Microbiology of air.

Microbiology of food. Microbiology of water.

Microbiology of dairy and dairy products. Industrial microbiology

UNIT-V

Types of microbial pathogens and diseases caused by them. Microbial interactions like symbiosis and antibiosis *etc.* Host defense mechanism against pathogens.

Symptoms, Etiology and control measures: Human diseases (Tuberculosis, HIV, candidiasis, polio, malaria), 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 Dagainawala.
9. Microbiology, Author- S.S. Purohit.
10. Microbiology, Authors- Prescott, Herley and Klein.
11. Bacteriology, Authors- Topley and Wilson.

PRACTICALS

BBT - 07: PLANT DIVERSITY & FUNDAMENTALS OF BIOCHEMISTRY

1. Study of examples of each type: Algae, Fungi, Bryophytes, Pteridophytes, Angiosperm, and Gymnosperm.
2. Study of different parts of the plant (T.S. of monocot and dicot, examples of each type) : root, stem and leaves, flower, Inflorescence.
3. Analysis of Sugars
 - a. Monosaccharide-Glucose, Fructose, Galactose, Mannose, Pentose.
 - b. Disaccharides-Sucrose, Maltose And Lactose. C) Polysaccharides-Starch And Dextrin.
4. Analysis of Amino Acids
5. Lipid Analysis [Group Experiments]
 - a. Determination Of Saponification Number.
 - b. Determination Of Acid Number.
 - c. Determination Of Iodine Number
6. Demonstration Experiments
 - a. Separation of Amino Acids By TLC.

PRACTICALS

BBT - 08: ANIMAL DIVERSITY & CELL BIOLOGY AND GENETICS

1. Study of Paramecium: W.M., Binary fission, conjugation
2. Earthworm ovary, Nervous system and Spermatheca,
3. Drosophila characters, sexual dimorphism, eye and wing mutation.
4. Microscopic slides of VS skin, oesophagus, stomach, liver, pancreas, lung, kidney, testis, ovary.
5. Identifications and systemic positions upto order of important non chordate and chordate specimens.
6. Permanent mounting.
7. Genetic exercise based on mendelian laws.
8. Detection of blood groups and Rh factors.
9. Mitosis in onion root tip
10. Identification of giant chromosome in chironomous larvae
11. Observation of Barr bodies
12. Cell Counting and viability
13. Blood Smear Preparation.
14. Separation of cell organelles by sucrose gradient.
15. Preparation and study of various stages of mitosis and meiosis.
16. Quantitation of DNA by spectrophotometry.
17. Preparation of competent.
18. U.V.Induced Mutagenesis.
19. Bacterial transformation by CaCl₂ method)
20. Transduction in *E. coli*.
21. Conjugation in *E. coli*.

PRACTICALS

BBT - 09: BASICS OF BIOSTATISTICS & PRINCIPLES OF MICROBIOLOGY

1. Exercise based on frequency distribution and graphic representation.
2. Exercise based on Chi- square test.
3. Exercise based on central tendency.
4. To study different methods of cleaning of glass wares used in microbiology laboratory.
5. To prepare cotton plugs for conducting microbiological experiments.
6. Demonstration of bacteria in water, soil, air and working table tops.
7. To perform Negative staining.
8. To perform Simple staining.
9. To perform Gram's staining.
10. To perform Acid- Fast.
11. To perform Capsule staining .
12. To prepare Nutrient Agar, Nutrient Broth.
13. To prepare Potato Dextrose Agar, Sabouraud Agar.
14. To Study different methods of obtaining pure culture of microorganisms.
15. To isolate and enumerate bacterial colonies from soil samples.
16. Isolation and enumeration of fungi from soil.
17. To perform *in-vitro* antibiotic sensitivity test against specific bacterial cultures.
18. Principles and application of instruments:
 - a. pH meters (digital).
 - b. Light and phase contrast microscope.
 - c. Colorimeter.
 - d. Spectrophotometer (Visible and UV).
 - e. Sound level meter.
 - f. Audiometer.
 - g. GM counter and Scintillation counter
 - h. Incubator
 - i. Shaker
 - j. Laminar flow bench