

# **B.Sc. Biotechnology- 2013**

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

**Selection: Common Entrance Test to be conducted by University of Kota  
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 Part I - 2013**

<b>Compulsory paper</b>	<b>Lec Hrs/week</b>	<b>Exam hrs</b>	<b>Max Marks</b>
BBT-00 Environmental studies	3	3	50
<b>Core paper (Theory)</b>			
BBT-01 Basic Bioscience	3	3	50
BBT-02 Mathematics and Biostatistics	3	3	50
BBT-03 Fundamentals of Chemistry and Biochemistry	3	3	50
BBT-04 Fundamentals of Physics and Computer	3	3	50
BBT-05 Biophysics and Instrumentation	3	3	50
BBT-06 Microbiology	3	3	50
<b>Total of theory papers</b>			<b>300</b>
<b>Core paper (Practicals)</b>			
BBT-07 Basic Bioscience + Mathematics And Biostatistics		3	50
BBT-08 Chemistry and Biochemistry + Physics and Computers		3	50
BBT-09 Biophysics and Instrumentation + Microbiology		3	50
<b>Total of Practical papers</b>			<b>150</b>
<b>Grand Total (Theory + Practical)</b>			<b>450</b>

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)

<b>Min. pass marks: 18</b>	<b>Distribution of Marks</b>		<b>Max. Marks: 50</b>
	<b>Duration: 3 hours</b>	<b>REGULAR</b>	
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
<b>TOTAL</b>	<b>50</b>	<b>50</b>	

**BBT 00 : Compulsory paper: Environmental studies**

## BBT - 01 Basic Bioscience (Theory)

**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. The classification up to the level of order. Binomial nomenclature. Algae (*Volvox*, *Oscillatoria*), Fungi (*Albugo/Puccinia*), Bryophytes (*Riccia*), Pteridophytes (*Lycopodium*), Gymnosperm (*Cycas*) and Angiosperm – monocot (Wheat), dicot (Sunflower)

### Unit-2

Anatomy-Internal structure of stem, leaf and root of Angiosperm and Gymnosperm. Differences in Angiosperm and Gymnosperm. Differences in dicot and monocot, Structure and function of different cells (parenchyma, collenchyma, sclerenchyma) Xylem and phloem. The concept of annual and perennials. Annual ring and wood formation.

### **Unit-3**

Morphology of seed plants, General organization of plant body such as aerial and under ground parts. 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.

### **Unit-4**

Biodiversity of animals, Classification and taxonomy of animals, Binomial nomenclature –Five kingdom approach. Taxonomy hierarchy, Concept of species. Study of animal types: Paramecium, Hydra and Earthworm – Classified, morphology, nutrition, respiration, reproduction. Elementary idea of Vermiculture, Sericulture, Apiculture and Pearl industry.

### **Unit-5**

Human anatomy, physiology of following organ system- digestive, respiratory, circulatory, nervous and sense organ. Developmental history (from fertilization to blastocyst stage).

## **BBT - 02 Mathematics and Biostatistics (Theory)**

**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**

Sets: theory, properties of sets. Complex number, Metrics.

Calculus: Integration: general introduction, significance and application for simple algebraic and trigonometric function. Extension of differential equations including homogenous and linear ODE's.

Convergence of series, Taylor's theorem, partial differentiation and local extrema of function of two variables.

### **Unit-2**

Linear algebra: Linear system of equations, row reduction algorithm, linear dependence of vectors and subspace of Euclidean n- space, eigen values and eigen vectors, diagonalisation of matrices, application to population growth models and mechanical systems.

### **Unit-3**

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.

Measure of central tendency – mean, median, mode.

### **Unit-4**

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

Descriptive statistics scatter plots, correlation, line of best fit.

#### **Unit-5**

Probability: Concept, calculation and theories.

Regression analysis, multiple linear regressions.

Confidence intervals and hypothesis, tests using normal t-tests.

## **BBT - 03 Fundamentals of Chemistry and Biochemistry (Theory)**

**Min. pass marks: 18**

**Duration: 3 hours**

**Max. Marks: 50**

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

#### **Unit-1**

Gaseous State: Kinetic theory of gases and derivation of kinetic gas equation. principles of oxidation- reduction, EMF and its measurement, single electrode potential, calculation of single electrode potential, thermodynamics of electro-potentials, classification of electrodes, amalgam, gas, metal/insoluble salts and oxidation- reduction electrodes, electrochemical cells.

#### **Unit-2**

Atomic chemistry

Bonding and structure: types of bonds (Ionic, Covalent, Coordinate). Bonding theories.

Structure of inorganic and organic molecules, bonding and reactivity in organic molecules,

Reaction Mechanism: Nucleophilic substitution catalysis in chemical and biological reactions

Organic Chemistry: Structure, bonding and reactivity in organic molecules, alcohol and Phenols, Aldehydes and Ketones, Acid

Esters, acid and base catalyzed hydrolysis, mechanism and action of serine hydrolases.

#### **Unit-3**

Introduction: Biological molecules, Molecular interactions as a basis for biological functions.

Chiral interactions, pH, pK. Buffer and colloids.

Carbohydrates: Definition, Classification, Structure of simple and complex carbohydrates.

Polysaccharides: Structure and linking in di- and Polysaccharides, Energy reserve and structural Polysaccharide.

#### **Unit-4**

Lipid: Structure of fatty acids (Palmitic acid, Stearic acid), lipids, oils and fats.

Vitamins fat and water-soluble.

Structure and properties of amino acids, their nature, peptide bond.

Determination of primary and secondary structure of proteins. The nature of tertiary and quaternary structure, methods of determining protein structure.

#### **Unit-5**

Protein purification: Principle functions; precipitation with salts and organic solvents, Chromatographic and electro-phoretic methods.

Nucleotides, nucleosides, purines, pyrimidines, structure of nucleic acids, B and Z form of DNA.

Enzymes and their role in metabolism, Anabolism and catabolism, Enzymes as catalysts, types of enzymes and their classification.

# **BBT - 04 Fundamentals of Physics and Computers (Theory)**

**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**

Elasticity: Stress and strain in solids. Hook's law, stress- strain curve, Properties of fluids, Viscosity: Streamline and turbulent flow, equation of continuity, flow of liquids through capillaries, Poiseulies equation, Reynolds number, Concept of pressure energy, Bernoulli's theorem and its applications, Venturi meter, Pilot's tube. Viscosity estimation by Oswald's viscometer, rotating cylinder, cone and plate.

## **Unit-2**

Surface tension: Surface tension surface energy, capillary action, angle of contact, relation between surface tension, excess pressure and curvature, Surface tension by Soap bubble jaeger's method, Quincke's method. Temperature dependence of surface tension.

Refrigeration: Introduction to refrigeration principles, coefficient of performance, simple structure of gas refrigerator. The molecule organization of membranes and the role of lipids and carbohydrates. The importance of membrane in metabolism.

## **Unit-3**

Spectral Identification: Quantitative and qualitative analysis.

Thermometry: Principles of thermometry, platinum resistant thermometer, thermocouple thermometers. Atomic structure: Bohr's II atom model, atomic nucleus.

Current electricity: DC circuits, concept to circuits AC. Resister, Capacitor.

Optics, Diffraction, Polarization, Interference, Lasers, Semiconductors, Semiconductor devices, Digital electronics.

Binary BCD number system, basic logic gates, fundamentals of measurement units.

## **Unit-4**

Introduction to computer: Use of computers in modern society e.g. weather forecasting, censure oil exploration, speech recognition, banking, publishing, accounting, research etc.

Information concepts and processing – evaluation of information processing-data, information, languages and communication, computer arithmetic operations.

Multi-user, multitasking, multiprocessing and real time operating systems.

## **Unit-5**

Computer networking, modern components of LAN and WAN.

Development and classification of computer, Advances, Spreadsheets.

Algorithms: Definition and properties, Flowcharts, principle-converting algorithm to flowcharting. Key Boards, storage devices, monitor interfacing, bus architecture and its effects on system performance. Use of basic programming in biology.

## **BBT - 05 Biophysics and Instrumentation (Theory)**

**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: Energy and its various forms, principle of Thermodynamics, energy exchange, conservation of energy.

Photobiology: Nature of light, Primary photochemical reactions, Photosynthesis, flowering, Solarization, Photo dynamism, Strategies in light reception, Photoreceptor in microbes. Plants and animals.

### **Unit-2**

Biophysics of vision, vision fault and correlations, Bioluminance.

Biophysics of sound vibration, Phono-receptor, Auditory function, Location and origin of sound, Hearing aids.

Membrane conductivity, Diffusion, Active transport, Osmosis, Diffusion pressure, deficit, Biosorption, Electrical properties of biological compartments, Electrochemical gradients, membrane potentials.

### **Unit-3**

Molecular interaction: Intra- molecular and Inter- molecular interaction, Attractive and repulsive forces operating within molecules and their overall effects on molecular interactions.

Radiations and their interaction with matter, Electromagnetic radiation, Ultraviolet and visible spectroscopy, Raman spectra, Nuclear magnetic Resonance, Electrophoresis, Radioactive tracer techniques Autoradiography.

### **Unit-4**

Instruments, basic principle and usage: colorimeter, spectrophotometry, Centrifuges, Analytical and differential pH meters. GM counter and Scintillation counter.

Microscopy: Compound microscope, Phase contrast, Dark field, Fluorescent and Electron microscopy

### **Unit-5**

Elucidation of intact biological structures in living organisms: Ultrasound. Optical filters, X-ray, X-ray diffraction, Computerized Axial Tomography, Electrocardiography, Electroencephalography and NMR imaging.

## **BBT - 06 Microbiology (Theory)**

**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**

Introduction, History of microbiology (including prokaryotes).

Origin and evolution of microorganism.

Classification and distribution of microorganisms.

### **Unit-2**

Structure, growth, nutrition, metabolism, physiology, genetics of viruses, mycoplasma, bacteria, fungi, protozoa and lichens.  
Microbiology of soil and geo-chemical cycles.  
Microbiology of air.

### **Unit-3**

Microbiology of water.  
Microbiology of food.  
Microbiology of dairy and dairy products.  
Industrial microbiology.

### **Unit-4**

Plant pathogenic microbes, disease causes and control.  
Human pathogenic microbes, disease causes and control.  
Host parasite relationships.

### **Unit-5**

Microbial economics.  
Method of sterilization and disinfection.  
Preparation and inoculation of culture media.  
Microbial staining techniques.

## **PRACTICAL**

### **BBT - 07: Basic bioscience + mathematics and biostatistics**

Study of examples of each type: Algae, Fungi, Bryophytes, Pteridophytes, Angiosperm, and Gymnosperm.  
Study of different parts of the plant: morphology and anatomy of root, stem and leaves, flower, Inflorescence. Fruit and seed types.  
Study of Paramecium: W.M., Binary fission, conjugation  
Hydra: W.M., LS and TS.  
Earthworm ovary, Nervous system and Spermatheca, Sectional slides.  
Drosophila characters, sexual dimorphism, eye and wing mutation.  
Insect collection, preservation and presentation.  
Microscopic slides of VS skin, oesophagus, stomach, liver, pancreas, lung, kidney, testis, ovary, spinal cord, endocrine gland and blastocyst of mammals.  
Permanent slides of vegetative and reproductive organs of plant types in theory.  
Exercise based on mathematics and biostatistics.  
Exercise based on frequency distribution and graphic representation.  
Exercise based on Chi- square test. Staining techniques.

## **PRACTICAL**

### **BBT - 08: Chemistry and Biochemistry + Physics and Computer**

Preparation of solution and buffer.  
Acid- base titration, molarity, molality, normality, sensitivity, specific accuracy.  
Unit volume and weight measurement  
Spot test for carbohydrates.  
Spot test for amino acids.

Spot test for soil.  
Reducing sugar estimation by Benedict's method and using Fehling's solutions.  
Quantitative estimation of amino acid.  
Protein estimation.  
Saponification of fats.  
Estimation of cholesterol.  
Enzyme assays.  
Viscosity measurements using thermocouple, RTD.  
Absorption spectrum of proteins.  
Iso-electric point of amino acids.  
Counting statistics using GM counter.  
Flat spiral spring: Y and n.  
Y of a rectangular thin bar by bending.  
Computer: Working and operating knowledge.  
Installing a computer: Using spread sheets.  
Use of Internet, e-mail, websites.  
Use of standard packages.  
Use of multimedia.

## **Practical**

### **BBT - 09: Biophysics and Instrumentation + Microbiology**

Absorption  
Adsorption  
Osmosis: Potato osmoscope  
Transport across membrane  
Study of DNA melting  
Sterilization technique  
Preparation of culture media.  
Cultivation and enrichment of microorganisms.  
Identification of microorganisms.  
Biochemical testing  
Quantitation of microorganisms.  
Transpiration: Ganong's potometer, four leaf method.  
Photosynthesis: Demonstration of Oxygen evolution.  
Light/Carbon dioxide necessary for photosynthesis.  
Detection of coliform for demonstration of purity of water.  
Principles and application of instruments:  
PH meters (digital).  
Light and phase contrast microscope.  
Colorimeter.  
Spectrophotometer (Visible and UV).  
Sound level meter.  
Audiometer.  
GM counter and Scintillation counter  
Incubator  
Shaker  
Laminar flow bench  
Hearing aids