**Syllabus and Course Scheme**
**Academic year 2019-20**

*B.Sc.- Biotechnology*
*Exam.-2020*

*UNIVERSITY OF KOTA*

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

*Website: uok.ac.in*

**B.Sc. Biotechnology- 2020**

**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-2020**

| **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 + Principles of Microbiology | | 3 | 50 |
| ***Total of Practical Papers*** | | ***150*** | |
| ***Grand Total (Theory + Practicals)*** | | ***450*** | |

**B.Sc. Biotechnology Pt-II Examination-2020**

| | **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**

| | **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 |
| BBT-26 Applied Animal Biotechnology+ Industrial Biotechnology | | 3 | 50 |
| BBT-27 Environmental Biotechnology + Computational Biology and IPR | | 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 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** |
|---|---|---|
| | **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** |

**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-1I

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-1II

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-1V

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-1I**

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

**UNIT-1II**

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-1V**

Lipids: classification and structure of fatty acids( Palmitic and stearic acid), Properties of oils and fats.
Biological functions of lipids. Structure 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. Lenhinger. 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 bilogy.
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, pathogenecity 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 - An overview of cell cycle; Amitosis, mitosis and meiosis. Components of cell cycle control system, Programmed cell death (Apoptosis).

### 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 & Dorouthy 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, 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.

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### 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. Leewenhook, 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 walk. Gram positive and Gram negative bacteria. Microbial spores, sporulation/ germination process.
Structure, growth, nutrition, metabolism, physiology, genetics of viruses. Mycoplasma.

## UNIT-III

Microbial growth, nutritional biodiversity, phases of growth, generation time, growth rate, monoauxic, diauxic and synchronous growth.
Microbes in extreme environment (temperature p) physical and chemical agents to kill microbes.

## UNIT-IV

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, candidasis,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 Daginawala.
9. Microbiology, Author- S.S. Purohit.
10. Microbiology, Authors- Presscott, 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

# B.Sc. Biotechnology Part-II
# Examination-2020

### BBT 10 Fundamentals of Molecular Biology

**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 to molecular biology – historical background, nature of genetic material, experimental proof for DNA as genetic material, types of nucleic acids (DNA and RNA). Watson Crick model of DNA, other forms of DNA (A-form, Bform and Z-form), properties of DNA, DNA denaturation and renaturation, concept of central dogma, satellite DNA and tandem repeats.

**UNIT -II**

DNA replication : mechanisms of prokaryotic DNA replication, semi-conservative model of replication, mechanism of DNA replication – discontinuous synthesis of DNA, RNA primer of DNA synthesis, DNA polymerases I, II, III and their role in DNA replication; eukaryotic DNA replication, DNA damage and repair.

**UNIT -III**

Regulation of gene expression in prokaryotes : Transcriptional control; enzyme induction and repression, constitutive. Synthesis of enzymes, the operon hypothesis : genes involved in regulation – regulatory genes, promoter gene, operator gene, and structural gene. Lac operon, Arg operon. Brief account of eukaryotic gene regulation.

**UNIT – IV**

Transcription control by termination and anti-termination, mRNA splicing, genetic code, types of RNA, wobble hypothesis, translation initiation and termination in prokaryotes.

**UNIT – V**

Post translational modification in prokaryotes and eukaryotes, protein sorting/ trafficking and protein localization and translocation: and signal transduction: channels and ion uptake.

## BBT – 11 Biophysics and Instrumentation

**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 -II

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 -III

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 -IV

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

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

### UNIT -V

Elucidation of intact biological structures in living organisms: Ultrasound. Optical filters, X-ray, X-ray diffraction, Computerized Axial Tomography, Electrocardiography, Electro-encephalography.

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## BBT 12: Basics of Plant Physiology

**Duration :3 hrs** **Max .Marks50**

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

Plant water relations : importance of water to plant life, physical properties of water diffusion and osmosis, absorption & ascent of sap. Transport of water and transpiration. Mineral nutrition : Essential macro and micro elements and their role. Transport of organic substances.

### UNIT – II

Photosynthesis : Significance, historical aspects, photosynthetic pigments, action spectra and enhancement effects, concept of two photo systems (Cyclic & Non cyclic) z-scheme. Photophosphorylation, C-3, C-4 and CAM pathway, photorespiration.

### UNIT – III

Respiration : ATP the biological energy currency, aerobic and anaerobic respiration, kreb's cycle, electron transport mechanism (chemi-osmotic theory), redox potential, oxidative phosphorylation, pentose phosphate pathway.

### UNIT – IV

Nitrogen and lipid metabolism : Biology of nitrogen fixation, importance of nitrate reductase and its regulation, ammonium assimilation, structure and function of lipids, fatty acid 21 biosynthesis, α&β oxidation, saturated and un saturated fatty acids, storage and mobilization of fatty acids.

### UNIT – V

Growth and Development : Definitions, phases of growth and development, kinetics of growth, seed dormancy Seed germination and factors of their regulation plant movements the concept of photoperiodism, plants hormones auxins, gibberellins, cytokinins, abscissic acid, ethylene, history of their discovery, biosynthesis and mechanism of actions photomorphogenesis, phytochromes and cytochromes.

## BBT 13 Plant Cell, Tissue and Organ Culture

**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

History, scope and applications of plant tissue culture – contribution of Indian Scientists. Concept of asepsis and methods of sterilization, Nutrient media, their composition and methods of preparation.

### UNIT -II

Basic Concepts in cell culture and cellular totipotency. Callus organogenesis – dedifferentiation. Somatic embryogenesis – induction of embryogeny in vitro, indirect and direct somatic embryogenesis,

### UNIT -III

Selection and preparation of explants for adventitious shoot bud induction and axillary bud proliferation. Steps of micropropagation-management of donor plants, culture establishment, shoot multiplication, rooting and hardening and acclimatization. Protoplast isolation, culture and differentiation. Somatic hybridization.

### UNIT -IV

Anther and pollen culture – production of haploids. In vitro fertilization, embryo, endosperm, ovary and ovule culture. Embryo rescue. Methods of cryopreservation for germplasm conservation. Somaclonal and gametoclonal variation. Meristem tip culture for elimination of viruses in plants.

Organ culture- Types, Techniques and process.

### UNIT -V

Cell culture and in vitro production of secondary metabolites. Important alkaloids and factors affecting their production. Hairy root culture, elicitation and biotransformation, Bioreactors – their types, construction and use in secondary metabolite production.

## BBT 14: Basics of Animal Physiology

**Duration :3 hrs** **Max .Marks50**

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

Digestion: Nutrients: Carbohydrates, lipids, proteins, vitamins, Digestive enzymes and hormones of GIT. Digestive mechanism: Mechanical and chemical digestion. Absorption and assimilation of end products of digestion.Balanced diet, malnutrition (PEM), obesity; endoscopy.

### UNIT-II

Respiration: Aerobic and anaerobic respiration. Structure of respiratory organs. Mechanism and regulation of breathing. Transport of $O_2$ and $CO_2$.Respiratory disorders: Emphysema, asthma, occupational disorders,spirometry.

### UNIT-III

Circulation: Circulatory fluids: Blood, lymph; blood cells; structure of haemoglobin.Blood circulation through heart, arteries, arterioles, capillaries,venules and veins. Cardiac cycle and its regulation. Blood clotting mechanism, blood pressure. Cardiac disorders, ECG, heart transplantation (an introductory idea).

### UNIT -IV

Excretion: Excretory products: $NH_3$, urea, uric acids, amino acids.Structure of kidney, nephron; mechanism of urine formation; micturition. Autoregulation, counter-current mechanism, renin-angiostatin system. Accessory excretory organs: Skin, liver, lungs etc. Excretory disorders, dialysis, Kidney transplant.

### UNIT -V

Muscle and Neural Physiology: Structure of smooth, skeletal and cardiac muscles; myofibrils. Isotonic and isometric contraction of muscles, sliding- filament theory of musle contraction; relaxation of muscle fibres; Properties of muscles ,myopathy.Kinds of neuron, structure of myelinated and nonmyelinated nerve fibres. Reflex action, types. Sensory Physiology:Tactile receptors, pain receptors, thermoreceptors, chemoreceptors.

## BBT 15 Fundamentals of Immunology and Animal Cell Culture

**Duration :3 hrs** **Max .Marks50**

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; and Immune Organs – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT. Antigens, Haptens,Adjuvants. Structure, Types, Functions and Properties of antibodies.

### UNIT- II

Characteristics of an antigen; Haptens; Epitopes (T & B cell epitopes); T-dependent and T-independent antigens; Adjuvants. Principles of Precipitation, Agglutination, Immunodiffusion, Immunoelectrophoresis, ELISA, ELISPOT, Western blotting, Immunofluoresence, Flow cytometry, Immunoelectronmicroscopy.Structure and Functions of MHC I & II molecules;

### UNIT- III

Complement- Components and biological activities.
Primary and Secondary Immune Response; Generation of Humoral and Cell Mediated Immune Response .Hypersensitivity, Autoimmune diseases.

### UNIT -IV

History of development of animal cell culture and methods of animal cell culture : culture media composition and preparation. Growth factors promoting proliferation of animal cell. Animal cell lines – their culture and maintenance. Stem cell cultures, embryonic stem cells and their applications.

### UNIT -V

Organ culture, whole embryo culture, transfection of animal cells : selectable markers, HAT selection, antibiotic resistance etc. Somatic cell fusion, transplantation of cultured cells. Differentiation of cells, culture of animal mycoplasma. Growth kinetics of cells in culture,

**PRACTICALS**

**BBT 16 Fundamentals of Molecular Biology&Biophysics and Instrumentation**

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 digestion and its analysis by gel electrophoresis.
6. Absorption
7. Adsorption
8. Osmosis: Potato osmoscope
9. Transport across membrane
10. Study of DNA melting
11. Photosynthesis: Demonstration of Oxygen evolution.
12. Light/Carbon dioxide necessary for photosynthesis.
13. 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
    k. Hearing aids

**PRACTICALS**

**BBT 17Basics of Plant Physiology&Plant Cell, Tissue and Organ Culture**

1. To study the permeability of plasma membrane using different concentration of organic solvents.
2. To demonstrate the phenomenon of the osmosis by the use of potato osmometer.
3. To study the phenomenon of plasmolysis and deplasmolysis.
4. To demonstrate the rate of transpiration by use of potometers (Ganong's/Farmers)
5. To study the relative rate of transpiration from the leaf surfaces of the different plants using cobalt chloride paper.
6. To demonstrate that light is necessary for photosynthesis.
7. To demonstrate the effect of different wavelengths of light during the photosynthesis.
8. To demonstrate the carbon-dioxide, light, water and chlorophyll are essential for photosynthesis by moll's experiment.
9. To compare the rate of photosynthesis under different condition by using wilmott's bubbler.

10. Comparison of the rate of respiration (R.Q.) of various plant parts or substrates with the help of Ganong' srespirometer.
11. Separation of chlorophyll pigments by the paper chromatography.
12. Sterilization techniques for non-living, plant material.
13. Tissue culture mediapreparation.
14. Slant preparation.
15. Excission of embryo / ovule / Anther and their inoculation.
16. Preparation of aseptic plant . Aseptic techniques.
17. Inoculation of culture. Root culture. Leaf culture. Shoot tip and meristem culture. Flower budand flower culture.
18. Isolated ovary culture.
19. Callus induction and regeneration.

**PRACTICALS**

**BBT 18 Basics of Animal Physiology&Fundamentals of Immunology and Animal Cell Culture**

1. Demonstration of catalase and ptyalin enzyme activity.
2. Haematocrit value.
3. Haemoglobin percentage.
4. RBC counting.
5. WBC counting.
6. Differential counting.
7. Blood group detection
8. Preparation of Blood film.
9. Preparation of smooth, skeletal (striated &non striated), cardiac muscle fibres.
10. Structure of Myelinated and non myelinated nerve fibre.
11. Sterilization techniques for animal material.
12. Media preparation.
13. Slant preparation.