Syllabus and Course Scheme
Academic year 2020-21

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
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.
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. 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: 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 & 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

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, 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

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, B form 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.

References:

1. Molecular Cell Biology, 7th Edition. Lodish, et. al.
2. Biochemistry, 4th edition. Donald Voet and Voet J
3. Harpers review of Biochemistry, 25th Edition. Murray RK, Rodwell VW.
4. Lehninger's Principles of Biochemistry, 5th Edition. Nelson DL and Cox MM
5. Biochemistry, 5th Edition. Garrett and Grisham
6. Molecular Biology of the Cell, 5th Edition, Bruce Alberts et. al.
7. Cytology, P.S. Verma, V.K. Agarval, S. Chand Publications

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, Bio luminance.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.

References:

1)Upadhyay, A., Upadhyay, K. and Nath N. (2005) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
2) Wilson K. and Walker J. (Eds.) (1995). Practical Biochemistry: Principles and Techniques, Cambridge University Press, U.K.
3) Sheehan, D. (2000). Physical Biochemistry: Principles and Applications, John Wiley and Sons Ltd. , Chichester, England.
4) Freifelder, D. (1982). Physical Biochemistry. Applications to Biochemistry & Molecular Biology, W.H. Freeman & Co.

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.

References:

1.Salisbury, F.B. and C.W. Ross (1992), Plant Physiology, Wadsworth Publication Company
2. Taiz, L. and Zeiger, E. (2002), Plant Physiology. 3rd Edn., Sinauer Associates
3. Srivastava, H.N. (2005) Plant Physiology, Pardeep Publications

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.

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.

References:

1.Bhajwani, S.S, & Razdan, M.K. (1996). Plant Tissue Culture. Theory and Practice, Elsevier.
2. Razdan, M.K. (2003) Introduction to Plant tissue culture, Science Publishers
3. Singh, B.D. (2004). Biotechnology expanding horizons, Kalyani Publishers, New Delhi.

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.

References:

1. Berry, A.K. Animal physiology.
2. Guyton, A.C. and Hall, J.E. A Text Book of Medical Physiology (10th Edition).
3. W.B. Saunders company.
4. Ganong, H. Review of Medical physiology. McGraw Hill.

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, Immunoelectron microscopy.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,

References:

1. Roitt, Brostoff, Male and Mosby. Immunology.
2. Kuby et al. Immunology. W.H. Freeman and Company.
3. Rao, C.V. An Introduction to Immunology. Narosa Pub. House.
4. Coleman, R.M. Fundamental Immunology. McGraw Hill.
5. Paul, W.E. Fundamentals of Immunology. Raven Press New York
6. Masters, J. Animal Cell Culture. Panima.
7. Freshney, I. Culture of Animal Cell. John Wiley.
8. Martin, C. (Ed). Animal Cell Culture Techniques. Springer.
9. Mather and Barnes. (Ed). Methods in Cell Biology. Vol. 5-7, Animal Cell Culture Method.Academic Press.
10. Paul, J. Animal Tissue Culture. Butler, M. and Dawson, M. Lab Fax : Cell Culture. Bios Scientific Publications.

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 17 Basics 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.

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**

BBT-19 Genetic Engineering and Recombinant DNA Technology

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

Introduction of genetic engineering. Isolation and purification of DNA from bacterial, plant and animal cells: agarose gel electrophoresis, Southern and Northern- blotting. SDS-PAGE and western blotting. Gene location: Hybridization techniques – Southern blotting; *In situ* hybridization.

Enzymes used in genetic engineering: restriction enzymes, DNA polymerases, kinases & phosphatases, DNA ligases and other enzymes.

UNIT-II

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

Genomic and cDNA libraries: Preparation and uses.

DNA Sequencing: traditional (Sanger coulsion and Maxam gilbert method) and solid phase automated sequencing.

UNIT-III

Gene tagging and Application of transposons in gene tagging. Cloning Vectors: Plasmid vectors, Bacteriophage. Cloning and expression of foreign genes in prokaryotes (*E.coli*). Cloning and expression of foreign genes in eukaryotes(yeast). Brief idea about gene cloning in plant and mammalian cells. Application of molecular cloning.

UNIT-IV

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

Application of bio informatics in search for DNA homology.

UNIT-V

Therapeutic use of r-DNA technology: Products of human therapeutic interest(insulin, hGH), antisense molecules, recombinant vaccines. Gene therapy.

Transgenic plants: Bt transgenic (cotton, brinjal), flavr savr tomato, golden rice.

Protein engineering. Transgenic animals.

Reference Books:

1. Sambrose and Russell. (2001), Molecular Cloning. 3 volumes. CSH Lab Pres. Hellen, K., Adrian, M. and John W. (2000). Recombinant DNA and Biotechnology.
2. Old and Primrose. (1994). Principles of Gene Manipulation, Blackwell Scientific Publications.
3. Glick B.R and Pasternak J.J. (2010), Molecular Biotechnology: Principles and Applications of Recombinant DNA. ASM Press.
4. Brown TA. (2010). Gene Cloning and DNA Analysis. 6th edition. Blackwell Publishing, Oxford,
5. Primrose, S. B. Twyman, P.M. and Old, R. W. (2001) Principles of gene manipulation (6th Ed.). Black well publishers.
6. Old and Primrose. (1994). Principles of Gene Manipulation, Blackwell Scientific Publications.

BBT – 20 Applied Plant Biotechnology

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 of plant tissue culture. Tissue culture laboratory organization. Concept of totipotency, Cyto-differentiation and its importance. Aseptic techniques.
Culture medium: Nutritional requirements of explants, PGR's and their *in vitro* roles, media preparation. Explants: Characteristics sterilization and Selection.

UNIT-II

Principle, protocol and importance of anther culture, pollen culture, organ culture, callus culture, cell suspension culture.Clonal propagation. Somatic embryogenesis and synthetic seed production. Bioreactors – their types, construction and use in secondary metabolite production.

UNIT-III

Protoplast Culture: Principle, Methods of fusion. Somatic hybridization.
Screening and identification of hybrid and cybrid.
Basic Techniques in r-DNA Technology for Plant transformation: Ti and Ri plasmids.

UNIT-IV

Genetic markers: Marker gene and reporter genes with examples.
Vectors and their applications in plant biotechnology : pBR322, phage , cosmids, phagmids.
Direct DNA transfer (particle bombardment, electroporation, microinjection).

UNIT-V

Plant secondary metabolites and their production. Hairy root culture for production of useful metabolites Applications of plants biotechnology in breeding and crop improvement. Therapeutic proteins and edible vaccines.

Reference Books:

1. Introduction to Plant Tissue Culture: M.K. Razdan
2. Plant Tissue Culture Theory & Practical: S.S. Bhojwani & M.R. Razdan
3. Slan A.C. (1996), Plant Tissue Culture- Oxford & (BH Publishing co. pvt.ltd.)
4. Lydiane kyle John Kleyin plant test tubes: An Introduction to micro propagation.
5. Introduction to plant biotechnology by H.S. Chawla
6. Plant Tissue Culture: Application and Limitations. Bhowjwani, S.S. 1990.
7. Plant Cell Culture, Advances in Biochemical Engineering and Biotechnology. Anderson, L.A.,Recombinant DNA. Watson, 1992.
8. Gene transfer to Plants. Portykns, 1995.
9. Plant Biotechnology, Ashwani Kumar, Shikha Rohy, I.K. International Pvt. Ltd, 2006.
10. Biotechnology by B.D.Singh (Kalyani Publishers)

BBT – 21 Applied Animal Biotechnology

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 and scope of animal tissue culture. Natural media and artificially defined media. Primary cell culture: Disaggregation of tissues, enzymatic disaggregation and mechanical disaggregation.
Cell lines: Cloning, selection and maintenance of cell lines.

UNIT-II

Growth kinetics of animal cells in cultures. Primary culture, Secondary culture (Transformed cell and continuous cell lines). Bioreactors for animal cell culture.
In Vitro Fertilization: Need and general Methodology.

UNIT-III

Transfection of animal cell lines. Large scale culture of cells. Growth factors promoting proliferation of animal cells: EGF, FGF, PDGF, IL-1. IL-2, NGF and Erythropoietin. Cryopreservation of cell line, ovum, sperm and embryo. *In vitro* fertilization and embryo transfer

UNIT-IV

Expression of cloned proteins in animal cells: Expression vector, over.production and down stream processing of the expressed proteins. Production and application of monoclonal antibodies.

UNIT-V

Application of animal cells cultures for studies of gene expression.. Production and application of monoclonal antibodies.
Transgenic animals: Technique and application, Sheep and Mice.

Reference Books:

1. Animal Tissue Culture- Mathur
2. Animal Tissue Culture - R. IanFreshney
3. Animal biotechnology- M.M.Ranga
4. Cell & Tissue Culture in animals- Masters
5. Biotechnology-expanding horizons B.D. Singh

BBT - 22 Industrial Biotechnology

Min. pass marks: 18 **Duration: 3 hours** **Max. Marks: 50**

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

UNIT- I

Fermentation- Bacterial, Fungal and Yeast, Biochemistry of fermentation. Traditional and Modern Biotechnology- A brief survey of organisms, processes, products. Bioreactor / Fermenter – Types and operation of Bioreactors, Media design for fermentation processes, Solid substrate & liquid fermentations.

UNIT- II

Basic concepts of Upstream and Downstream processing in Bioprocess.
Primary Metabolites- Production of commercially important primary metabolites like organic acids, amino acids and alcohols.

UNIT- III

Secondary Metabolites- Production processes for various classes of secondary metabolites: Antibiotics, Vitamins and Steroids.

UNIT- IV

Production of Industrial Enzymes. Cheese, Beer, SCP & Mushroom culture, Production of recombinant proteins having therapeutic and diagnostic applications, vaccines.

UNIT - V

Production of Biopesticides, Biofertilizers, Biopolymers, Biodiesel

Reference Books:

1. Casida, L.E. “Industrial Microbiology”, New Age International (P) Ltd, 1968.
2. Presscott, S.C. and Cecil G. Dunn, “Industrial Microbiology”, Agrobios (India), 2005.
3. Cruger,Wulf and Anneliese Crueger, “Biotechnology: A Textbook of Industrial Microbiology”, 2nd Edition, Panima Publishing, 2000.
4. Stanbury, P.F., A. Whitaker and S.J. Hall “Principles of Fermentation Technology”, 2 nd Edition, Butterworth – Heinemann (an imprint of Elsevier), 1995.
5. C.F.A Bryce and EL.Mansi, Fermentation microbiology & Biotechnology, 1999.
6. K.G.Ramawat & Shaily Goyal, Comprehensive Biotechnology, 2009, S.Chand.

BBT - 23 Environmental Biotechnology

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

Pollution of air, water and land with reference to their causes, nature of pollutions, impact and control strategies environmental damage by agriculture, perspectives of pollution in urban, industrial and rural areas. Habitat Pollution by Chlorinated Hydrocarbons (DDT, PCBs, Dioxin etc), Organophosphates, Heavy Metals, Die-offs, Endocrine disrupting chemicals.The scope of environmental biotechnology.

UNIT-II

Liquid waste treatment; Biofilters, activated sludge systems; membrane bioreactors.
Biotechnological approaches for solid waste management.
Phytotechnology-terrestrial phytosystems, metal phytoremediation,
Phytotechnology-aquatic phytosystems, nutrient film techniques, algal treatment systems.

UNIT-III

Biodegradation of macromolecules; Biodegradation of xenobiotics; Vermicomposting.
Heavy metal pollution; Bioremediation of metal contaminated soils, spilled oil and grease deposits and synthetic pesticides. Microorganisms and organic pollutants; Extremophiles

UNIT-IV

Biosensors to detect environmental pollutants. Natural pesticides – Neem and *Thuringiensis*.
Biotechnology strategies in forestry and wasteland management.
Biotechnology in biodiversity conservation: gene banks, germplasm conservation and DNA Banks.

UNIT-V

Biological control of other insects swarming the agriculture fields. Enrichment of ores by microorganisms (biomining). Biofertilizers, nitrogen-fixing microorganisms enriching the soil with assimilable nitrogen compounds.
Genetically modified organisms and Biosafety- a general account.

Reference Books:

1. Environmental Biotechnology: Concepts and Applications Hans-Joachim Jördening, Josef Winter John Wiley & Sons,
2. Advanced Environmental Biotechnology By S.K.Agarwal APH Publishing,
3. Environmental Biotechnology By S.N Jogdand Himalaya Publishing
4. Textbook of Environmental Biotechnology By Mohapatra I. K. International Pvt Ltd
5. Environmental Biotechnology: Basic Concepts and Applications By Indu Shekhar Thakur
6. Environmental Biotechnology: Theory and Application By Gareth G. Evans , Judy Furlong.
7. Manahan, S.E. 1997. Environmental Science and Technology. Lewis, New York.
8. Evans, G.M. and Furlong J.C. 2003. Environmental Biotechnology: Theory and Application. John Wiley and Sons.
9. Thomas, J.A. and Fuchs, R. 2002. Biotechnology and Safety Assessment. Academic Press.

BBT -24 Computational Biology and IPR

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- I

Introduction to Bioinformatics and Biological Databases.: Principles of DNA and Protein sequencing, File Formats for storage of Sequence and Structural Data, Primary Sequence Databases of Nucleic Acids and Proteins, Organism Specific Genome Databases, Structural Databases.

UNIT- II

Specialized Sequence Databases of Expressed Sequence Tags, Gene Expression, Single Nucleotide Polymorphism, OMIM, Unigene etc., Data Retrival with ENTERZ, SRS and DBGET, Secondary Databases (Pfam, PROSITE, PRINT, Block, etc.)

UNIT- III

Algorithms and Tools: Sequence Alignment (Pair wise and Multiple). Alignment Algorithms, Database, Similarity Searches (BLAST, FASTA AND psi-BLAST). Amino Acid Substitution Matrices (PAM, BLOSUM), Profiles and Motifs.

UNIT- IV

Introduction to Intellectual Property: Patents, Types, Trademarks, Copyright & Related Rights,
Industrial Design and Rights, Traditional Knowledge, Geographical Indications- importance of IPR –patentable and non patentables – patenting life – legal protection of biotechnological inventions –World Intellectual Property Rights Organization (WIPO).

UNIT- V

Grant of Patent and Patenting Authorities: Types of patent applications: Ordinary, PCT, Conventional, Divisional and Patent of Addition; An introduction to Patent Filing. Procedures; Patent licensing and agreement; Patent infringement- meaning, scope, litigation, case studies, Rights and Duties of patent owner.

Reference Books:

1. Bioinformatics: Concepts, Skills and Application by Rastogi, S.C
2. B N Mishra, Bioinformatics: Concept and application, Pearson Education (in Press)
3. Anthony JF Griffths: An intro to Genetic analysis. 1st Ed.
4. Michael Starkey and Ramnath Elaswarapu; Genomics Protocols, Humana Pres
5. Stephen Misner & Stephen Krawetz Bioinformatics Methods and Protocol
6. Lawrence Hunter – Artificial Intelligence & Mol. Biology.
7. Westhead P: Instant notes on Bioinformatics; Viva Publication
8. Hooman H Rasidi Bioinformatics Basic Application in Biological Science and medicine; CRC Press.
9. Mittal, D.P. (1999). Indian Patents Law, Taxmann, Allied Services (p) Ltd.
10. Singh K K (2015). Biotechnology and Intellectual Property Rights: Legal and Social Implications.

PRACTICAL

BT-25 Genetic Engineering and Recombinant DNA Technology+ Applied Plant Biotechnology

1. Isolation of plasmid DNA.
2. Isolation of phage DNA.
3. Restriction mapping of Plasmid DNA.
4. Cloning in Vectors.
5. PCR.
6. To study the production of transgenic.
7. Isolation & identification of secondary metabolites from plant cell
8. Preparation of synthetic seeds: Encapsulation Techniques.
9. Demonstration of protoplast fusion employing PEG.

BBT-26 Applied Animal Biotechnology+ Industrial Biotechnology.

1. To study of transplantations -tumors, organs, cells.
2. Western- blotting.
3. Batch fermentation in conical flask.
4. Solid state fermentation.
5. Screening of microbes for production of industrially important enzymes.
6. Optimization of conditions for optimal production of enzyme: - Media composition, Incubation temperature, Aeration, Incubation time.
7. Instrumentation of fermentor. Design of various types of fementers & bioreactors.
10. Study different parts of fermenter.
11. A visit to any educational institute/industry to see an industrial fermenter, and downstream processing operations.

BBT-27 Environmental Biotechnology + Computational Biology and IPR

1. To estimate total hardness of water
2. To estimate Calcium hardness of water
3. To estimate the total solids (TS), total dissolved solids (TDS) and suspended solids (SS) in the given water sample
4. To estimate dissolved oxygen content of wastewater.
5. To estimate chemical oxygen demand of the given sample.
6. To estimate Biological Oxygen Demand (BOD)
7. To measure the concentration of chloride in it the given sample
8. Working on Biological databases, NCBI, DDBJ, EMBL.
9. Visualizing and Retrieving protein and nucleic acid sequences, structures, EST sequences, SNP data using database browsers and genome browsers.
10. Converting sequences between different formats. Nucleic acid sequence analysis by using
11. Phylogeny approaches. BLAST and FASTA.
12. Protein Sequence analysis and structure predication working on docking and visualizing