

Proposed syllabus and Scheme of Examination

for

B.Sc. (Honors) with Biotechnology

Submitted

to

*Mohanlal Sukhadia University
Udaipur*

Under

Choice Based Credit System

2015

Department of Biotechnology
Mohanlal Sukhadia University
Syllabus and Scheme of Examination

For

B.Sc. (Honors)CBCS Program Biotechnology

Type of course	Course code	Title of the Course	L-T-P/Week	No. of credits	University exam	Internal assessment	Total
Semester I							
Core course 1	B1BT01CT01	Plant Biology and Diversity	3-1-0	4	80	20	100
Core course 2	B1BT02CT02	Introduction to Microbiology	3-1-0	4	80	20	100
Core course practical 1	B1BT03CP01	Plant Biology and Diversity	0-0-4	2	80	20	100
Core course practical 2	B1BT04CP02	Introduction to Microbiology	0-0-4	2	80	20	100
GE1	B1BT05GET01		3-1-0	4	80	20	100
GE Practical 1	B1BT06GEP01		0-0-4	2	80	20	100
Ability Enhancement Compulsory Course (AECC)	B1BT07AECC01	English Communication	2-0-2	2	80	20	100
				20	560	140	700
Semester II							
Core course 3	B2BT01CT03	Animal Biology and Diversity	3-1-0	4	80	20	100
Core course 4	B2BT02CT04	Fundamentals of Biochemistry	3-1-0	4	80	20	100
Core course practical 3	B2BT03CP03	Animal Biology and Diversity	0-0-4	2	80	20	100
Core course practical 4	B2BT04CP04	Fundamentals of Biochemistry	0-0-4	2	80	20	100
GE2	B2BT05GET02		3-1-0	4	80	20	100

GE Practical 2	B2BT06GEP02		0-0-4	2	80	20	100
Ability Enhancement Compulsory Course (AECC)	B1BT07AECC02	Environmental Science	2-0-2	2	80	20	100
				20	560	140	700
Semester III							
Core course 5	B3BT01CT05	Cell Biology, Genetics and evolution	3-1-0	4	80	20	100
Core course 6	B3BT02CT06	Basics of Molecular Biology	3-1-0	4	80	20	100
Core course 7	B3BT03CT07	Microbial Biology and Diversity	3-1-0	4	80	20	100
Core course practical 5	B3BT04CP05	Cell Biology, Genetics and evolution	0-0-4	2	80	20	100
Core course practical 6	B3BT05CP06	Basics of Molecular Biology	0-0-4	2	80	20	100
Core course practical 7	B3BT06CP07	Microbial Biology and Diversity	0-0-4	2	80	20	100
GE3	B3BT07GET03		3-1-0	4	80	20	100
GE Practical 3	B3BT08GEP03		0-0-4	2	80	20	100
SEC I	B3BT09SEC01	Any one from the given list	2-0-2	2	80	20	100
				26	720	180	900
Semester IV							
Core course 8	B4BT01CT08	Metabolic Pathways	3-1-0	4	80	20	100
Core course 9	B4BT02CT09	Principles of Plant Tissue Culture	3-1-0	4	80	20	100
Core course 10	B4BT03CT10	Principles of Animal Cell Culture	3-1-0	4	80	20	100
Core course practical 8	B4BT04CP08	Metabolic Pathways	0-0-4	2	80	20	100
Core course practical 9	B4BT05CP09	Principles of Plant Tissue Culture	0-0-4	2	80	20	100
Core course practical 10	B4BT06CP10	Principles of Animal Cell Culture	0-0-4	2	80	20	100
GE4	B4BT07GET04		3-1-0	4	80	20	100
GE Practical 4	B4BT08GEP04		0-0-4	2	80	20	100
SEC II	B4BT09SEC02	Any one from the given list	2-0-2	2	80	20	100

				26	720	180	900
Semester V							
Core course 11	B5BT01CT11	Metabolic Pathways	3-1-0	4	80	20	100
Core course 12	B5BT02CT12	Principles of Plant Tissue Culture	3-1-0	4	80	20	100
Core course practical 11	B5BT03CP11	Metabolic Pathways	0-0-4	2	80	20	100
Core course practical 12	B5BT04CP12	Principles of Plant Tissue Culture	0-0-4	2	80	20	100
DSE1	B5BT05ET01	Principles of Recombinant DNA Technology	3-1-0	4	80	20	100
DSE 2	B5BT06ET02	Natural Resources and Environmental Biotechnology	3-1-0	4	80	20	100
DSE Practical 1	B5BT07EP01	Principles of Recombinant DNA Technology	0-0-4	2	80	20	100
DSE Practical 2	B5BT08EP02	Natural Resources and Environmental Biotechnology	0-0-4	2	80	20	100
				24	640	160	800
Semester VI							
Core course 13	B6BT01CT13	Plant Physiology	3-1-0	4	80	20	100
Core course 14	B6BT02CT14	Animal Physiology	3-1-0	4	80	20	100
Core course practical 13	B6BT03CP13	Plant Physiology	0-0-4	2	80	20	100
Core course practical 14	B6BT04CP14	Animal Physiology	0-0-4	2	80	20	100
DSE3	B6BT05ET03	Plant Biotechnology and its Commercial Applications	3-1-0	4	80	20	100
DSE 4	B6BT06ET04	Biotechnology in Human and Animal Health	3-1-0	4	80	20	100

DSE Practical 1	B6BT07EP03	Plant Biotechnology and its Commercial Applications	0-0-4	2	80	20	100
DSE Practical 2	B6BT08EP04	Biotechnology in Human and Animal Health	0-0-4	2	80	20	100
				24	640	160	800

Type of course	Course code	Title of the Course
Core course 1	B1BT01CT01	Plant Biology and Diversity
Core course 2	B1BT02CT02	Introduction to Microbiology
Core course 3	B2BT01CT03	Animal Biology and Diversity
Core course 4	B2BT02CT04	Fundamentals of Biochemistry
Core course 5	B3BT01CT05	Cell Biology, Genetics and evolution
Core course 6	B3BT02CT06	Basics of Molecular Biology
Core course 7	B3BT03CT07	Microbial Biology and Diversity
Core course 8	B4BT01CT08	Metabolic Pathways
Core course 9	B4BT02CT09	Principles of Plant Tissue Culture
Core course 10	B4BT03CT10	Principles of Animal Cell Culture
Core course 11	B5BT01CT11	Metabolic Pathways
Core course 12	B5BT02CT12	Principles of Plant Tissue Culture
Core course 13	B6BT01CT13	Plant Physiology
Core course 14	B6BT02CT14	Animal Physiology

Core course practical		
Core course practical 1	B1BT03CP01	Plant Biology and Diversity
Core course practical 2	B1BT04CP02	Introduction to Microbiology
Core course practical 3	B2BT03CP03	Animal Biology and Diversity
Core course practical 4	B2BT04CP04	Fundamentals of Biochemistry
Core course practical 5	B3BT04CP05	Cell Biology, Genetics and evolution
Core course practical 6	B3BT05CP06	Basics of Molecular Biology
Core course practical 7	B3BT06CP07	Microbial Biology and Diversity
Core course practical 8	B4BT04CP08	Metabolic Pathways
Core course practical 9	B4BT05CP09	Principles of Plant Tissue Culture
Core course practical 10	B4BT06CP10	Principles of Animal Cell Culture
Core course practical 11	B5BT03CP11	Metabolic Pathways
Core course practical 12	B5BT04CP12	Principles of Plant Tissue Culture
Core course practical 13	B6BT03CP13	Plant Physiology
Core course practical 14	B6BT04CP14	Animal Physiology

Generic Elective	
GE1	B1BT05GET01
GE2	B2BT05GET02
GE3	B3BT07GET03
GE4	B4BT07GET04

Generic Elective Practical	
GE Practical 1	B1BT06GEP01
GE Practical 2	B2BT06GEP02
GE Practical 3	B3BT08GEP03
GE Practical 4	B4BT08GEP04

Skill Enhancement Courses (Any four)

Botany	Biotechnology
1. Biofertilizers	1. Probiotic Technology
2. Herbal Technology	2. Animal Cell Sciences
3. Nursery and Gardening	3. Microbiological Analysis of Air and Water
4. Floriculture	4. Techniques in Biotechnology
5. Medicinal Botany	5. Techniques in Plant Tissue Culture
6. Plant Diversity and Human Welfare	
7. Ethnobotany	
8. Mushroom Culture Technology	

Discipline Specific Electives Theory		
DSE1	B5BT05ET01	Principles of Recombinant DNA Technology
DSE 2	B5BT06ET02	Natural Resources and Environmental Biotechnology
DSE3	B6BT05ET03	Plant Biotechnology and its Commercial Applications
DSE 4	B6BT06ET04	Biotechnology in Human and Animal Health

Discipline Specific Electives Practical		
DSE Practical 1	B5BT07EP01	Principles of Recombinant DNA Technology
DSE Practical 2	B5BT08EP02	Natural Resources and Environmental Biotechnology
DSE Practical 1	B6BT07EP03	Plant Biotechnology and its Commercial Applications
DSE Practical 2	B6BT08EP04	Biotechnology in Human and Animal Health

Ability Enhancement Course		
Ability Enhancement Compulsory Course (AECC)	B1BT07AECC01	English Communication
Ability Enhancement Compulsory Course (AECC)	B1BT07AECC02	Environmental Science

Total credits: 140

SEMESTER I

C1

Plant Biology and Diversity

Unit I

Introduction to Plant kingdom- classification of different plant groups, units of classification, Binomial nomenclature, Plant Herbarium.

General features, classification, thallus organization, mode of nutrition, reproduction, life cycle and economic importance of algae and fungi. General features and economic importance of lichen.

16 Credit hours

Unit II

General features, classification, reproduction, life cycle and economic importance of bryophytes and pteridophytes.

12 Credit hours

Unit III

General features, classification, reproduction, life cycle and economic importance of gymnosperms and angiosperms.

12 Credit hours

Unit IV

Plant anatomy- Introduction, organization of meristem, theories related to their organization. Tissue and tissue system –Parenchyma, collenchyma, sclerenchyma, xylem, phloem and secretory structure. Primary and secondary structure of roots, stem and leaf.

10 Credit hours

Unit V

Life history of a typical angiosperm, Microsporogenesis, Megasporogenesis, development of male and female gametophyte, pollination, fertilization, embryo and seed development. Structure, development and types of endosperm, Polyembryony. Apomixis and parthenocarpy.

10 Credit hours

Recommended Books

1. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 1996. Introductory Mycology. John Wiley and Sons, Inc.
2. Kumar, H.D. 1988. Introductory Phycology. Affiliated East-West Press Ltd., New Delhi.
3. Parihar, N.S. 1991. Bryophyta. Central Book Depot, Allahabad.
4. Vashishta, P.C. 1991. Vascular Cryptogam. S. Chand and Co. Ltd., N. Delhi.
5. Pandey, Mishra and Trivedi. 2001. A text book of Botany, Vol. 1 and II. Publishing House New Delhi.
6. Bhojwani, S.S. and Bhatnagar, S.P. 2000. The embryology of Angiosperm, 4th Revised and Enlarged edition. Vikas Publishing House, New Delhi.
7. Sambamurthy, A.V.S.S. and Subramanyam, N.S. 1989. A Textbook of Economic Botany. Wiley Easter Ltd. New Delhi.
8. Singh, V., Pandye P. C and Jain D. K. 2011. Text Book of Botany, Rastogi Publication, Meerut.
9. Singh, V., Pandye P. C and Jain D. K. 2011. Text Book of Angiosperm, Rastogi Publication, Meerut.

C2

Introduction to Microbiology

Unit-I

Bacteriology : Modern systems of classification of bacteria. General features, distribution, cell size, shape and arrangement, structure of bacterial cell capsule, flagella, pilli, cell wall – chemical composition and wall characteristics, plasma membrane, mesosomes, cytoplasm, nucleoids.

15 Credit hours

Unit-II

Virology – virus classification, phylogeny, general features, structure, replication in bacteriophages. Transmission of plant and animal viruses and diseases caused by them.

Viroids, virusoids and prions: general features and diseases caused by them.

15 Credit hours

Unit-III

Mycoplasma – history, ultrastructure, nutrition, classification, phylogeny, reproduction and methods of cultivation. Elementary account of most common human /animals diseases (Pulmonary pneumonia, urethritis) caused by mycoplasma.

Brief account of phytoplasma and important diseases caused by them (Sesame phyllody, little leaf of brinjal, grassy shoot of sugarcane).

10 Credit hours

Unit-IV

Methods in microbiology – microbial cultures, physical conditions for growth , methods for culturing aerobic and anaerobic bacteria. Culture media – selective and differential media nutrient agar, nutrient broth, enrichment media and other media.

10 Credit hours

Unit-V

Plant-microbe interaction: bacterial (associative symbiont, PGPR, *Rhizobium*, fungal symbiosis-mycorrhiza), symbiotic association (bacteria and fungi, microbe-microbe interactions-symbiosis between algae and fungi: lichens) : Antagonistic interactions – amensalism, competition, parasitic and predation.

10 Credit hours

Recommended Books

1. Pelczar and Krieg. Microbiology. McGraw Hill.
2. Prescott, H. and Klein. 2000. Microbiology. McGraw Hill.
3. Tortora. Microbiology : An Introduction. Pearson Education.
4. Stainer, R.Y., Ingrahm, J.L., Wheelis, M.L. and Painter, P.R. General Microbiology. The MacMillian Press Ltd.
5. Madigan, M.T., Martinko, J.M. and Parker, J. B. Biology of Microorganism. Prentice-Hall.
6. Dubey, R.C. and Maheshwari, D.K. A Text Book of Microbiology. S. Chand and Company.

SEMESTER II

C3

Animal Biology and Diversity

Unit-I

Introduction to taxonomy, rules of nomenclature , domain- kingdom classification , taxonomic hierarchy of animals, organization of animal body- levels of organization; body plan; symmetry; germ layers; body cavity (coelom) and metamerism.

15 Credit hours

Unit-II

General characteristics and classification of invertebrates (upto classes) Protozoa, Porifera, Coelenterata, Platyhelminthes, Archelminthes, Arthropoda, Annelida, Mollusca, Echinodermata.

10 Credit hours

Unit-III

General characteristics and classification of vertebrates (upto orders). General characters of Protochordates, Pisces, Amphibia, Reptilia, Aves, Mammalia.

10 Credit hours

Unit-IV

Animal tissues –Epithelial tissue (Types of simple and stratified epithelium, glandular epithelium types of glands), Connective tissue (Connective tissue proper, supportive connective tissue, fluid connection tissue (blood and lymph), muscular tissue (striated muscle, smooth muscle, cardiac muscle), nerve tissue.

15 Credit hours

Unit-V

Developmental biology – elementary idea of spermatogenesis, oogenesis, fertilization, cleavage, blastulation and gastrulation. foetal membranes, placenta and its classification. Organogenesis, regeration and growth.

10 Credit hours

Recommended Books

1. Ganguli, B.B., Sinha, A.K. and Adhikari, S. 2001. Biology of Animals. (Vol. I and III). New Central Book Agency, Calcutta.
2. Kotpal, R.L. 1990. Modern Text Book of Zoology, Invertebrates, 8th Edition. Rastogi Publication, Meerut.
3. Jordan, E.L. and Verma, P.S. 2001. Invertebrate Zoology. S. Chand and Co., New Delhi.
4. Balinsky. Introduction to Embryology. Panima.
5. Subramaniam, T. Developmental Biology. Narosa

C4

Fundamentals of Biochemistry

Unit-I

Identifying characteristics of living matter, Bioelements, Water: structure and unique properties, Acid, Base, Buffers, Polyprotic acids. Principles of oxidation- reduction, Chemical bonding: Covalent and Non covalent bonds. **10 Credit hours**

Unit II

Monosaccharides : Classification, configuration, conformation, Common Disaccharides, Structure and occurrence of storage and structural polysaccharides, Glycosaminoglycans, Glycoprotein: structure and function. **10 Credit hours**

Unit III

Fatty acids, Triacylglycerol, Glycerophospholipids, Sphingolipids: Sphingomyelins, cerebroside and gangliosides, Cholesterol, Micelles, Bilayers, Liposomes, Lipoprotein structure and function. **15 Credit hours**

Unit IV

Amino acids: Structure, nomenclature and general properties, Peptide bond, Primary structure of proteins: amino acid composition, Secondary structure: peptide group, Tertiary and quaternary structure of proteins. **15 Credit hours**

Unit V

Vitamins: water and fat soluble, their coenzyme forms, sources and deficiency diseases.

Recommended dietary allowance (RDA): source and biochemical function. **10 Credit hours**

Recommended Books

1. Voet and Voet. 2000. Biochemistry. John Wiley.
2. Lehninger. 2000. Principles of Biochemistry. CBS Publishers.
3. Stryer, L. 2002. Biochemistry. W.H. Freeman.
4. Harper. 2003. Biochemistry. McGraw-Hill.
5. Zubay. 1995. Biochemistry. Brown Publishers.
6. Trehan, K. Biochemistry. Wiley Eastern Publications.
7. Jain, J.L. Fundamentals of Biochemistry. S. Chand and Company.
8. Deb, A.C. Fundamental of Biochemistry.
9. Methew, C.K. Biochemistry. Pearson Education.

SEMESTER III

C5

Cell Biology, Genetics and Evolution

Unit-I

Cell: types, ultrastructure, cell theory. Structure and functions of cell organelles – endoplasmic reticulum, golgi complex, mitochondria, chloroplast, ribosomes, lysosomes, peroxisomes, nucleus, Vacuole and Cytoskeleton structures.

15 Credit hours

Unit-II

Chromosome: morphology and structural organization – centromere, secondary constriction, telomere, chromonema, euchromatin and heterochromatin, chemical composition and karyotype. Special types of chromosomes: Salivary gland and Lampbrush chromosomes. Cell cycle: mitosis and meiosis and their regulation.

15 Credit hours

Unit-III

Mendel's work, laws of heredity, monohybrid and dihybrid cross, test cross, back cross, reciprocal cross. incomplete dominance, codominance, hyperdominance and lethal gene interaction. Interaction of genes : supplementary, complementary, duplicate, collaborator, recessive epistasis and dominant epistasis.

10 Credit hours

Unit-IV

Cytoplasmic Inheritance : Plastid inheritance in *Mirabilis*, petite-characters in yeast and kappa particles in *Paramecium*.

Sex determination in plants and animals : concepts of allosomes and autosomes, XX-XY, XX-XO ZW-ZZ, ZO-ZZ types, linkage and crossing over, coupling and repulsion hypothesis, mechanism of crossing over and its importance.

10 Credit hours

Unit-V

Evolution and origin of species – theories of evolution, lamarkism, darwinism, mutation theory neodarwinism., Selection, speciation, polymorphism, mechanism of reproductive isolation and origin of adaptations.

10 Credit hours

Recommended Books

1. Alberts, B., Bray, D. Lewis, J., Raff, M., Roberts, K. and Watson, J.D. 1999. Molecular Biology of Cell. Garland Publishing Co. New York, USA.
2. Snustad, D.P. and Simmons, M.J. 2000. Principles of genetics. John Wiley and Sons.
3. Russel, P.J. 1998. Genetics. The Benjamin/Cumming Publishing Co.
4. Gasque, E. Manual of Laboratory experiments in cell Biology. W.C. Wilson Public.
5. Gardaner *et al.* Principles of genetics. John Wiley and Sons.
6. Robertis, E.D.P., Robertis, E.M.F. Cell and Molecular Biology. Sauder College Publication.
7. Beeker, W.M. The world of the cell. Pearson Education.
8. Karp, G. Cell and Molecular Biology. John Willey and sons.
9. Lodish and Baltimore. Molecular Cell Biology. W.H. Freeman and Co.
10. Rastogi V.B. Organic evolution.

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.

12 Credit hours**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, prokaryotic and eukaryotic DNA replication and polymerases. DNA ligases: mechanism of action and role in DNA replication; role of other proteins in DNA synthesis.

12 Credit hours**Unit-III**

Regulation of gene expression in prokaryotes : Transcriptional control; enzyme induction and repression, constitutive and facultative gene. Synthesis of enzymes.

Operon hypothesis : genes involved in regulation – regulatory genes, promoter gene, operator gene, and structural gene, role of cAMP and cAMP receptor protein (CRP) in the expression of e.g. Lac operon, Tryptophan operon and catabolite repression. Brief account of eukaryotic gene regulation.

12 Credit hours**Unit – IV**

Transcription control by termination and anti-termination, mRNA splicing, genetic code, altered genetic code in ciliates and mitochondria and Chloroplast, types of RNA, the assembly line for protein synthesis, wobble hypothesis, translation initiation and termination in prokaryotes and eukaryotes, reading frame and open reading frame.

12 Credit hours**Unit – V**

Post translational modification in prokaryotes and eukaryotes, protein sorting: synthesis of secretory and membrane protein, import into nucleus, mitochondria, chloroplast and peroxisomes. DNA damage and repair.

12 Credit hours

Suggested Readings

1. Watson, J.D. Molecular Biology of Gene. Pearson Education.
2. Friefelder, D. Molecular Biology. Narosa Publishing House, New Delhi.
3. Weaver, R. Molecular Biology. McGraw Hill.
4. Lewin, B. Gene VIII. Pearson Education.
5. Lodish and Baltimore. Molecular Cell Biology. W.H. Freeman and Co.
6. Cooper, M. The Cell – A molecular approach. Sinauer.
7. Daniel. Molecular Cell Biology. Scientific American Books.
8. Smith. Molecular Biology. Faber and Faber Publications.
9. Dabre, P.D. Introduction to Practical Molecular Biology. John Wiley and Sons, Ltd.
10. Meyers, R.A. (Ed). Molecular Biology and Biotechnology : A comprehensive desk reference. VCH Publishers, New York.

C7

Microbial Biology and Diversity

Unit-I

Structure of bacterial cell wall – chemical composition and wall characteristics, plasma membrane, mesosomes, cytoplasm, nucleoids, plasmids, types of plasmids and cytoplasmic inclusions. Important diseases of plants (Citrus cancer, Crown gall), humans (Tuberculosis, Typhoid).

15 Credit hours

Unit-II

Cyanobacteria: structure, cell wall, plasma membrane, cytoplasm, cytoplasmic inclusions – cyanophycin, gas vacuoles, carboxysomes, phosphate bodies, phycobilisomes. Specialized structures : heterocysts, morphology and classification, distribution, organization, nutrition, mode of reproduction and economic importance.

15 Credit hours

Unit-III

Viruses – theory, classification and phylogeny, general features-virus architecture and structure, replication in bacteriophages, plant and animal viruses, transmission of plant viruses, effect of

viruses on plants (symptoms), virus animal interactions, virus epidemiology, some important diseases of plants (yellow vein mosaic of bhindi, leaf curl of tomato and bean mosaic), humans (Aids, Polio, Hepatitis) viroids and prions.

10 Credit hours

Unit-IV

Mycoplasma – history, ultrastructure, nutrition, classification, phylogeny, reproduction and methods of cultivation. Elementary account of most common human /animals diseases (Pulmonary pneumonia, urethritis) caused by mycoplasma.

10 Credit hours

Unit-V

Brief account of phytoplasma and important diseases caused by them (Sesame phyllody, little leaf of brinjal, grassy shoot of sugarcane).

10 Credit hours

Recommended Books

1. Pelczar and Krieg. Microbiology. McGraw Hill.
2. Prescott, H. and Klein. 2000. Microbiology. McGraw Hill.
3. Tortora. Microbiology : An Introduction. Pearson Education.
4. Stainer, R.Y., Ingrahm, J.L., Wheelis, M.L. and Painter, P.R. General Microbiology. The MacMillian Press Ltd.
5. Madigan, M.T., Martinko, J.M. and Parker, J. B. Biology of Microorganism. Prentice-Hall.
6. Cappuccino, J.G. and Sherman, N. Microbiology – a laboratory manual. Addison Wesley.
7. Alexander, M. Introduction to soil microbiology. John Wiley and Sons.
8. Colwd, D. Microbial Diversity. Academic Press.
9. Dubey, R.C. and Maheshwari, D.K. A Text Book of Microbiology. S. Chand and Company.
10. Dimmock, N. J. and Primrose, S.B. Introduction to Modern Virology, IV Edition. Blackwell Scientific Publications. Oxford.

SEMESTER IV

C8

Metabolic Pathways

Unit-I

Transport across biomembrane: Passive transport, facilitated transport, Active transport; sodium, potassium and ATPase pump, Aquaporins and ion channels. Role of calmodulin.

Bioenergetics- general concepts of thermodynamics, energy, enthalpy, free energy, catalysis, activation energy. Metabolism- catabolism and anabolism. **12 Credit hours**

Unit-II

Photosynthesis : significance, historical aspects, photosynthetic pigments, action spectra, red drop effect, Emerson enhancement effects, concept of two photosystems, Z-scheme, photophosphorylation, Calvin cycle, C₄ pathway, CAM plants, photorespiration.

10 Credit hours

Unit-III

Carbohydrate metabolism: aerobic and anaerobic respiration (glycolysis), Krebs cycle, electron transport mechanism (chemi-osmotic theory), redox potentials, oxidative phosphorylation, pentose phosphate pathway, Gluconeogenesis, glycogen biosynthesis and degradation.

10 Credit hours

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 biosynthesis, β -oxidation saturated and unsaturated fatty acids, storage and mobilization of fatty acids.

18 Credit hours

Unit – V

Secondary metabolism in plants. Structure, and functions of phenolics, lignins and lignans, alkaloids, terpenoids and flavonoids.

10 Credit hours

Recommended Books

1. Horton and Moran. Principles & Biochemistry. Prentice Hall.

2. Buchanan, G. and Jones. Biochemistry and Molecular Biology of Plant. American Society of Plant Physiology.
3. David, L., Nelson and Cox. Lehninger : Principles of Biochemistry. McMillon Worth Pub.
4. Stryer. Biochemistry. John Wiley & Sons.

C9

Principles of Plant Tissue Culture

Unit-I

Plant tissue culture- History, contribution of Indian Scientists. Concept of cellular totipotancy and differentiation, laboratory facilities and supplies, asepsis and methods of sterilization. Culture medium- composition and methods of preparation. Role of plant growth regulators, vitamins and other adjuvants.

15 Credit hours

Unit-II

Pathways of micropropagation- axillary bud proliferation, adventitious shoot bud proliferation, Callus organogenesis, Somatic embryogenesis, Steps of micropropagation-management of donor plants, culture establishment, shoot multiplication, rooting, hardening and acclimatization.

15 Credit hours

Unit-III

Protoplast isolation, culture and Somatic hybridization, production of haploids -anther and pollen culture, ovary culture. Embryo and endosperm culture. Embryo rescue. Production of synthetic seeds.

10 Credit hours

Unit-IV

Methods of cryopreservation for germplasm conservation. Somaclonal and gametoclonal variation. Meristem tip culture for elimination of viruses in plants. *In vitro* fertilization, Commercialization of plant tissue culture- Global scenario and plant tissue culture industries in India.

10 Credit hours

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.

10 Credit hours

Suggested Readings

1. Robert Smith. Plant tissue culture : Techniques and Experiments. South Asia Edition.
2. Gamborg and Phillip. Plant Cell, Tissue and Organ Culture. Narosa.
3. Dixon and Gonzales. Plant Cell Culture. Panima.
4. Narayanswamy. Plant Cell and Tissue Culture. McGraw Hill.
5. Bhojwani, S.S. and Rajdan, M.K. Plant Tissue Culture : Theory and Practices a revised Edition. Elsevier.
6. Razdan, M.K. Introduction to plant tissue culture. Oxford & IBH Publishers.
7. Chawla, H.S. Introduction to Plant Biotechnology. Oxford & IBH Publishers.
8. Dey, K.K. Plant Tissue Culture.
9. Purohit, S.D. Introduction to Plant Cell Tissue and organ culture.

C10

Principles of Animal Cell Culture

Unit-I

History, techniques and methods of animal cell culture: culture media natural and artificial media. Balanced salt solutions and simple growth medium: composition, types and preparation. Role of CO₂, serum and growth factors in culture media. Serum and protein-free defined media and their applications.

15 Credit hours

Unit-II

Primary cultures, Secondary cultures. anchorage dependent growth, non-anchorage dependent cells and their growth. Characterization of cultured cells. test of viability, cytotoxicity and measurement of growth.

10 Credit hours

Unit-III

Animal cell lines – Commonly used animal cell lines –origin ,characteristics, nomenclature and maintenance. Transformed animal cells and cell lines , measurement of cell death, (apoptosis). Stem cell cultures, scaling-up of animal cell cultures and production of recombinant gene products.

15 Credit hours

Unit-IV

Organ culture various techniques applications and limitations. whole embryo culture, transfection of animal cells : selectable markers, HAT selection, Somatic cell fusion, hybridoma technology and production of monoclonal antibodies.

10 Credit hours

Unit-V

Growth kinetics of cells in culture, applications of animal cell culture. Three-dimensional culture and tissue engineering (artificial skin and artificial cartilage), *In vitro* fertilization in humans, super ovulation, embryo transfer in humans and livestock.

10 Credit hours

Suggested Readings

1. Masters, J. Animal Cell Culture. Panima.
2. Freshney, I. Culture of Animal Cell. John Wiley.
3. Martin, C. (Ed). Animal Cell Culture Techniques. Springer.
4. Mather and Barnes. (Ed). Methods in Cell Biology. Vol. 5-7, Animal Cell Culture Method. Academic Press.
5. Paul, J. Animal Tissue Culture.
6. Butler, M. and Dawson, M. Lab Fax : Cell Culture. Bios Scientific Publications.

SEMESTER V

C11

Immunology and Enzymology

Unit-I

Immune system and immunity: innate immunity, acquired immunity; structure, composition and functions of cells and organs involved in immune system: T cells, B-cells, macrophages, eosinophils, neutrophils, mast cells and natural killer Cells; thymus gland, bone marrow, spleen and lymph nodes.

15 Credit hours

Unit-II

Antigens – structure, properties and types (iso and alloantigens). Haptens, adjuvants; their role and significance. Antigen specificity. Immunoglobulins – structure, heterogeneity, types and properties.

10 Credit hours

Unit-III

Antigen antibody reactions – agglutination, precipitation, complement fixation, immunofluorescence, immunoelectrophoresis, Applications of these methods in diagnosis of microbial infections.

10 Credit hours

Unit-IV

History and introduction to enzymes, Classification of enzymes, IUBMB system of nomenclature, E.C. numbers, Introduction to coenzyme, cofactors and prosthetic groups; Enzyme kinetics (Michaelis-Menten equation), importance and determination of V_{max} and K_m values.

10 Credit hours

Unit-V

Regulation of enzyme activity: metabolic compartmentation, covalent modification, feedback regulation. Enzyme inhibition: competitive and non competitive. Multienzyme complexes, Isolation and purification of enzymes: salt precipitation, gel filtration, ion exchange and affinity chromatography.

15 Credit hours

Suggested Readings

1. Coico R, Sunshine, Benjamin E. Immunology : A short course. John Wiley and Sons.
2. Roitt, Brostoff, Male and Mosby. Immunology.
3. Kuby *et al.* Immunology. W.H. Freeman and Company.
4. Rao, C.V. An Introduction to Immunology. Narosa Pub. House.
5. Coleman, R.M. Fundamental Immunology. McGraw Hill.
6. Paul, W.E. Fundamentals of Immunology. Raven Press New York.
7. Palmer, T. Understanding Enzymes.
8. Price and Stevenson. Fundamentals of Enzymology. Oxford University Press.
9. Dixon and Webb. The Enzymes. Academic Press, London.
10. Foster, F.L. The nature of Enzymology. John Wiley and Sons.

C12

Microbial Technology

Unit-I

Introduction to industrial biotechnology, basic principles of fermentation technology, fermentation media – natural and synthetic media, fermenters and bioreactors – construction, design and operation. Process of aeration, agitation, temperature regulation, Types of fermentation – solid state, submerged, batch and continuous fermentation.

15 Credit hours

Unit-II

Process development – Shake flask fermentation, down stream processing: disintegration of cells, separation, extraction, concentration and purification of products, quality control, standard operating procedures and good manufacturing practices.

10 Credit hours

Unit-III

Brief account of the following products obtained by industrial microbiological fermentation – Alcohol, Alcoholic Beverage-Beer, Organic acid – Citric acid, Antibiotic – Penicillin, Amino acids – Glutamic acid, Vitamin-B12.

10 Credit hours

Unit-IV

Food spoilage – bacterial, fungal and yeast; food preservation – principles and general methods, elementary idea of canning and packing; sterilization and pasteurization of food products; technology of fermented foods – Yoghurt, Buttermilk, Idli, Dosa, Cheese.

13 Credit hours

Unit-V

Microbial foods – Single Cell Proteins (SCP), Single Cell Oils (SCO); Hazard Analysis and Critical Control (HACCP) concept; Techniques of mass culture of Algae-spirulina; Microbial polysaccharides and polyesters; production of xanthan gum and polyhydroxyalkaloides.

12 Credit hours

Suggested Reading

1. Waites, Morgan, Rockey. Industrial Microbiology. Blackwell Science.
2. Saha, B.D. Fermentation Biotechnology. American Chemical Society.
3. Demain and Davies . Industrial Microbiology and Biotechnology. A.S.M. Press Washington.
4. Glazer, A.N. and Nikaido, H. Microbial Biotechnology : Principle and application of applied microbiology. W.H. Freeman and com.
5. Stanbary, Whitaker and Hall. Principles of Fermentation Technology.
6. Shuler and Kargi. Bioprocess Engineering. Pearson.
7. Mukherji, K.G. Microbial Technology. APH. Pub. Corp.
8. Ray. Fundamental Food Microbiology. CBH Pub.
9. Bell, Neaves and Williams. Food Microbiology and Laboratory Practice. Panima.

Unit-I

Genetic Engineering : definition, scope and importance, molecular tools for genetic engineering. Restriction endonucleases- types, nomenclature, recognition sequences, cleavage pattern. Vectors – general characteristics of vectors, desirable characters such as size, ori site, selection/markers gene, restriction sites and MCS, cloning and expression vectors.

12 Credit hours**Unit-II**

Plasmid vectors: pBR-322, pUC vectors, Ti-plasmid, M13 derived pUC vectors, bacteriophage λ vectors, cosmids, YAC and BAC. Creation of recombinant DNA: cloning and selection of individual gene.

Transformation techniques: preparation of competent cells of bacteria, physical and chemical methods of gene transfer in plant and animal cells.

12 Credit hours**Unit-III**

Genomic library and cDNA library, reverse transcriptase, Colony hybridization, screening by DNA hybridization, labelling of DNA, RNA and proteins: use of radioactive isotopes, non-radioactive labelling, relative advantages, *in vivo* labelling, nick translation, random primer labelling, autoradiography. Blotting techniques southern, northern, western and eastern.

12 Credit hours**Unit-IV**

Protein profiling: SDS PAGE, 2D gel electrophoresis and its significance, gel retardation assay, T-DNA and transposon mediated gene tagging, chloroplast transformation and its utility, DNA microarray.

12 Credit hours**Unit-V**

Antisense RNA technology, Ribozyme: biochemistry, hammerhead, hair pin and other ribozymes, strategies for designing ribozymes, application of antisense and ribozyme technologies.

12 Credit hours

Suggested Readings

1. Christopher, H. Gene cloning and Manipulation. Cambridge University, Press.
2. Nicholl, D.S.T. An introduction to genetic engineering. Cambridge University Press.
3. Sambrook, Russell and Maniatis. Molecular Cloning : A Laboratory Manual (Vol. I, II and III). Cold Spring Harber Laboratory.
4. Glover, D.M. and Hames, B.D. DNA Cloning : A practical approach. IRL Press. Oxford.
5. Brown, T.A. Gene cloning. Blackwell Publisher.
6. Kreuzar, H. and Massey, A. Recombinant DNA technology. A.S.M. Press, Washington.
7. Llibelli, Lanza and Campbell. Principles of Cloning. Academic Press.

DSE2

Natural Resources and Environmental Biotechnology

Unit-I

Natural resources- Energy resources (renewable and non-renewable), conventional and non-conventional sources of energy, forest resources, water resources. Conservation of natural resources- *ex situ* and *in situ* conservation strategies, wildlife management, afforestation, world conservation strategies (WCS) and National Conservation Strategies (NCS)

15 Credit hours

Unit – II

Waste water and its treatment, BOD and COD. Ground water remediation, water softening, water demineralization, ion-exchange and reverse osmosis, disinfection of water; ozonation and chemo-sterilization of water.

10 Credit hours

Unit – III

Solid waste and their treatment, organic compost and process of composting, vermi-culture technology. Microbial degradation of xenobiotics, microorganism in abatement of heavy metal pollution, aeromicrobiology: aeroallergens and aeroallergy.

10 Credit hours

Unit – IV

Environmental biotechnology- Introduction, scope and applications, Biogas, biogas production- Solubilization, acetogenesis and methanogenesis , mechanism of methane formation. Microbes and their genetic engineering for degradation of pollutants.

10 Credit hours

Unit – V

Application of microbes as biofertilizer, biopesticides, microbial leaching, biomining and biohydrometallurgy. Principles and applications of biosensors for detection of pollutants, Oil spills- Causes and recovery, use of super bugs for removal of oil spills.

15 Credit hours

Suggested Readings

1. Mooray Moo-Young. (Eds). Comprehensive Biotechnology (Vol. I, II, III) Pergamon Press, England.
2. Metcalf and Eddy. Waste water engineering treatment and uses. McGraw Hill.
3. Jogdand, S.N. Environmental Biotechnology. Himalaya Publication House.
4. De, A.K. Environmental Chemistry. Wiley Eastern Ltd.
5. Abbasi and Abbasi. Renewable Energy Sources and their environmental impact. Prentice Hall of India, Pvt. Ltd.
6. Chatterji, A.K. Introduction to Environmental Biotechnology. Prentice Hall of India.
7. Thakur, I. S. Text Book of Environmental Biotechnology. I. K. International Publisher, New Delhi.
8. Mohapatra, P. K. Text Book of Environmental Biotechnology. I. K. International Publisher, New Delhi.

SEMESTER VI

C13

Plant Physiology

Unit-I

Plant–water relationship : Importance of water to plant life, diffusion, osmosis (endo and exo), diffusion pressure deficit (DPD), suction pressure, turgor pressure, wall pressure. Ascent of sap: theories, mechanism and significance.

10 Credit hours

Unit-II

Transpiration: stomata structure and types, opening and closing of stomata, mechanism and significance, antitranspirant agents.

Mineral nutrition : essential macro and micro-elements and their role, mineral uptake, deficiency and toxicity symptoms.

10 Credit hours

Unit-III

Growth and development in plants: definitions, phases of growth and development, kinetics of growth, seed dormancy, seed germination and factors of their regulation.

Plant growth regulators: auxins, gibberellins, cytokinins, abscissic acid and ethylene, history of their discovery, biosynthesis and mechanism of action.

10 Credit hours

Unit-IV

Plant movements: types and significance. Photoperiodism: definition, process and significance. Physiology of flowering, florigen concept, biological clocks, physiology of senescence. Vernalization: definition, process, vernalizing and antivernalizing agents and significance.

15 Credit hours

Unit-V

Stress physiology: stress, plant responses to stress, water stress, temperature stress, salinity stress, metal stress, herbivory stress. Heat shock proteins. Reactive oxygen molecules. HR and SAR responses.

15 Credit hours

Suggested Readings

1. Hopkins, W.G. Introduction to plant physiology. John Wiley and Sons.
2. Salisbury, F.B. and Ross, C.W. Plant physiology. Wadsworth Publishing Co. California, USA.
3. Mohr, H. and Schopfer, P. Plant physiology. Springer Verlag, Berlin, Germany.
4. Taiz, L. and Zeiger, E. Plant Physiology (2nd Edition) . Sinauer Associates, Inc., Publishers, Massachusetts, USA

C14

Animal Physiology

Unit-I

General and cellular basis of animal physiology. Digestion and absorption of food-in stomach and small intestine; circulation of body fluid, blood vessels, blood flow and blood cells, ABO blood groups and Rh factor, mechanism of blood clotting.

13 Credit hours

Unit-II

Respiration – mechanism of respiration; vital capacity of lungs; transport of gases; dissociation curve of oxyhaemoglobin and control of respiration.

12 Credit hours

Unit-III

Excretion – Formation of ammonia, urea and uric acid; structure and functions of nephron; control of renal functions – role of kidney in the regulation of water and salt. Muscle and movement – ultrastructure and physiology of muscle contraction. Nerve physiology – ultrastructure of a neuron, synapse, propagation of nerve impulse.

15 Credit hours

Unit-IV

Structure and functions of endocrine glands (pituitary, adrenal, thyroid and parathyroid). Neuro-endocrine regulation, secondary messenger concept.

10 Credit hours

Unit-V

Reproductive physiology – reproductive mechanisms, functional morphology of reproductive organs, gametogenesis, reproductive cycle, hormonal control.

10 Credit hours

Suggested Readings

1. Guyton, A.C. and Hall, J.E. A Text Book of Medical Physiology (10th Edition). W.B. Saunders company.
2. Ganong, H. Review of Medical physiology. McGraw Hill.
3. Fluer, S. Physiology (a regular system approach). McMillan Pub. Co.
4. Shier, Jakie, Butler and Lewis. Human Anatomy and Physiology. WCB, USA.
5. Berry, A.K. Animal physiology.

Unit-I

Role of micropropagation in silviculture, horticulture, agriculture, and conservation of biodiversity and threatened plant species. Somatic embryogenesis with special reference to production of synthetic seeds, Application of plant biotechnology in plant pathology with special reference to culture of obligate parasites.

12 Credit hours**Unit-II**

Screening of germplasm and cell line selection. Application of somaclonal variation with special reference to development of disease resistant cell lines. Applications of plant biotechnology in breeding and crop improvement with special reference to production of haploids and triploids.

12 Credit hours**Unit-III**

Role of tissue culture in genetic engineering for crop improvement – *Agrobacterium* mediated gene transfer in plants and development of genetically modified organisms with special reference to drought and salinity, insect and virus resistance .

12 Credit hours**Unit-IV**

Bioreactors for production of secondary metabolites. Introduction types : stirred-tank type, air-lift type, membrane type bioreactor, packed bed reactor. Modes of culture applied in bioreactors – batch culture, fed-batch culture, semi-continuous culture, continuous culture.

12 Credit hours**Unit-V**

Secondary products in tissue cultures – production of alkaloids, phenols, steroids, lignins, coumarins, flavonoids, anthroquinones and naphthoquinones, isoprenoids, Plant cell immobilization, gel entrapment, applications of immobilization techniques. Secondary metabolite production using immobilized cells.

12 Credit hours

Suggested Readings

1. Chrispeels, M.J. and Sadava, D.E. Plant, genes and agriculture. Jones and Barlett Pub., Boston, London.
2. Kyte, L. and Kleyn. Plant From test tube. Timber Press, Portland, Oregon.
3. Ravishanker, G.A. and Venkatraman, L.V. Biotechnology application of plant tissue and cell culture. Oxford and IBH Publishing Co. Pvt. Ltd.
4. Reinert, J. and Bajaj, Y.P.S. Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture. Narosa.
5. Chawla, H.S. Biotechnology in Crop Improvement. International Book Distributing Company.
6. Henery, R.J., Chapman and Hall. Practical application of plant molecular Biology.
7. Hammond, J. and McGarvey, P. Plant Biotechnology. Springer Verlag.

DSE4

Biotechnology in Human and Animal Health

Unit-I

Introduction to transgenic animals; methods of obtaining transgenic(DNA microinjection, retrovirus mediated gene transfer, embryonic stem cells), Factors affecting transgenic animal production; Importance of transgenic animals-increased productivity of domestic animals, improved desired characters of domestic animals, production of proteins for pharmaceutical use with special reference to insulin production. Transgenic silkworms.

15 Credit hours

Unit-II

Animal cloning: Introduction, methods of cloning and its importance. Methods of cloning in animal systems such as rat, sheep, and fish. Animal models for tackling human diseases; Gene knock out and mice models.

10 Credit hours

Unit-III

Gene therapy and cell mediated therapy. Genetic diseases targeted for gene therapy, Use of genetically modified and humanized antibodies against cell surface antigens in cancer treatment and organ transplantation, importance of Adenosine deaminase (ADA) gene in curing severe combined immuno deficiency (SCID)

10 Credit hours

Unit-IV

Diagnostics : application of immunological and molecular diagnostic methods (RIA, ELISA, PCR, DNA fingerprinting) in forensic medicine and disease diagnostics. Immune system and vaccine, development of vaccines for Hepatitis, Rabies, Herpes and Tuberculosis using recombinant DNA technology, peptide vaccines, vector vaccines, Edible vaccines.

10 Credit hours

Unit-V

An elementary account of genomics and proteomics, human genome project – its inception and outcome. Intellectual Property Rights (IPR) and biosafety issues. Ethical and moral issues. Current legislation for use of genetically modified organisms. Patenting biotechnological inventions.

15 Credit hours

Suggested Readings

1. Primrose, S.B. Molecular Biotechnology. Panima.
2. Watson and Zoller. Recombinant DNA. Panima.
3. Winnacker. An introduction to Gene Technology – From genes to clones. VCH.
4. Boylan, M. Genetic engineering – science and ethics on new frontier. Pearson Edu.
5. Old and Primrose. Principles of Gene Manipulation.
6. Glick and Pasternak. Molecular Biotechnology. ASM Press Washington, USA.
7. Mickloss, D.V. and Freyer, G.A. DNA Science : A first course in recombinant technology. Cold Spring Harbor Laboratory Press, New York.
8. Carl A. Pinkert. Transgenic animal technology.

Skill Enhancement Courses

SEC1

PROBIOTIC TECHNOLOGY

TOTAL HOURS: 30

CREDITS: 2

Unit-I

No of Hours: 6

Enumeration of probiotic bacteria, Isolation: Pour plate technique. Streaking four way, Zig Zag, and linear. Spreading, Slant, Stab culture.

Unit-II

No of Hours: 6

Morphological and cultural Characterization: Colony characteristics, Simple staining, Gram's staining, Negative staining.

Unit-III

No of Hours: 6

Biochemical characterization: Catalase test, Growth in litmus milk, Growth on BCP-MRS agar, nitrate reduction, arginine hydrolysis, Esculin hydrolysis. Voges Proskauer's test.

Unit-IV

No of Hours: 6

Carbohydrate fermentation: Arabinose, Cellobinose, Galactose, Maltose, Mannose, Mannitol, Raffinose, Rahmanose. PCR based identification.

Unit V

No of Hours: 6

Screening of probiotic properties: Antibiotic resistance, Bile tolerance, BSH activity, Antibacterial activity, preparation of skim milk and viability testing.

SEC 2

ANIMAL CELL SCIENCES

TOTAL HOURS: 30

CREDITS: 2

Unit I

No of Hours: 6

Microtomy: Principles & types, sample preparation & sectioning parameters.

Unit II

No of Hours: 6

Immunological Techniques:- antigen- antibody reactions, Radil Immuno diffusion, ELISA.

Unit III

No of Hours: 6

Animal Tissue culture : Design, Layout and Equipment . Media: preparation and metaphase chromosome preparation .

Unit IV

No of Hours: 6

Histochemical techniques : principle and types , various enzymatic anlysisand cryosectioning.

Unit V

No of Hours: 6

Marketing & management of animal biotechnology : Effective advertising and marketing, technology decisionmaking, and resource decision-making etc., Product marketing decision.

SEC 3

MICROBIOLOGICAL ANALYSIS OF AIR AND WATER

TOTAL HOURS: 30

CREDITS: 2

Unit 1 Aeromicrobiology

No of Hours: 4

Bioaerosols, Air borne microorganisms (bacteria, Viruses, fungi) and their impact on human health and environment, significance in food and pharma industries and operation theatres, allergens

Unit 2 Air sample collection and analysis

No of Hours: 7

Bioaerosol sampling, air samplers, methods of analysis, CFU, culture media for bacteria and fungi, Identification characteristics

Unit 3 Control measures

No of Hours: 4

Fate of bioaerosols, inactivation mechanisms – UV light, HEPA filters, desiccation, Incineration

Unit 4 Water Microbiology

No of Hours: 5

Water borne pathogens, water borne diseases

Unit 5 Microbiological analysis of water

No of Hours: 10

Sample Collection, Treatment and safety of drinking (potable) water, methods to detect potability of water samples: (a) standard qualitative procedure: presumptive test/MPN test, confirmed and completed tests for faecal coliforms (b) Membrane filter technique and (c) Presence/absence tests Precipitation, chemical disinfection, filtration, high temperature, UV light

SEC 4
TECHNIQUES IN BIOTECHNOLOGY

TOTAL HOURS: 30

CREDITS: 2

Unit-I (General Instruments)

No. of Hours 6

Principles, working and applications of- Autoclave, Laminar Airflow, Hot Air Oven, UV and Visible Spectrophotometer.

Unit-II (Microscopy)

No. of Hours 6

Microscopy: Principles and applications of Simple, compound, Phase contrast. Micrometry.

Unit-III (Centrifugation)

No. of Hours 5

Centrifugation: Rotors, Bench top, Low Speed, High Speed, Cooling Centrifuge. Principles and Application of Ultracentrifugation.

Unit-IV (Electrophoresis)

No. of Hours 10

Agarose gel electrophoresis, Native and SDS PAGE analysis, PCR, Molecular, biochemical and cytological markers.

Unit-V (Chromatography)

No. of Hours 3

Principals and applications of Paper and thin layer chromatography.

SEC 5

TECHNIQUES IN PLANT TISSUE CULTURE

TOTAL HOURS: 30

CREDITS: 2

Unit –I (Introduction to Plant Tissue culture)

No. of Hours 6

Introduction to Plant Tissue culture, Laboratory organization, Tools and techniques, methods of sterilization. Laboratory contaminants- it's control and measures.

Unit-II (Media and Culture Preparation)

No. of Hours 7

Role of Micro and macro nutrients, Vitamins and carbon source in tissue culture, Media preparation- pH, Temperature, Solidifying agents, Various media preparations, Slant Preparations etc. Maintenance of cultures, Environmental Conditions,.

Unit-III (Culture techniques)

No. of Hours 5

Explants selection, explants characteristics, sterilization and inoculation for culture establishment

Unit-IV (Initiation of Cultures)

No. of Hours 6

Induction and growth parameters; Culture initiation, Callus culture., Micropropagation through various explants (Leaf, Stem, Axillary bud).

Unit-V

No. of Hours 6

Meristem tip culture and its application. Techniques and significance of Androgenesis and Gynogenesis (anther and pollen, ovary and ovule culture). Production of Synthetic seeds.