DEPARTMENT OF BIOTECHNOLOGY

SR & BGNR GOVT ARTS AND SCIENCE COLLEGE (A), KHAMMAM

4. SYLLABUS

B.Sc- I Year, Semester – I
PAPER - I
CELL BIOLOGY & GENETICS

UNIT- I: Cell Structure and Function

1.1 Cell as basic unit of life (Viral, bacterial, fungal, plant and animal cells)
1.2Ultra structure of prokaryotic cell (Extra Chromosomal Material – Plasmid)
1.3 Ultra structure of eukaryotic cell (Cell wall, cell membrane, Golgi Complexes, Endoplasmic Reticulum, Peroxisome, Lysosomes etc)
1.4 Fluid mosaic model, sandwich model, membrane permeability
1.5 Structure of chromosomes-componenets of chromosomes (histone and nonhistone proteins), specialized chromosomes (Polytene and Lamp Brush)
1.6 Chromosomal abberations -structural and numerical

UNIT-II: Chromosome Organization and Cell Division

2.1 Bacterial cell division
2.2 Eukaryotic cell cycle phases
2.3 Mitosis stages and significance
2.4 Meiosis stages and significance
2.5Senesence and Necrosis
2.6Apoptosis

UNIT- III: Mendalism& Mendel's Laws

3.1 Mendel's experiments – Factors contributing to success of Mendel's experiments
3.2 Mendel,s laws - Law of segregation – Monohybrid ratio, Law of Independentassortment – Dihybrids, Trihybrids
3.3 Deviation from Mendel's Laws - partial or incomplete dominance,co-dominance, non allelic interaction and modified dihybrid ratios
3.4 Penetrance and expressivity (polydactyl and waardenberg syndrome),Pleiotropism, phenocopy - microcephaly,cleft lip
3.5 Multiple Alleles : ABO blood groups & Rh factor
3.6 Sex determination in humans, drosophila, x-linked inheritance (haemophilia, color blindness), X- inactivation

UNIT-IV: Sex Determination & Recombination

4.1 Linkage and recombination – Discovery of linkage, cytological proof of crossing over, Recombination frequency and map distance.
4.2 Non-Mendelian inheritance - Cytoplasmic inheritance (Shell coiling in snail)
4.3 Cytoplasmic male sterility in maize
4.4 Mitochondrial inheritance in humans, poky strains in neurospora

4.5 Chloroplast inheritance in chlamydomonas
4.6 Hardy weinberg equilibrium

Practical Paper – I

1. Identification of plant, fungi, bacteria and animal cells.
2. Preparation of different stages of Mitosis from onion root tips
3. Preparation of different stages of Meiosis from grass hopper testis
4. Preparation of polytene chromosomes from Drosophila salivary gland.
5. Monohybrid and dihybrid ratio in *Drosophila*
6. Monohybrid and dihybrid ratio in maize
7. Problems on codominance, epistasis, two point and threepoint test cross, gene mapping
8.Statistical applications of Hardy weinberg equilibrium

Spotters:

1. Prokaryotic cell (Bacteria)
2. Mitochondria
3. Chloroplast
4. Crossing over
5. Polytene
6. Lampbrush
7. Test cross
8. Blood grouping
9. Haemophilia
10. Phenocopies

B.Sc- I Year, Semester – II
PAPER – II
BIOLOGICAL CHEMISTRY AND MICROBIOLOGY

UNIT-1 Biomolecules

1.1Carbohydrates-Importance, classification, Structure and functions of Monosaccharides (Glucose and Fructose), Disachharides (Sucrose, Lactose, Maltose) and polysaccharides (Starch, Glycogen, inulin)
1.2Amino acids: Importance, classification, Structure, physical and chemical properties of amino acids, peptide bond formation
1.3Proteins: importance, structure of proteins- primary, secondary, tertiary and quarternary
1.4Lipids: importance, properties and classification, Simple lipids-TAG and waxes, Complex lipids- phosphos lipids and glycolipids, Derived lipids- steroids, terpenes and carotenoids
1.5Nucleic acids: structure and chemistry of DNA (Watson and crick) and RNA (TMV), structure and forms of DNA (A,B and Z forms)
1.6Enzymes-classification and nomenclature. Michaelis Menton Equation-Factors influencing the enzyme reactions and Enzyme inhibition(Competitive and Non-competitive), co enzymes

UNIT-2 Bioenergetics

2.1Glycolysis, TCA Cycle
2.2 Electron transport, Oxidative phosphorylation
2.3 Gluconeogenesis and its significance
2.4 Transamination and Oxidative deamination reactions of amino acids
2.5 β-oxidation of fatty acid
2.6 Glyoxalate cycle

UNIT-3 Fundamentals of microbiology

3.1Historical development of microbiology and contributors of microbiology
3.2Microscopy: bright field microscopy, dark field microscopy, phase contrast microscopy, fluorescent microscopy, SEM and TEM
3.3Outlines of classification of microorganisms
3.4Structure and general characteristics of bacteria and virus
3.5Disease causing pathogens and symptoms (Eg: Mycobacterium, Hepatitis)
3.6 Structure and general characteristics of micro-algae and fungi

UNIT-4 Culture and identification of microorganisms

4.1Methods of sterilization- physical and chemical methods
4.2 Bacterial nutrition, nutritional types, essential macro and micro nutrients and growth factors
4.3 Bacterial growth curve- batch, continuous and synchronous cultures, bacterial growth measurement cell number and cell mass
4.4 Factors affecting bacterial growth
4.5 Culturing of anaerobic bacteria and viruses

4.6 Pure culture and its characteristics

Practical paper-II

1. Preparation of molar and molal solutions
2. Preparations of buffers (acidic, basic, neutral)
3. Qualitative tests of sugars, amino acids and lipids
4. Estimation of total sugars by Anthrone method
5. Separation of amino acids by Paper chromatography
6. Estimation of protein by biuret method
7. Sterilization methods
8. Preparation of microbiological media (bacterial, algal and fungal)
9. Isolation of bacteria by streak, spread and pour plate methods
10. Isolation of bacteria from soil
11. Simple staining and differential staining (gram staining)
12. Bacterial growth curve
13. Technique of micrometry (ocular and stage)

Spotters

1.Osazone
2. Globular protein
3. Lock and key model
4. Competitive inhibition
5. Rubisco
6. ATP synthase
7. Autoclave
8. Laminar air flow
9. Tyndallization
10. Bacterial growth curve
11. Hot air oven
12. Serial dilution technique

B.Sc- II Year, Semester – III
PAPER – III
MOLECULAR BIOLOGY AND rDNA TECHNOLOGY

UNIT-I

1.1 Transcription in prokaryotes: enzymatic synthesis of RNA, basic features of RNA synthesis, E. coli RNA polymerase, classes of RNA molecules
1.2 Transcription mechanism in prokaryotes- promoter, initiation, elongation, proof reading and rho dependent, independent mechanism
1.3Transcription in eukaryotes: polymerase of eukaryotes, promoters of eukaryotes
1.4Synthesis of hnRNA and post transcriptional modifications
1.5The genetic code, properties of genetic code, wobbles hypothesis
1.6 Translation mechanism in prokaryotes and eukaryotes

UNIT-II

2.1 Gene regulation in prokaryotes
2.2 Transcriptional level regulation- positive and negative regulation
2.3 Auto and co-ordinated regulation
2.4 Operon concept- lac, trp operons
2.5 Translation regulation in eukaryotes and prokaryotes
2.6 Inhibitors of protein synthesis- antibiotics and other inhibitors

UNIT-III

3.1Enzymes used in gene cloning: restriction endonucleases, ligases, phosphatases, methylases, kinases
3.2 Cloning vehicles, plasmids, cosmids, phage vectors
3.3 Construction of genomic and cDNA libraries
3.4 Identification of cloned genes- Colony hybridisation
3.5 Expression of vectors, bacterial vectors
3.6 Yeast vectors

UNIT-IV

4.1Principle, methodology and applications of PCR technology
4.2Variations of PCR
4.3 DNA finger printing technique and its applications in medicine
4.4 Principles involved in blotting techniques- southern, northern and western blotting
4.5 Genome sequencing: Sangers method
4.6 Applications of rDNA technology in medicine

Practical paper -III

1. Isolation of DNA from plant, animal/bacterial cells
2. Isolation of plasmid DNA
3. Analysis of DNA by agarose gel electrophoresis
4. Restriction digestion of DNA
5. PCR
6. Competent cell preparation, transformation and selection.

Spotters

1. Spliceosome
2. RNAP
3. t – RNA
4. Lac Operon
5. 5 – cap
6. PBR 322
7. Reverse transcriptase
8. Shine – Dalgarno sequence
9. Taq DNA polymerase

B.Sc- II Year, Semester – IV
PAPER – IV

BIOSTATISTICS AND BIOINFORMATICS

UNIT-I

1.1Introduction to biostatistics, history and applications
1.2Concept of sampling and sampling distributions
1.3 Measures of central tendency (mean, median, mode)
1.4 Measures of deviation (standard deviation, variance and co-efficient of variation)
1.5 Concept of probability, basic laws and its application to mendelian segregation
1.6 Concept of probability distribution, binomial, poisson distribution, normal distribution and their applications in biology

UNIT-II

2.1Concept of test of hypothesis- t-Test and chi square test, their application in biolgy
2.2 Simple correlation and regresion
2.3 Concept of analysis of variance (ANOVA)- one way classification
2.4 ANOVA- Two way classification
2.5 Graphical representation of data
2.6 Importance of statistics in biology

UNIT-III

3.1Usage of MS-DOS commands, internal and external commands
3.2Directory and file commands, copying, erasing, renaming and displaying files
3.3Microsoft word: concept of toolbar, character, paragraph and document formatting
3.4Drawing tool bar, header, footer, document editing, page set up, short cut keys, text and graphics
3.5 Microsoft power point: slide presentation, slide layout and design, custom animation, image importing, slide transition
3.6 MS Excel- Applications, Functions, Charts, Pivot Tables, validations, formatting of spread sheet

UNIT-IV

4.1 Introduction to bioinformatics, history and emergence
4.2 Biological databases (nucleic acids and proteins)
4.3 Introduction to Genomics and Proteomics
4.4 Biochips
4.5 Data retrieval tools (BLAST, PubMED)
4.6Applications of Bioinformatics

Practical paper-IV

1. Finding statistical significance of a given data using chi – square test.
2. Graphical representation of data (Histograms, frequency polygon, Pie diagram)
3. Acquaintance with the Biological databases through Internet
4. acquaintance of nucleic acid databases
5. Acquaintance of protein databases
6. Micro soft Power point presentation
7. Preparation of document using Microsoft word
8. Preparation of Microsoft excel sheets

Spotters

1. Probability theorems
2. Test of hypothesis
3. F-test
4. Biological databases
5. NCBI
6. BLAST
7. t-Test
8. Dos- commands
9. Nucleic acid database
10. Protein database

B.Sc- IIIYear, Semester – V
ELECTIVE PAPER-(A)
PLANT BIOTECHNOLOGY

UNIT – I

1.1 Historical perspectives of plant tissue culture, and Basic requirement for tissue culture laboratory
1.2 Culture mediums for plant tissue culture- MS medium and B5 Medium.
1.3 Sterilization of media-steam, dry and filter sterilization- Explants sterilization
1.4 Plant growth regulators and differentiation.
1.5 Method of tissue culture-formulation of medium explants collection, surface sterilization, inoculation, Callus induction, subculture and regeneration of plants
1.6 organ culture- leaf, root and stem culture

UNIT - II

2.1. Suspension cultures- growth and subculture, types and synchronization of suspension cultures.
2.2 Immobilization of cells and the effect of elicitors on the production of secondary metabolites of
commercial value
2.3 Meristem culture and its uses in production of virus free plants
2.4. Clonal propagation, Micro propagation of plants – medicinal plants and endangered plants –method and advantages
2.5 Production of secondary metabolites- culture techniques
2.6large scale production of commercially important compounds

UNIT- III

3.1 Somatic embryogenesis- Principle, protocol and importance.
3.2 Artificial seeds – production, applications and limitations.
3.3 Embryo rescue and its importance
3.4Anther culture and production of androgenic haploids.
3.5Somaclonal variations- applications of somaclonal variations to crop improvement
3.6 Cryopreservation of plant cultures and application of plant tissue culture

UNIT - IV

4.1. Protoplast – properties of protoplast ,Protoplast – Isolation (mechanical and enzymatic methods),
4.2 Culturing and regeneration of protoplasts
4.3 Different methods of protoplast fusion (mechanical fusion, chemo fusion, electro fusion)
4.4 Selection of somatic hybrids and cybrids.
4.5 Introduction to *Agrobacterium tumifaciens,* Features of Ti Plasmid, molecular mechanism of T-DNA transfer**.**
4.6 Physical gene transfer methods – Particle Bombardment, Electrophoration and microinjection

Practical paper- V elective (A)

1. Preparation of medium for tissue culture. (MS or B5)
2. Sterilization methods of explants (seed leaf, inter node &root), medium
3. Establishment of callus cultures –from carrot.
4. Cell suspension cultures.
5. Protoplast isolation and culture.
6. Synthetic seed production.

Spotters

1. Callus
2. Somatic embryos
3. Rhizogenesis
4. Multiple shoots
5. Green house
6. Somatic hybrids
7. Synthetic seeds
8. GUS gene
9. Gene gun
10. Ti plasmid

B.Sc BIOTECHNOLOGY SEMESTER V
ELECTIVE THEORY (B)
MEDICAL BIOTECHNOLOGY

UNIT: I

1.1 Scope and importance of medical biotechnology
1.2 Karyotyping of human chromosomes
1.3 Chromosome banding– G banding and R-banding technique
1.4 Inheritance patterns in Man– Pedigree analysis
1.5 Diagnosis using monoclonal antibodies- ELISA
1.6 Genetic counselling – calculating risk and discussing the options

UNIT: II

2.1 Chromosomal disorders caused due to structural chromosomal abnormalities (Deletions, duplications, Translocations)
2.2 Chromosomal disorders caused due to numerical chromosomal abnormalities (autosomal and allosomal)
2.3 Monogenic disorders (autosomal and X-linked diseases)
2.4 Mitochondrial diseases – LHON, MERRF
2.5 Types and causes of male and female infertility
2.6 IVF- methodology

UNIT: III

3.1 Gene therapy – exvivo and *invivo*gene therapy; somatic and germline gene therapy;
3.2 Strategies of gene therapy: gene augmentation – ADA deficiency; Prodrug therapy/ suicide gene – glioma
3.3 Stem cells – potency definitions; embryonic and adult stem cells;
3.4 Applications of stem cells – cell based therapies and regenerative medicine
3.5 Encapsulation technology and therapeutics-Diabetes
3.6 Human genome sequences – mapping and cloning of human disease genes

UNIT: IV

4.1 Cancer – Types
4.2 Oncogenes, tumour suppressor genes, stability of genome, control of cell cycle
4.3 Molecular basis of colon cancer and breast cancer
4.4 DNA/RNA based diagnosis– HBV, HIV
4.5 Applications of PCR in disease diagnosis
4.6 Haemoglobinopathies

Practical paper- V elective (B)

1. Karyotyping of normal and abnormal human chromosome sets
2. Human pedigree analysis
3. Estimation of C-reactive protein
4. Dot ELISA
5. Genotyping of candidate genes for diseases by RFLP
6. Encapsulation of mammalian cells

SPOTTERS

1. Pedigree
2. Monoclonal antibodies
3. ELISA
4. Oncogenes
5. Cri du Chat syndrome
6. Trisomy
7. Diabetes Mellitus
8. SCID
9. Stemcells
10. HBV

B.Sc- IIIYear, Semester – VI
ELECTIVE PAPER-(A)
ENVIRONMENTAL BIOTECHNOLOGY

UNIT-I

1.1 Introduction to environment and pollution
1.2 Types of pollution- air, water and land pollutions
1.3 Types of pollutants– inorganic, organic and biotic sources
1.4 Sources of pollution – domestic waste, agricultural waste, industrial effluents and municipal waste
1.5 Biomonitoring of environmental pollutants by bioindicators
1.6 Emission control biotechnology- air sampling techniques

UNIT-II

2.1 Renewable and non- renewable energy resources
2.2 Fossil fuels as energy source and their impact on environment
2.3 Non-conventional source – biomass as source of bioenergy
2.4 Types of biomass – plant, animal and microbial biomass
2.5Biodelignification by enzymes
2.6 Biodesulphurisation of coal

Unit-III

3.1 Microbial treatment of waste water (sewage of industrial effluent)- aerobic and anaerobic methods
3.2 Solid waste and management; Bioremediation– concepts and types (in-situ and ex-situ)
3.3 Bioremediation of toxic metal ions– biosorption and bioaccumulation
3.4 Microbial bioremediation of pesticides and Xenobiotic compounds
3.5 Phytoremediation- concepts and application
3.6 Degradative plasmids and genes in biominning

UNIT-IV

4.1 Climate change, greenhouse gases and global warming,
4.2 Impact of pollution on environment and measurement methods
4.3 Production of biofuels, bioethanol & biomethanol
4.4 Conservation of biodiversity
4.5 Carbon sequestration – vision, methods and management strategies
4.6 GEMS and their impact on environment

Practical paper VI - elective (A)

1. Estimation of BOD in water samples
2. Estimation of COD in water samples
3. Estimation of total dissolved solid in water samples
4. Isolation of microorganisms from soil/industrial effluents
5. Production of biogas using cow/cattle dung
6. Bioremediation

Spotters:

1. Aerosols
2. Biomagnification
3. Tidal energy
4. Habitat destruction
5. Biodegradable plastic – Poly hydroxy butyrate
6. Elinino affect
7. Coral reefs
8. Xenobiotic compounds
9. Global warming
10. Bioethanol

B.Sc- IIIYear, Semester – VI
ELECTIVE PAPER-(B)
ANIMAL BIOTECHNOLOGY

UNIT-I

1.1. Animal tissue culture, history, requirements for animal cell culture
1.2. Substrate, liquids, culture mediums-Natural (Clots, Biological fluids, Tissue extracts), complex natural and chemically defined media
1.3. Explant-culture of explants, Cell culture technique- initiation, preparation and sterilization of media
1.4 Isolation of explants, disaggregation of explants, culture, subculture
1.5 Cell lines, evolution of cell lines, maintenance of cell lines, large scale culture of cell lines- monolayer, suspension and immobilized cell culture,
1.6 Development of primary culture and cell lines, subculture

UNIT-II

2.1. Cultured cells and evolution of continuous cell lines (established cell lines)
2.2. Commonly used cell lines - their origin and characteristics
2.3. Cell line preservation and characterization
2.4. High level expression of foreign gene in animal cells-expression vectors, enhancers, regulatory sequences.
2.5 Expression foreign genes in animal cells: advantage and disadvantages.
2.6 Properties of cell lines – biology and characterisation of cultured cells

UNIT-III

3.1. Transfection methods of animal cells (Calcium phosphate, DEAE-dextran, Lipofection, Electroporation, Microinjection)
3.2 Embryonic stem cell transfer
3.3 Selection of recombinant cells with various marker genes (Thymidine Kinase, Dihydrofolate reductase, CAD protein, XGPRT, HAT, Neomycin phosphotransferase)
3.4 Production of transgenic animals (Mice, Cattle, Sheep, pigs, Fish and Birds)
3.5 Applications, advantages and disadvantages of animal tissue culture
3.6 Ethical issues related to transgenic animals

UNIT-IV

4.1 Stem cells: Characteristic features, maintenance, culture and Applications of Embryonic and adult stem cells
4.2 Animal cloning- nuclear transfer and embryonic stem cell method
4.3 Molecular pharming: Transgenic animals and their applications,
4.4 Methods used for transgenesis with reference to transgenic mice,cattle, sheep, goats, pigs, chicken and fish.
4.5 Animal cells as a bioreactor for the production of commercially important products
4.6 Cryopreservation- principles

Practical paper VI - elective (B)

1. Preparation of media
2. Isolation of cells from Chick embryo
3. Establishment and maintenance of primary cell cultures
4. Subculture of monolayer cells
5. Subculture of suspension cells
6. Determination of viable cells by trypan blue test

Spotters:

1. Trypsinization
2. Monolayer
3. Transgenic Mice
4. Lipofection
5. Microinjection
6. Cell lines
7. Marker genes
8. Bioreactor
9. HAT
10. Dolly

5. CURRICULUM PLAN

Month	B.ScSyllabus Topic Sem-I
June	1.1 Cell as basic unit of life (Viral, bacterial, fungal, plant and animal cells) 1.2 Ultra structure of prokaryotic cell (Extra Chromosomal Material – Plasmid) 1.3 Ultra structure of eukaryotic cell (Cell wall, cell membrane, Golgi Complexes, Endoplasmic Reticulum, Peroxisome, Lysosomes etc) 1.4 Fluid mosaic model, sandwich model, membrane permeability
July	1.5 Structure of chromosomes-componenets of chromosomes (histone and nonhistone proteins), specialized chromosomes (Polytene and Lamp Brush) 1.6 Chromosomal abberations -structural and numerical 2.1 Bacterial cell division 2.2 Eukaryotic cell cycle phases 2.3 Mitosis stages and significance 2.4 Meiosis stages and significance
August	2.5 Senesence and Necrosis 2.6 Apoptosis 3.1 Mendel's experiments – Factors contributing to success of Mendel's experiments 3.2 Mendel,s laws - Law of segregation – Monohybrid ratio, Law of Independent assortment – Dihybrids, Trihybrids 3.3 Deviation from Mendel's Laws - partial or incomplete dominance,co-

	dominance, non allelic interaction and modified dihybrid ratios
September	3.4 Penetrance and expressivity (polydactyl and waardenberg syndrome), Pleiotropism, phenocopy - microcephaly, cleft lip 3.5 Multiple Alleles: ABO blood groups & Rh factor 3.6 Sex determination in humans, drosophila, x-linked inheritance (haemophilia, color blindness), X- inactivation 4.1 Linkage and recombination – Discovery of linkage, cytological proof of crossing over, Recombination frequency and map distance. 4.2 Non-Mendelian inheritance - Cytoplasmic inheritance (Shell coiling in snail)
October	4.3 Cytoplasmic male sterility in maize 4.4 Mitochondrial inheritance in humans, poky strains in neurospora 4.5 Chloroplast inheritance in chlamydomonas 4.6 Hardy weinberg equilibrium

Month	**B.ScSyllabus Topic**
	Sem-II
December	1.1 Carbohydrates-Importance, classification, Structure and functions of Monosaccharides (Glucose and Fructose), Disachharides (Sucrose, Lactose, Maltose) and polysaccharides (Starch, Glycogen, inulin) 1.2 Amino acids: Importance, classification, Structure, physical and chemical properties of amino acids, peptide bond formation 1.3 Proteins: importance, structure of proteins- primary, secondary, tertiary and quarternary

January	1.4 Lipids: importance, properties and classification, Simple lipids-TAG and waxes, Complex lipids- phosphos lipids and glycolipids, Derived lipids- steroids, terpenes and carotenoids 1.5 Nucleic acids: structure and chemistry of DNA (Watson and crick) and RNA (TMV), structure and forms of DNA (A, B and Z forms) 1.6 Enzymes-classification and nomenclature. Michaelis Menton Equation-Factors influencing the enzyme reactions and Enzyme inhibition (Competitive and Non-competitive), co enzymes
February	2.1 Glycolysis, TCA Cycle 2.2 Electron transport, Oxidative phosphorylation 2.3 Gluconeogenesis and its significance 2.4 Transamination and Oxidative deamination reactions of amino acids 2.5 β-oxidation of fatty acid 2.6 Glyoxalate cycle
March	3.1 Historical development of microbiology and contributors of microbiology 3.2 Microscopy: bright field microscopy, dark field microscopy, phase contrast microscopy, fluorescent microscopy, SEM and TEM 3.3 Outlines of classification of microorganisms 3.4 Structure and general characteristics of bacteria and virus 3.5 Disease causing pathogens and symptoms (Eg: Mycobacterium, Hepatitis) 3.6 Structure and general characteristics of micro-algae and fungi
April	4.1 Methods of sterilization- physical and chemical methods 4.2 Bacterial nutrition, nutritional types, essential macro and micro nutrients and growth factors 4.3 Bacterial growth curve- batch, continuous and synchronous cultures, bacterial growth measurement cell number and cell mass 4.4 Factors affecting bacterial growth 4.5 Culturing of anaerobic bacteria and viruses 4.6 Pure culture and its characteristics

	B.ScSyllabus Topic

Month	Sem-III
June	1.1 Transcription in prokaryotes: enzymatic synthesis of RNA, basic features of RNA synthesis, E. coli RNA polymerase, classes of RNA molecules 1.2 Transcription mechanism in prokaryotes- promoter, initiation, elongation, proof reading and rho dependent, independent mechanism 1.3 Transcription in eukaryotes: polymerase of eukaryotes, promoters of eukaryotes
July	1.4 Synthesis of hnRNA and post transcriptional modifications 1.5 The genetic code, properties of genetic code, wobbles hypothesis 1.6 Translation mechanism in prokaryotes and eukaryotes 2.1 Gene regulation in prokaryotes 2.2 Transcriptional level regulation- positive and negative regulation 2.3 Auto and co-ordinated regulation 2.4 Operon concept- lac, trp operons
August	2.5 Translation regulation in eukaryotes and prokaryotes 2.6 Inhibitors of protein synthesis- antibiotics and other inhibitors 3.1 Enzymes used in gene cloning: restriction endonucleases, ligases, phosphatases, methylases, kinases 3.2 Cloning vehicles, plasmids, cosmids, phage vectors 3.3 Construction of genomic and cDNA libraries
September	3.4 Identification of cloned genes- Colony hybridisation 3.5 Expression of vectors, bacterial vectors 3.6 Yeast vectors 4.1 Principle, methodology and applications of PCR technology 4.2 Variations of PCR

October	4.3 DNA finger printing technique and its applications in medicine 4.4 Principles involved in blotting techniques- southern, northern and western blotting 4.5 Genome sequencing: Sangers method 4.6 Applications of rDNA technology in medicine

Month	**B.ScSyllabus Topic** **Sem-IV**
December	1.1 Introduction to biostatistics, history and applications 1.2 Concept of sampling and sampling distributions 1.3 Measures of central tendency (mean, median, mode) 1.4 Measures of deviation (standard deviation, variance and co-efficient of variation)
January	1.5 Concept of probability, basic laws and its application to mendelian segregation 1.6 Concept of probability distribution, binomial, poisson distribution, normal distribution and their applications in biology 2.1 Concept of test of hypothesis- t-Test and chi square test, their application in biolgy

	2.2 Simple correlation and regresion 2.3 Concept of analysis of variance (ANOVA)- one way classification
February	2.4 ANOVA- Two way classification 2.5 Graphical representation of data 2.6 Importance of statistics in biology 3.1 Usage of MS-DOS commands, internal and external commands 3.2 Directory and file commands, copying, erasing, renaming and displaying files 3.3 Microsoft word: concept of toolbar, character, paragraph and document formatting
March	3.4 Drawing tool bar, header, footer, document editing, page set up, short cut keys, text and graphics 3.5 Microsoft power point: slide presentation, slide layout and design, custom animation, image importing, slide transition 3.6 MS Excel- Applications, Functions, Charts, Pivot Tables, validations, formatting of spread sheet 4.1 Introduction to bioinformatics, history and emergence 4.2 Biological databases (nucleic acids and proteins)
April	4.3 Introduction to Genomics and Proteomics 4.4 Biochips 4.5 Data retrieval tools (BLAST, Pub MED) 4.6 Applications of Bioinformatics

Month	B.ScSyllabus Topic	
	Sem-V	
June	1.1 Historical perspectives of plant tissue culture, and Basic requirement for tissue culture laboratory 1.2 Culture mediums for plant tissue culture-MS medium and B5 Medium. 1.3 Sterilization of media-steam, dry and filter sterilization- Explants sterilization	1.1 Scope and importance of medical biotechnology 1.2 Karyotyping of human chromosomes 1.3 Chromosome banding– G banding and R-banding technique
July	1.4 Plant growth regulators and differentiation. 1.5 Method of tissue culture-formulation of medium explants collection, surface sterilization, inoculation, Callus induction, subculture and regeneration of plants 1.6 organ culture- leaf, root and stem culture 2.1. Suspension cultures- growth and subculture, types and synchronization of suspension cultures. 2.2 Immobilization of cells and the effect of elicitors on the production of secondary metabolites of commercial value	1.4 Inheritance patterns in Man– Pedigree analysis 1.5 Diagnosis using monoclonal antibodies- ELISA 1.6 Genetic counselling – calculating risk and discussing the options 2.1 Chromosomal disorders caused due to structural chromosomal abnormalities (Deletions, duplications, Translocations) 2.2 Chromosomal disorders caused due to numerical chromosomal abnormalities (autosomal and allosomal)
August	2.3 Meristem culture and its uses in production of virus free plants 2.4. Clonal propagation, Micro propagation of plants – medicinal plants and endangered plants –method and advantages 2.5 Production of secondary metabolites-culture techniques 2.6 large scale production of commercially important compounds 3.1 Somatic embryogenesis- Principle, protocol and importance. 3.2 Artificial seeds – production, applications and limitations.	2.3 Monogenic disorders (autosomal and X-linked diseases) 2.4 Mitochondrial diseases – LHON, MERRF 2.5 Types and causes of male and female infertility 2.6 IVF- methodology 3.1 Gene therapy – exvivo and *invivo*gene therapy; somatic and germline gene therapy; 3.2 Strategies of gene therapy: gene augmentation – ADA deficiency; Prodrug therapy/ suicide gene – glioma
September	3.3 Embryo rescue and its importance 3.4 Anther culture and production of androgenic haploids. 3.5 Somaclonal variations- applications of somaclonal variations to crop improvement 3.6 Cryopreservation of plant cultures and application of plant tissue culture 4.1. Protoplast – properties of protoplast, Protoplast – Isolation (mechanical and enzymatic methods) 4.2 Culturing and regeneration of protoplasts 4.3 Different methods of protoplast fusion (mechanical fusion, chemo fusion, electro fusion)	3.3 Stem cells – potency definitions; embryonic and adult stem cells; 3.4 Applications of stem cells – cell-based therapies and regenerative medicine 3.5 Encapsulation technology and therapeutics-Diabetes 3.6 Human genome sequences – mapping and cloning of human disease genes 4.1 Cancer – Types 4.2 Oncogenes, tumour suppressor genes, stability of genome, control of cell cycle 4.3 Molecular basis of colon cancer and breast cancer

October	4.4 Selection of somatic hybrids and cybrids. 4.5 Introduction to *Agrobacterium tumifaciens*, Features of Ti Plasmid, molecular mechanism of T-DNA transfer**.** 4.6 Physical gene transfer methods – Particle Bombardment, Electrophoration and microinjection	4.4 DNA/RNA based diagnosis– HBV, HIV 4.5 Applications of PCR in disease diagnosis 4.6 Haemoglobinopathies

Month	**B.ScSyllabus Topic**	
	Sem-V	
December	1.1 Introduction to environment and pollution 1.2 Types of pollution- air, water and land pollutions 1.3 Types of pollutants– inorganic, organic and biotic sources 1.4 Sources of pollution – domestic waste, agricultural waste, industrial effluents and municipal waste	1.1. Animal tissue culture, history, requirements for animal cell culture 1.2. Substrate, liquids, culture mediums-Natural (Clots, Biological fluids, Tissue extracts), complex natural and chemically defined media 1.3. Explant-culture of explants, Cell culture technique-initiation, preparation and sterilization of media 1.4 Isolation of explants, disaggregation of explants, culture, subculture
January	1.5 Biomonitoring of environmental pollutants by bioindicators 1.6 Emission control biotechnology- air sampling techniques 2.1 Renewable and non- renewable energy resources 2.2 Fossil fuels as energy source and their impact on environment 2.3 Non-conventional source – biomass as source of bioenergy	1.5 Cell lines, evolution of cell lines, maintenance of cell lines, large scale culture of cell lines- monolayer, suspension and immobilized cell culture, 1.6 Development of primary culture and cell lines, subculture 2.1. Cultured cells and evolution of continuous cell lines (established cell lines) 2.2. Commonly used cell lines - their origin and characteristics 2.3. Cell line preservation and characterization
February	2.4 Types of biomass – plant, animal and microbial biomass 2.5 Biodelignification by enzymes 2.6 Biodesulphurisation of coal 3.1 Microbial treatment of waste water (sewage of industrial effluent)- aerobic and anaerobic methods 3.2 Solid waste and management; Bioremediation– concepts and types (in-situ and ex-situ)	2.4. High level expression of foreign gene in animal cells-expression vectors, enhancers, regulatory sequences. 2.5 Expression foreign genes in animal cells: advantage and disadvantages. 2.6 Properties of cell lines – biology and characterisation of cultured cells 3.1. Transfection methods of animal cells (Calcium phosphate, DEAE-dextran, Lipofection, Electroporation, Microinjection) 3.2 Embryonic stem cell transfer

March	3.3 Bioremediation of toxic metal ions– biosorption and bioaccumulation 3.4 Microbial bioremediation of pesticides and Xenobiotic compounds 3.5 Phytoremediation- concepts and application 3.6 Degradative plasmids and genes in biomining 4.1 Climate change, greenhouse gases and global warming,	3.3 Selection of recombinant cells with various marker genes (Thymidine Kinase, Dihydrofolate reductase, CAD protein, XGPRT, HAT, Neomycin phosphotransferase) 3.4 Production of transgenic animals (Mice, Cattle, Sheep, pigs, Fish and Birds) 3.5 Applications, advantages and disadvantages of animal tissue culture 3.6 Ethical issues related to transgenic animals 4.1 Stem cells: Characteristic features, maintenance, culture and Applications of Embryonic and adult stem cells
April	4.2 Impact of pollution on environment and measurement methods 4.3 Production of biofuels, bioethanol &biomethanol 4.4 Conservation of biodiversity 4.5 Carbon sequestration – vision, methods and management strategies 4.6 GEMS and their impact on environment	4.2 Animal cloning- Nuclear transfer and embryonic stem cell method 4.3 Molecular pharming: Transgenic animals and their applications, 4.4 Methods used for transgenesis with reference to transgenic mice, cattle, sheep, goats, pigs, chicken and fish. 4.5 Animal cells as a bioreactors for the production of commercially important products 4.6 Cryopreservation- principles