BSc Biotechnology

Kumaun University, Nainital
Curricula/Syllabi

SEMESTER I
Elementary mathematics for Biologists (50 marks)
Essential Physics for Biologists (50 marks)
Chemical Science I (50 marks)
Practical based on above courses (50)

SEMESTER II
Biology of Plant (50 marks)
Biology of Animals (50 marks)
Chemical Science II (50 marks)
Practical based on above courses (50 marks)

SEMESTER III
Fundamentals of Computers (50 marks)
Biochemistry (50 marks)
Cell Biology (50 marks)
Practical based on above courses (50 marks)

SEMESTER IV
Microbiology (50 marks)
Molecular Biology (50 marks)
Genetics (50 marks)
Practical based on above courses (50 marks)

SEMESTER V
Instrumentation and Bioanalytical Techniques (50 marks)
Genetic engineering and Bioinformatics (50 marks0
Immunology (50 marks)
Practical based on above courses (50 marks)

SEMESTER VI
Animal Biotechnology (50 marks)
Plant Biotechnology (50 marks)
Environmental Biotechnology and Biosafety (50 marks)
Practical based on above courses (50 marks)

B.Sc. I Semester
ELEMENTARY MATHEMATICS FOR BIOLIGISTS

Value-50 Marks

UNIT- I

- Algebra- Simultaneous equations (linear and quadratic) upto two variables only; Determinants- properties of determinants; Matrices- definition and types, Arithmetic operation on matrices, Partial fraction.
- Complex number and De moivers theorem

UNIT-II

- Differential Calculus- Differentiation, Differentiation of Standard function including functions of a function (chain rule), Differentiation of implicit functions; Logarithmic differentiation.
- Integral calculus- Integration of parts, substitution of partial fractions, Integration of algebric function; The definite integral- properties of definite integral.

UNIT- III

- Frequency distribution- graphical representation of frequency distribution using bar chart, pie chart, histograms, frequency polygon, frequency curve and cumulative frequency curve.
- Mean, Median and Mode and their characteristics; quartiles, range, dispersion, mean deviation, standard deviation, standard error of mean; Coefficient of variation.

UNIT-IV

- Correlation and regression- definition, Karl – Pearson's coefficient of correlation, line of regression, regression coefficient.

UNIT-V

- Sampling- An idea of probability; large samples, Test of significance of large samples at 5% and 1% levels of significance; t-test, chi square test and F test.

B.Sc. I Semester
Essential Physics for Biologists

Value-50 Marks

General properties

Basic conservation laws of mechanics, Momentum, Angular momentum, Torque, central force Inertial and non-initial frames of references, Fictitious force, Galilean and Lorentz transformations, Work and Energy conservation of energy. Rotation of Rigid bodies, Moments of inertia of various bodies, Surface tension, viscosity, elasticity,

Heat and Thermodynamics

Temperature and heat, heat capacity and specific heat, heat capacity of ideal gases, conductivity of heat. Zeroth, First and second laws of thermodynamics, entropy and heat engine, Brief ideal of thermodynamic relationships.

Electricity and magnetism

Coulomb's law, Gauss's law of electrostatics and its application magnetic field: Dia Para and Ferromagnetism, Faraday's law of induction, self and mutual inductance's, Brief idea of A.C. circuit, power factor, impedance and power dissipation etc.

Optics

Elementary ideas about interference, Diffraction of light, transmission diffraction and polarization and its different forms, Brewster's and Malus law, Polaroids and retardation plates, Optical activity.

Modern and Nuclear Physics

Photoelectric effect, Compton scattering and pair production, X-rays, their production and uses, Wave particle duality, de Broglie waves, Bohr atomic modal, laser, solar cell and micro-waves, Uncertainty principle and its application.

Radioactivity, Decay law, half life, average life of radioactive material, Alpha, beta and gamma decay

Measuring Instruments

Galvanometer, ammeter, voltmeter, pH meter, Lux meter, Spectrometer, LCR meter.

B.Sc. I Semester
Chemical science I

50 Marks

UNIT-I

- Atomic structure, chemical bonding, ,hybridization, valence shell electron pair repulsion (VSEPR) theory. To NH_3, H_3O^+, SF_4, ClF_3 and H_2O, Molecular orbital theory (MOT) ,
- Periodic properties: viz. ionization potential, electron affinity, electronegativity etc. study of s,p and d- block elements.
- Coordination compound: Werners theory and IUPAC nomenclature of coordination compounds valence bond theory and discussion of inner and outer orbit complexes.

UNIT-II

- Acids and bases: elementary ideas of Bronsted – Lowery and Lewis concept of acid and bases. SHAB (soft and hard acid and base), buffer solution, pH, pKa and pKb values ,
- Solution: Henrys law, Roults law, osmotic pressure and its measurement, effect of solute on B.P. and F.P. of solution. Vapour pressure, surface tension, viscosity, parachor, Rheochor and their applications

UNIT-III

- Chemical kinetics:1^{st} 2^{nd} and 3^{rd} order reactions, determination of order of reaction, molecularity and order of reaction, Energy of activation, Arhenus equation, half- life period, catalyst and composite reaction.
- Electrochemistry: Galvanic cells, EMF, type of electrodes, refrence electrodes, electroanalytical methods viz; potentiometry, conductometry, polarography, weak and strong electrolyte, degree of hydrolysis of salts.

UNIT-IV

- Ionic and Liquid crystals
- Nuclear chemistry: concepts of nuclides, isotopes, isobars, isotones, radioactivity, nuclear reaction,
- Colloidal solutions: properties of collides, Tyndel effect, flocculation,Hardy –Sultze rule.

B.Sc. I Semester
Essential Physics for Biologists

25 Marks

Practical

1. Diffraction grating.
2. Resolving power of Telescope.
3. Refractive index of Prism
4. L.C.R. Circuit.
5. P.N. Junction Diode
6. Thermal Coefficient
7. Focal length by pins method
8. Calibration of Am-meter
9. Calibration of Voltmeter
10. Demonstration of different resistances
11. Demonstration of different capacitance

B.Sc. I Semester
Chemical Science I

25 Marks

Practical

1. Volumetric Analysis : Acid-Base, Oxd-Red, Iodometric Titration, Potassium dichromate.
2. Determination of surface tension/ viscosity
3. Calculation of parachor
4. Separation of the organic binary mixture and identification of the compounds.

B.Sc. II Semester
Biology of Plants

50 Marks

UNIT-I

- Plant Kingdom. The classification up to the level of genus and species, Important characters of each class with suitable examples.
- Mechanism of Photosynthesis,photophosphorylation.
- Mechanisms and significance of respiration.

UNIT-II

- Plant- water relations, absorpation movement and transpiration of water.
- Translocation of minerals and nutrients.

UNIT-III

- Dicot and monocot root and stem, structure and function of different cells (Angiosperms and Gymnosperms)
- Inflorescence and their types with example, fruit and their types with example.
- Secondary growth of stem
- Development of seed, Seed germination and dormancy

UNIT- IV

- Plant growth hormones- introduction and functions.
- Major auxin & Cytokinin ,their functions and application
- Vernalization, Photoperiodism

UNIT-V

- Apomixis
- Parthenocarpy, Polyembryoni
- Ecobiology of the medicinally and aromatically important plants.

B.Sc II Semester
BIOLOGY OF ANIMALS

50 Marks

UNIT-I

- Basic concept of classification for the five kingdom approach, Linnaean hierarchy.
- Principles of nomenclature, International code of zoological nomenclature.
- Outline classification of Non-chordates and chordates including general characters and examples of major living groups.

UNIT-II

- Organic evolution- Evidences.
- Theory of evolution- Lamarckism & Neo- Lamarckism; Darwinism & Neo-Darwinism; Modern synthetic theory of evolution.
- Population genetics- Hardy-Weinberg law.

UNIT-III

- Digestion: Digestion & absorption of carbohydrates, proteins and lipids, role of enzymes and hormones, Respiratory pigments.
- Respiration: , Respiratory pigments,Transport of oxygen and carbon dioxide; Control of breathing.
- Circulation: Composition and function of blood & lymph, Heart beat & cardiac cycle.
- Structure of muscles and mechanism of muscle contraction.
- Structure of muscles and mechanism of muscle contraction

UNIT-IV

- Nervous system: CNS, PNS, Autonammic system, nerve impulse.
- Excretion: Composition of Urine & its formationin mammals
- Endocrines: A brief idea of structure and functions of Hypothalamus, Pituitary, Thyroid, Parathyroid, Adrenal, Pancreas, Testis & ovary.

UNIT-V

- Aquatic adaptations of fish- Morphological, Anatomical and physiological. A brief idea of fish culture.

- Outline of Sericulture, Apiculture & insects pest management.

B.Sc.IISemester
Chemical science II

50 Marks

UNIT-I

- Basic stereochemistry: Geometrical isomerism, E, Z, nomenclature enantiomerism, distereoisomerism, D, L configuration, and absolute configuration (R,S nomenclature) , conformational analysis, and IUPAC nomenclature.

- Concepts of thermodynamics in chemical reaction.

UNIT-II

- Reaction mechanism: type of organic reactions, reaction intermediates, S_{N1}, S_{N2}, E_1 and E_2 reactions, hemolytic and heterolytic fission, nucleophile, electrophiles, mechanism of Aldol condensation, Cannizaro reaction, Friedal craft reaction, Beckmann reagent, Dield-Alder reaction, Hoffmann-reaction, electrophilic substitution reations, orientation effect.

UNIT-III

- Aliphatic and aromatic organic comounds: general method of preparation, properties, chemical reaction and application of both aliphatic and aromatic hydrocarbon, aldehydes, ketones, alcohols, ether, thioether, amines, amids, anhydrides, and carboxylic acids, phenols, organic chemistry of Sulphur compounds, chloramin-t, saccharin etc

UNIT-IV

- Heterocyclic aromatic compounds: pyridine, pyrol, quinoline, isoquinoline structure properties synthesis and applications.
- Basic concepts about bioactive natural product viz, alkaloids, terpenoids, steroids.

Unit V

- Basic concept about analgesics,antipyretics,preparation and uses of asperin,paracetamol,sulphadrug viz sulphanilamide,sulphaquanidine and sulphapyridine.

B.Sc. II Semester
Biology of Plant

15 Marks

Practical

1. Specimen of Algae, Fungi, Brypphyta, pteridophyla & Gymnosperms.
2. Section cutting of leaf/stem/root.
3. Study of inflorescence, fruits & seeds.
4. Families- Melvacese, Cruciferae, Compositae.

B.Sc. II Semester
Biology of Animals

15 Marks

Practical

1. Dissection of cranial nerves of scoliodon.
2. Dissection of nervous system of prawn.
3. Study of museum specimenls spermanent slides of chordates and non-chordates.
4. Dehydration procedure.

B.Sc. II Semester
Chemical Science II

20 Marks

Practical

1. Preparation of organic compound, Nitration, Bromination, Acetylation etc.
2. Preparation of Inorganic compound.
3. Paper, Thin layer and column chromatography of sugars, Amino acid, phenols etc.
4. Qualitative analysis of inorganic mixture containing not more than six ionic species. (excluding insoluble substances)

B.Sc. III Semester
FUNDAMENTAL OF COMPUTERS

50 Marks

UNIT-I

- History of development of computers, Generation o f computers, Basic components of a computer, Input & Output devices, Classification of computers.
- Concept of computer languages- Introduction to basic, FORTRAN, C & C^{++}

UNIT-II

- Computer Networking: Concepts, various configurations of a computer Network.
- Basic concepts of LAN, WAN & MAN

UNIT-III

- Microsoft office:
  MS-Word
  MS-Excel
  MS-Power Point
  MS-Access

UNIT-IV

- Computer software- Operating system
- Introduction to DOS and Windows
- Introduction to scandisk, Defragmentation and Antivirus software.
- Prevention & & cure of computer viruses and worms.

UNIT-V

- Binary representation of data
- Algorithm and flow charts
- Internet & its applications.

B.Sc. III Semester
BIOCHEMISTRY

50 Marks

UNIT-I

- Bio molecules-Their functions and biological significance
- Thermodynamics of biochemical reactions, Energy rich biomolecules (ATP, NADP & Other phosphorylated compounds).
- Carbohydrates : chemical structure, classification & properties, Importance in biological systems. Amino acids & peptides – classification, properties & structure; primary, secondary, tertiary & Quaternary structure of proteins.
- Lipids : Structure, classification, properties & functions.

UNIT – II

- Enzymes : classification, characterstics, factors affecting enzyme activity. Enzyme kinetics, Km, Enzyme inhibition.
  Coenzymes, isoenzymes & multienzyme complexes Apoenzyme, Allosteric enzymes.

UNIT – III

- Nucleic acids : Base composition, nucleosides, nucleotides & polynucleotide structure.Forms and types of nucleic acid'Primary and secondary structure of nucleic acids.

UNIT – IV

- Hormones : Structure, chemical classification, Mode of action at molecular level, functions in brief & regulation.
- Vitamins : Structure & Functions.

UNIT – V

- Coordinated control of Metabolism : Glycolysis, , citric acid cycle, pentose phosphate pathway, Glycogen breakdown & synthesis, control of glycogen metabolism, Electron transport & Oxidative phosphorylation, Fatty acid oxidation & Fatty acid biosynthesis, Nitrogen fixation in plants & micro organisms, inborn errors of metabolism, glucogenic & Ketogenic amino acids, Urea cycle, Catabolism of Purine & pyrimidine nucleotides.

B.Sc. III Semester
CELL BIOLOGY

Value : 50 marks

UNIT – I

- Cell as a unit of living system. The cell theory; Precellular evolution; Eukaryotic and Prokaryotic cells.
- Biochemical composition of cells (Protein, lipids, carbohydrates, nucleic acids).

UNIT – II

- Structure and functions of various cell organelles; ultrastructure of plasma membrane; cell wall, endoplasmic reticulum, mitochondria, Golgi body, chloroplast, lysosomes, peroxisomes & glyoxisomes.

UNIT – III

- Structure of nucleus, nucleolus and chromosomes; Giant chromosomes (lampbrush & polytene).
- Cytoskeletal structures (actin, microtubules intermediate filament)

UNIT –IV

- Cell division (Mitosis and Meiosis); Cell cycle; Difference between cancerous and normal cells.
- Cell senescence, cell death and apoptosis.

UNIT – V

- Cell-cell interaction; cell adhesion to matrix, cell locomotion (muscle contraction, cell beading).
- Membrane trans post

B.Sc. III Semester
Fundamentals of Computers

25 Marks

Practical

1. Introduction to C^{++}
2. Introduction to Array
3. For loop and while loop
4. IF Statement
5. Basic, Networkig.

Practical **Biochemistry** **25Marks**

1. Estimation of Carbohydrates
2. Estimation of Proteins
3. Separation of amino acids by paper chromatography
4. Thin layer chromatography
5. Gel Electrophoresis
6. Assay of enzyme activity and enzyme kinetics
7. Saponification of Fats

B.Sc. IV Semester
MICROBIOLOGY

50 Marks

UNIT – I

- History of microbiology :Importance & scope of microbiology
- Classification and nomenclature of Microbes
- ,Importance & scope of microorganisms in human welfare

UNIT – II

- Characteristics and examples of *Archaebacteria ,* eubacteria, viruses, viroids and prions.
- Size, shape and arrangement of bacterial cells, cell wall, cytoplasmic membrane (Protoplasts, spheroplasts), flagella, pili, spores and cysts.
- Bacteriophage – lytic and lysogenic cycle; Staining techniques – simple (Monochrome and negative) and differential (Gram and acid fast).

UNIT – III

- Control of microorganisms – Methods of sterilization, disinfection, sanitation, pasteurization, physical and chemical methods of control.

- Staining techniques – Simple (Monochrome and negative) and differential (Gram and acid fast).

UNIT – IV

- Bacterial nutrition – Nutritional classes of microorganisms.
- Microbial media and its types.
- Isolation of pure culture from natural sources and its maintenance.

UNIT – V

- Microbial growth – Growth curve, conditions affecting growth.
- Batch and continuous culture; Measurement of bacterial growth.
- Introduction to microbial pathogens & diseases(Cholera, tuberculosis, tetanus,measles & Mumps ,influenza ,rabies , Polio mylities, toxoplasmesis, HIV, Candydiasis etc.)

B.Sc. IV Semester
MOLECULAR BIOLOGY

Value- 50 Marks

UNIT – I

- Control Dogma of Molecular Biology,
- Recapitulation of Nucleic acid structure forms.Nucleic acid as genetic material(Avery et al's experiment & Hershey &Chase's experiment)
- DNA polymerases in Prokaryotes & Eukaryotes
- Replication of DNA : Semi conservative replication of DNA (Messelsen & Stahl experiment), Uni–directional bi–directional replication of DNA &rolling circle DNA replication, DNA replication in prokaryotes (Initiation, elongation & termination), DNA replication in eukaryotes (Initiation, elongation & termination)

UNIT-II

- Transcription: Transcription in prokaryotes (Promoter sites, initiation & elongation, termination), Transcription in Eukaryotes (Promoter, enhancer & silencer sites for initiation, transcription factors, elongation & termination), RNA polymerase in prokaryotes & Eukaryotes.
- RNA processing- capping, tailing & splicing,ribozyme,RNA editing.

UNIT-III

- Protein Synthesis : Translation in Prokaryotes & Eukarytoes (Formation of aminoacyd tRNA, Initiation, Elongation & Termenation of polypeptide). Post translational Modification of proteins.
- Genetic code : Porperties of genetic code, chain initiation & chain termination codons, wobble hypothesis.

UNIT-IV

- Concept of gene and its organization
- Regulation of gene expression: Positive & Negative regulation, The operon model for transcriptional regulation (Lac operon & Trp operon) control of lac operon, regulation of trp operon.

UNIT-V

- Organization of genetic material: Chromosomal DNA content & C-Value paradox, Repetitive DNA, satellite DNA, (reassociation Kinetics, Chemical complexity & Kinetic complexity)
- Homologous recombination ,Holliday model

B.Sc IV Semester
GENETICS

50 Marks

UNIT-I

- Modern concept of gene & genome
- Introduction of genetics, genotype , phenotype and other genetic terminology
- Mendel's laws of inheritance and their molecular interpretation.
- DNA as genetic material-experimental proof

UNIT-II

- Chromosomes- structural organization of prokaryotic and eukaryotic chromosomes, Kinds of chromosomes based on chromosomal aberration- structural & numerical.

UNIT-III

- Mutation: spontaneous and induced, chemical and physical mutagens, induced mutations in plants, animals and microbes for economic benefits, Replica plating techniques.
- Hereditary defects- Kleinfelters syndrome, Down's syndrome, Turners syndrome,

UNIT-IV

- Microbial genetics- Recombination in bacteria; Molecular mechanism of recombination, Transformation, Transduction, Conjugation ,replica plating.

UNIT-V

- Concept inMonosomy, trisomy, nullisomy & others introduction
- Introduction to Genetic & physical maps
- Classical experiment of genetics in drosophila for establishing linkages and crossing over.
- Biochemical genetics – *Neurospora crassa* experiments

SemesterIV
Microbiology

Practicals: **25 Marks**

1. Preparation of nutrient agar slants, plates and nutrient broth and their sterilization
2. Inoculation of agar slants, agar plate and nutrient broth
3. Culture of micro-organism using various techniques
4. Simple and differential staining procedures, endospore staining, flagellar staining, cell wall staining,
Capsular staining, negative staining
5. Bacterial colony counting
6. Microscopic Observation of different vegetative, capsular and spore forms of bacteria and fungus under
7. Isolation of microbes from soil samples and determination of the number of colony forming units
8. Study of growth curve of E. coli

Practicals **Molecular Biology** **25 Marks**

1. Estimation of DNA content in the given sample by diphenylamine method
2. Estimation of RNA content by the Orcinol method
3. Isolation of DNA from bacterial or plant or animal cell
4.Spectrophotometric quantitation of DNA.
5.DNA hyperchromacity.

B.Sc. V Semester
INSTRUMENTATION AND BIOANALYTICAL TECHNIQUES
Value- 50 Marks

UNIT-I

- Balances (Electrical & Electronics)
- Microscopy- (Compound, Phase contrast, Electron- TEM & SEM), Fluorescence microscopy
- pH meter

UNIT-II

- Chromatography: Paper chromatography, Thin layer chromatography, Column chromatography, Gas chromatography

UNIT-III

- Colorimetry and Spectrophotometry (UV-VIS): Lambert Beer's law, Concept of IR, NMR and mass spectrometry, Radio-immuno assay; ELISA; Western blotting
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UNIT-IV

- Centrifugation: Zonal, Density gradient, Differential centrifugation; Tracer techniques & Autoradiography

UNIT-V

- Electrophoresis: PAGE, Agarose gel Electrophoresis
- Autoclave
- Laminar air flow

B.Sc. V Semester
GENETIC ENGINEERING & BIOINFORMATICS

50 Marks

UNIT-I

- Scope & History of Genetic Engineering
- Isolation & Purification of genomic & plasmid DNA from Bacteria, Plant & Animal cells.
- Vectors: Nomenclature, properties, plasmids, cosmids, phages, yeast vector, plant & animal vectors, cassette vectors.
- Restriction enzymes & other enzymes required in recombinant DNA technology.

UNIT-II

- Introduction to techniques in Molecular Biology: Gene synthesis, cDNA synthesis & cloning, Gene sequencing (Maxma Gilbert method & Sanger's method), PCR (its forms & application). Northern, Southern & Western blotting. In situ hybridization, dot blots cDNA library construction & screening.
- Genomic library construction & screening
- Linkers, adaptors, Blunt end ligation, Homopolymer tailing

UNIT-III

- Basic principal & introduction of antisense & ribozyme technology, post transcriptional gene silencing (RNAi technology), Gene therapy,
- Introduction to microarray technology

UNIT-IV

- Cloning & expression of foreign genes in Prokaryotes (E.Coli) & Eukaryotes (e.g. yeast).
- Application of recombinant DNA technology.

UNIT-V

- Bioinformatcs: History and scope, concepts of CD-ROM, e- mail, web sites, internet networking, database, collection & retrieval data of gene bank. Tools for sequence alignment (FASTA, BLAST, PSI-BLAST), primer designing, phylogenetic analysis, database searching for similar sequences.

B.Sc. V Semester
IMMUNOLOGY

50 Marks

UNIT-I

- Immune system organs and cells
- Body defense mechanisms against infection- Innate & acquired.

UNIT-II

- Body defence mechanisms against infection- Innate & acquired.
- Active & Passive immunity, primary & secondary Immune response.

UNIT-III

- Important attributes of antigens epitops, heptans & Carriers, Antibody structure, Immunoglobulin classes & antibody diversity.

UNIT-IV

- Antigen & Antibody interaction in vivo & vitro. Agglutination & Precipitation reaction, Hemogglutination, Immunofluorescence, ELISA, RIA etc.

UNIT-V

- General idea about MHC in mouse, HLA system in humans, significance of MHC molecules & basic idea of complement system.
- Monoclonal antibodies & their applications.
- Immune disorders- Autoimmune diseases (Rheumatoid arthritis, Hashimoto's thyroiditis, & immunodeficiency (AIDS & SCID).

SemesterV
Bioanalytical technique

Practicals **10 Marks**

1. Garvimetric estimation of barium, zinc, iron, copper, sulphate and chromium
2. Organic Mixture: Separation of two component organic mixtures (water soluble), systemic analysis of each component.

Practicals **Genetic Engineering** **20 Marks**

1. Isolation of Plasmid DNA
2. Restriction digestion with EcoRI' HindIII or any other restriction enzyme available
3. Agrose gel electrophoresis of Restricted and Unrestricted DNA fragments.

Practicals **Immunology** **20Marks**

1.Demostration of immunization techniques and bleeding of experimentnal animals.
2. Seperation of serum.
3. Antibody and Antigen interaction- Agglutination, Precipitation, Ochterlony double diffusion
4. ELISA

B.Sc VI SEMESTER
ANIMAL BIOTECHNOLOGY

50 Marks

UNIT-I

Animal Cell Culture:

- History and development of cell culture
- Layout and basic requirements for cell culture laboratory
- Sterilization and preparation for cell culture
- Culture media – Natural and synthetic; Importance of serum in cell culture
- Growth factors- EGF, ECF, PDGE, IL –2, NGF & erythropoietin

UNIT-II

- Types of animal cell culture
- Concept of transformation and neoplastic cells
- Development of primary culture (chicken embryo fibroblast)
- Commonly used cell lines- their organization and characteristics (vero, BHK-21, MDBK, HeLa etc.)
- Subculture and cryopreservation
- Application of animal cell culture technology

UNIT-III

Immunodiagnostics and Vaccine Technology

- Introduction to immunodiagnostics
- Monoclonal antibodies
- Introduction to vaccines
- Types of vaccines
- Killed V/s Attenuated vaccines
- Modern generation vaccines

UNIT-IV

Embryo Biotechnology and Animal Cloning

- Embryo Biotechnology: Introduction to embryo transfer technology
- Brief Introduction to developmental Biology: oocyte, sperm, fertilization, embryogenesis
- Methodology: Selection of donor; superovulation; selection of recipient; synchronization of estrous; embryo transfer; cryopreservation
- Animal Cloning: Introduction to animal cloning
- Importance and scope of animal cloning

UNIT-V

Fermentation Technology and Animal Transgenesis

- Introduction to fermentation Technology
- Bioreactors for large scale production of animal cells
- Production of hormones and special secondary metabolites- insulin, growth hormone and interferon
- A brief introduction to animal transgenesis.
- Various methods of animal transgenesis.
- Gene Therapy : Introduction; Types of gene therapy, Applications.
- Socio ethical issues

B.Sc. VI Semester

PLANT BIOTECHNOLOGY **50 Marks**

UNIT-I

- Introduction and history of plant tissue culture
- Applications
- Selection & sterilization of explant
- Media used for sterlization & culture
- Growth regulators

UNIT-II

- Cytopreservation
- Synthetic seeds and its application
- Micropropogation
- Somatic Embryogenesis & organogenesis
- Protoplast culture & fusion

UNIT-III

- Anther and Ovary culture
- Di haploids and their applications
- In Vitro pollination & fertilization
- Their applications in plant breeding

UNIT-IV

- DNA Markers
- Types of markers
- Applications of DNA markers in plant science
- Diversity analysis,mapping and tagging,evolutionary studies and marker assisted selection.

UNIT-V

- Plant transformation & methods:Agrobacterium-mediated,biolistic ,transfection etc. successful examples of transgenic plants,advantage of transgenic plants.
- Recent developments in transformation methods.

B.Sc.VI Semester
ENVIRONMENTAL BIOTECHNOLOGY & BIOSAFETY

50 Marks

UNIT-I

- Basic concept of Ecosystem- types, structure and functions.
- Renewable and non- renewable resources
- Conservation of Biodiversity, in situ, ex situ, Gene bank.
- An idea of biosensors, biopolymers, bioplastic and biochips.

UNIT-II

- Wastewater management- Treatment of municipal waste and industrial effluents.
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- Solid waste and soil pollution management- Management of non-hazardous solid waste and medical solid waste.
- Management of hazardous waste
- Air pollution and its control
- Reclamation of wasteland

UNIT-III

- Conventional fuels (Firewood, coal, gas, animal oils) and their environmental impact.
- Modern fuels- Methanogenic bacteria & biogas, microbial hydrogen production, solar energy.
- Plant based petroleum industry
- Biopesticides- Bacterial & Fungla
- Biofertilizers- Nitrogen fixers, PSB, Mycorrhiza & VAM; vermicomposting.

UNIT-IV

- Bioabsorption of metals- microorganisms and metal aborption; bacterial metal resistance; mechanism of bioabsorption; Phytoremediation
- Bioremediation- microganisms in bioremidiation; bioremediation technologies.
- Biorecovery of petroleum- MEOR

UNIT-V

- Concept of biosafety in relation ot
- Organism pathogenicity
- Biological active biotechnology product
- Release of GMOs to the environment
- Genetic modification and food uses
- Biosafety and recombinant DNA guidelines
- Concept of GMP(Good manufacturing practices) & GLP (Good Laboratory practices)

Semester VI
Plant Biotechnology

25 Marks

Practicals

1. Plant tissue culture, Media preparation
2. Ex plant selection and sterilization
3. Callus culture
4. Callus spliting and Regeneration
5. Rooting and Shooting of callus using Auxins and Cytokinins
6. Hardening of the tissue culture generated plantlets

One more practical of 25 Marks to be formed