PARUL UNIVERSITY - FACULTY OF APPLIED SCIENCE

Department of Biotechnology

SYLLABUS FOR 4th Sem B.Sc. PROGRAMME

Molecular Biology (11102251)

Type of Course: B.Sc.

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme (Hrs./Week)			Credit	Examination Scheme					Total
				External		Internal			
Lect	Tut	Lab		T	P	T	CE	P	
3	-	-	3	60	-	20	20	-	100

Lect - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

Contents:

Sr.	Topic	Weightage	Teaching Hrs.
1	**Unit 1**: **Nucleic acids as genetic material** Nucleic acids: history and discovery, structure, nucleosides, nucleotides, base composition, Watson Crick model, A, B and Z forms of DNA, Chargaff's rule, base composition, Structure of mRNA, rRNA, tRNA, hnRNA, Single stranded DNA, Informosome, Direct and Indirect evidences for DNA as genetic material, transforming principle, blender experiment, bacterial transformation and conjugation experiments, RNA and proteins as genetic material, Central dogma of the cell, Reverse transcription, Cell cycle and its control. Phases of cell cycle that carry replication, transcription and translation	22%	10
2	**Unit-2**: **Replication of DNA:** Watson and Crick's model, Semiconservative mode of replication, replication fork, rolling circle and theta replication, replication processes in prokaryotes and eukaryotes **Transcription:** Comparison and differences between DNA and RNA synthesis, mechanism of prokaryotic and eukaryotic transcription, Classes of RNA molecules and processing, promoters, enhancers and silencers, posttranscriptional regulation, chromatin structure and transcription, processing of mRNA, tRNA and rRNA, Introduction and significance of miRNA, siRNA, shRNA.	29%	13

3	**Unit-3**: **Genetic Code and Translation:** Basis of cryptoanalysis, codon assignment, deciphering genetic code, wooble hypothesis, codon degeneracy, mitochondrial and chloroplast codons **Translation:** Central dogma and central dogma reverse, synthesis of amino acyl tRNA, stages of protein synthesis in prokaryotes and eukaryotes, protein sorting, modification, folding and transport, ubiquitination, protein degradation, antibiotics and protein synthesis	25%	11
4	**Unit-4**: **Regulation of Gene Action:** Transcriptional control, operon structure, inducible and repressible operons, Lac, Ara and Trp operons mechanisms, posttranscriptional and post translational regulation in eukaryotes, protein trafficking, posttranslational modifications, hormonal control	24%	11

***Continuous Evaluation:**

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

Reference Books:

1. Cell and Molecular Biology
   Gerald Karp
2. Molecular Biology of the Cell
   Bruce Alberts
3. Molecular Cell Biology
   Lodish
4. The Cell:A Molecular Approach
   Cooper GM
5. Genes VIII
   Lewin
6. Principles of Molecular Biology (TextBook)
   Burton E. Tropp
7. Molecular Biology
   Robert Weaver

PARUL UNIVERSITY - FACULTY OF APPLIED SCIENCE

Department of Biotechnology

SYLLABUS FOR 4th Sem B.Sc. PROGRAMME

Recombinant DNA Technology (11102254)

Type of Course: B.Sc.

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme (Hrs./Week)			Credit	Examination Scheme					Total
				External		Internal			
Lect	Tut	Lab		T	P	T	CE	P	
3	-	-	3	60	-	20	20	-	100

Lect - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

Contents:

Sr.	Topic	Weightage	Teaching Hrs.
1	**Unit-1**: **Isolation, Identification, and Characterization of DNA Fragments:** Nucleic Acid Purification methods, Yield Analysis, Radiolabelling of Nucleic acids: Probe preparation by random primer, nick translation, end labelling. Primer extension labelling, Non radioactive probes, molecular probes (Immunogenetics purposes) Southern and Northern Hybridization –principle, method and listing applications only. Techniques of introducing DNA into cell-calcium chloride transformation and High efficiency transformation by electroporation, Agro bacterium-mediated transformation, Protoplast transformation, Particle gun	25%	11
2	**Unit-2**: **Molecular Tools and Applications:** Polymerase Chain Reaction-Essential features, design of primers, DNA polymerases for PCR, study with reference to principle, methodology and single application in detail, conventional PCR, RT-PCR. Mutagenesis: random mutagenesis and directed mutagenesis(primer extension method, error prone PCR methods	24%	11
3	**Unit-3**: **Applications of rDNA technology:** -in understanding genes and genomes, in biotechnology (protein production and protein engineering), in medicine and forensics, transgenic plants and animals, Organism cloning, Engineering of β-carotene, engineering of abzymes and phage display for hormone engineering. Mapping: promoter (Foot printing analysis), Transcriptional start site (Primer extension), Size of transcript –run off and run on assay.	24%	11

4	**Unit-4**: **Gene Cloning strategies and analysis:** Cloning strategies- cloning from mRNA, cloning from genomic DNA, Cosntructionof Genomic library Maniatis Strategy, cDNA cloning with conventional cDNA and full length cDNA.. Genetic selection and screening methods- Chromogenic substrates, insertional inactivation, complementation Screening using nucleic acid hybridization – Nucleic acid probes, screening clone banks, Immunological screening for expressed genes Analysis of cloned genes- in vitro mRNA translation, restriction mapping, blotting techniques, DNA sequencing	27%	12

***Continuous Evaluation:**

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

PARUL UNIVERSITY - FACULTY OF APPLIED SCIENCE

Department of Biotechnology

SYLLABUS FOR 4th Sem B.Sc. PROGRAMME

Bioinformatics - I (11102255)

Type of Course: B.Sc.

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme (Hrs./Week)			Credit	Examination Scheme					Total
				External		Internal			
Lect	Tut	Lab		T	P	T	CE	P	
3	-	-	3	60	-	20	20	-	100

Lect - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

Contents:

Sr.	Topic	Weightage	Teaching Hrs.
1	**Unit-1**: **Introduction:** History of Bioinformatics. The notion of Homology. Sequence Information Sources, EMBL, GENBANK, Entrez, Unigene, Understanding the structure of each source and using it on the web.	18%	8
2	**Unit-2**: **Data structure and retrival:** Data storage, Data retrieval and Interoperability. Flat files, relational, object oriented databases and controlled vocabularies. File Format (Genbank, DDBJ, FASTA, PDB, Swiss Prot). Introduction to Metadata and search; Indices, Boolean, Fuzzy, Neighboring search. The challenges of data exchange and integration. Ontologies, interchange languages and standardization efforts. General Introduction to XML, UMLS, CORBA, PYTHON and OMG/LIFESCIENCE	36%	16
3	**Unit-3**: **Sequence and Phylogeny analysis:** Introduction, Detecting Open Reading Frames, Outline of sequence, Assembly, Mutation/Substitution Matrices, Pairwise Alignments, Introduction to BLAST, using it on the web, Interpreting results, Multiple Sequence Alignment, Phylogenetic Analysis.	29%	13

4	**Unit-4**: **Biological databases:** Searching Databases: SRS, Entrez, Sequence Similarity Searches-BLAST, FASTA, Data Submission.	17%	8

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PARUL UNIVERSITY - FACULTY OF APPLIED SCIENCE

Department of Biotechnology

SYLLABUS FOR 4th Sem B.Sc. PROGRAMME

Lab-1 (Molecular Biology and Recombinant DNA Technology) (11102256)

Type of Course: B.Sc.

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme (Hrs./Week)			Credit	Examination Scheme					Total
				External		Internal			
Lect	Tut	Lab		T	P	T	CE	P	
-	-	3	2	-	30	-	-	20	50

Lect - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

Contents:

Sr.	Topic	Weightage	Teaching Hrs.
1	**Molecular Biology**: 1. Isolation of DNA from plants (Dellaporta method and CTAB method)	%	3
2	**Recombinant DNA technology**: Minipreparation of plasmids	%	3
3	**Recombinant DNA Technology**: Preparation of Insert and Vector for restriction enzyme directed cloning	%	3
4	**Molecular Biology**: Isolation of DNA from blood	%	3
5	**Molecular Biology**: Agarose gel electrophoresis	%	3
6	**Molecular Biology**: SDS - PAGE	%	3
7	**Recombinant DNA Technology**: Preparation of chemically competent cells for transformation of *E. coli* (DH5α and DH10β)	%	3
8	**Recombinant DNA Technology**: Ligation reaction of restriction enzyme digested insert and vector	%	3
9	**Molecular Biology**: Estimation of DNA by DPA method	%	3

10	**Molecular Biology**: Estimation of RNA by orcinol method	%	3
11	**Recombinant DNA Technology**: CaCl2 mediated transformation of recombinant plasmid	%	3
12	**Recombinant DNA Technology**: Blue-White screening	%	3
13	**Molecular Biology**: Quantification of DNA and RNA by UV spectrophotometer Preparation of mitotic chromosomes	%	3
14	**Molecular Biology**: Preparation of meiotic chromosomes	%	3
15	**Recombinant DNA Technology**: Replica Platting	%	3
16	**Recombinant DNA Technology**: Preparation of Insert and Vector for PCR directed cloning	%	3
17	**Molecular Biology**: Mitochondria and chloroplast isolation	%	3
18	**Recombinant DNA Technology**: Electrophoresis (Agarose and PAGE)	%	3
19	**Recombinant DNA Technology**: Gel elution of DNA bands	%	3

***Continuous Evaluation:**

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

PARUL UNIVERSITY - FACULTY OF APPLIED SCIENCE

Department of Biotechnology

SYLLABUS FOR 4th Sem B.Sc. PROGRAMME

Lab-2 (Animal Physiology, Plant Physiology and Bioinformatics-I) (11102257)

Type of Course: B.Sc.

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme (Hrs./Week)			Credit	Examination Scheme					Total
				External		Internal			
Lect	Tut	Lab		T	P	T	CE	P	
-	-	3	2	-	30	-	-	20	50

Lect - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

Contents:

Sr.	Topic	Weightage	Teaching Hrs.
1	**Plant Physiology**: Basics of Plant Anatomy (Angiosperms and Gymnosperms)	%	3
2	**Bioinformatics - I**: Sequence information resource	%	3
3	**Animal Physiology**: ECG and Blood Pressure measurement	%	3
4	**Animal Physiology**: Estimation of Body mass index	%	3
5	**Bioinformatics - I**: Understanding and use of various web resources: EMBL, Genbank, Entrez, Unigene, Protein information resource (PIR)	%	3
6	**Plant Physiology**: Tissue Water Potential - Red onion cells	%	3
7	**Plant Physiology**: Stomatal potential - microscopic study	%	3
8	**Bioinformatics - I**: Basic Programming in XML, UMLS, CORBA, PYTHON	%	3

9	**Animal Physiology**: Study of digestive, nervous, respiratory and endocrine system by chart and models	%	3
10	**Bioinformatics - I**: Using various BLAST and interpretation of results	%	3
11	**Plant Physiology**: Estimation of chlorophyll a and chlorophyll b	%	3
12	**Plant Physiology**: Measuring Stomatal Frequency in Broad Bean	%	3
13	**Bioinformatics - I**: Retrieval of information from nucleotide databases	%	3
14	**Bioinformatics - I**: Sequence alignment using BLAST	%	3
15	**Plant Physiology**: Measuring Water Potential In Potato Tissue	%	3
16	**Plant Physiology**: Seed germination (Monocot and dicot)	%	3
17	**Bioinformatics - I**: Multiple sequence alignment using Clustal W	%	3

***Continuous Evaluation:**

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

PARUL UNIVERSITY - FACULTY OF APPLIED SCIENCE

Department of Biochemistry

SYLLABUS FOR 3rd Sem B.Sc. PROGRAMME

Animal Physiology (11103203)

Type of Course: B.Sc.

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme (Hrs./Week)			Credit	Examination Scheme					Total
				External		Internal			
Lect	Tut	Lab		T	P	T	CE	P	
3	-	-	3	60	-	20	20	-	100

Lect - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

Contents:

Sr.	Topic	Weightage	Teaching Hrs.
1	**Unit-1**: **Introduction and scope of physiology:** Cell, tissue and organ system, Cell as a basic component, cellular homeostasis Paratonic Variation movements (Nastic movements) and hygroscopic movements.	%	4
2	**Unit-2**: **Digestive System:** Composition, functions and regulation of saliva, gastric, pancreatic intestinal and bile secretions – digestion and absorption of carbohydrates, lipids, proteins nucleic acids, minerals and vitamins.	%	8
3	**Unit-3**: **Cardiovascular system:** Structure and function of Heart structure and composition of blood, general functions of blood, mechanism of blood clotting, anticoagulants vitamins.	%	11
4	**Unit-4**: **Nervous system:** Types of Nervous system, structure and functions of neurons, types of neurons, synapse, conduction of nerve impulse in nerve fiber, structural and functions of brain parts in brief.	%	11

5	**Unit-5**: **Urinary system:** **A**natomy and Histology of kidneys, the nephron, renal physiology- glomerular filtration and tubular reabsorption and tubular secretion. **Endocrine system:** Hormones- location, structure, secretions and effects of hormones (in brief), feedback mechanism- positive and negative.	%	11

***Continuous Evaluation:**

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

PARUL UNIVERSITY - FACULTY OF APPLIED SCIENCE

Department of Microbiology

SYLLABUS FOR 4th Sem B.Sc. PROGRAMME

Immunology - II (11101255)

Type of Course: B.Sc.

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme (Hrs./Week)			Credit	Examination Scheme					Total
				External		Internal			
Lect	Tut	Lab		T	P	T	CE	P	
3	-	-	3	60	-	20	20	-	100

Lect - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

Contents:

Sr.	Topic	Weightage	Teaching Hrs.
1	**Unit-1**: **Immunoglobulins Structure and Function:** Basic and fine structure of immunoglobulin, light chains, heavy chains and sequences, antigen determinants on immunoglobulin, isotopic, allotypic, Idiotypic immunoglobulin superfamily, complement activation, Antibody dependent cell mediated cytotoxicity, Passive antibody therapy (IgG, IgM, IgA, IgE and IgD), hypersensitivity and immunological disorder	24%	11
2	**Unit-2**: **Generation of B- cell and T- cell response:** Antigens, Immunogenicity vs. Antigenicity, Epitopes (properties of B-cell and T-cell epitopes), Major Histocompatibility Complexes.	25%	11
3	**Unit-3**: **Vaccines and Immunization:** Vaccines (whole organism, purified macromolecules, recombinant vaccine, synthetic polypeptide etc.), types and their characteristics, monoclonal antibody, hybridoma technology, cell mediated immune response, lymphokines, cytokines.	27%	12

4	**Unit-4**: **Hypersensitivity**: An allergy, types of hypersensitivity, Immunology of hypersensitivity, Primary and Secondary immune response, Autoantibodies – Autoimmune diseases, Rheumatoid Arthritis, Myasthenia Gravis, Systemic Lupes Erythematus, Rhesus incompatibility, Protection of fetus from immune response, allergy and immunr response against allergy Immunotechniques: Immuno diffusion, immunoelectrophoresis ELISA, RIA, fluorescence activated cell sorter, PBMC, immunoblotting.	25%	11

***Continuous Evaluation:**

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

PARUL UNIVERSITY - FACULTY OF APPLIED SCIENCE

Department of Biotechnology

SYLLABUS FOR 3rd Sem B.Sc. PROGRAMME

Plant Physiology (11102205)

Type of Course: B.Sc.

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme (Hrs./Week)			Credit	Examination Scheme					Total
				External		Internal			
Lect	Tut	Lab		T	P	T	CE	P	
3	-	-	3	60	-	20	20	-	100

Lect - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

Contents:

Sr.	Topic	Weightage	Teaching Hrs.
1	**Unit-1**: **Absorption of water, transpiration and ascent of sap:** Water – structure, physical properties and significance to plant life Movement of materials into and out of cells – diffusion, osmosis, osmotic pressure, plant cell as osmotic systems, significance of osmosis in plants Plasmolysis, its advantages and imbibition. Mechanism of water absorption - Active (osmotic and non osmotic) and passive absorption. External factors affecting water absorption. Transpiration – kinds of transpiration, mechanism of stomatal transpiration and its significance and factors affecting the rate of transpiration, antitranspirants. Ascent of Sap, Path of Ascent Sap. Vital theories, root pressure theory, physical forces theory, transpiration pull and cohesion of water theory Absorption of mineral salts: - Mechanism of mineral salt absorption – ion- exchange, passive and active absorption, the carrier concept theory.	%	13
2	**Unit-2**: Photosynthetic apparatus, Photosynthetic pigments and absorption of light energy. Excited states of atoms or molecules – Fluorescence, Phosphorescence, Quantum requirement and quantum yield, Red drop and Emerson's enhancement effect. Photosynthetic units – the Quantosomes, action spectrum. Mechanism of photosynthesis: Light reaction (Hill reaction) and Dark reaction (Calvin cycle), Blackman's law of limiting factors, factors affecting photosynthesis, significance of photosynthesis to mankind.	%	12

3	**Unit-3**: **Growth and Growth Hormones:** Growth, Kinetics of growth (Growth curve or sigmoid curve). Natural growth hormones - Auxins, Gibberellins, kinetin and cytokinins, ethylene, abscisic acid (ABA) (Discovery, Chemical nature, physiological effects and practical applications). **Photoperiodism and Vernalization** : Classification of plants on the basis of photoperiods, importance of photoperiodism. Vernalization – conditions necessary for vernalization, mechanism of vernalization, practical utility of vernalization.	%	10
4	**Unit-4**: **Plant Movements**: Movements of locomotion – Autonomic and Paratonic (tactic) Movements of curvature – Autonomic and paratonic (tropic) growth movements, Paratonic Variation movements (Nastic movements) and hygroscopic movements. **Stress physiology :** oduction, water deficit and drought resistance, salt stress and salt resistance, cold injury and cold resistance, chilling injury and chilling resistance, freezing injury (frost) and freezing resistance, high temperature(heat) stress and high temperature(heat) resistance, heavy metal stress and heavy metal resistance.	%	10

***Continuous Evaluation:**

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.