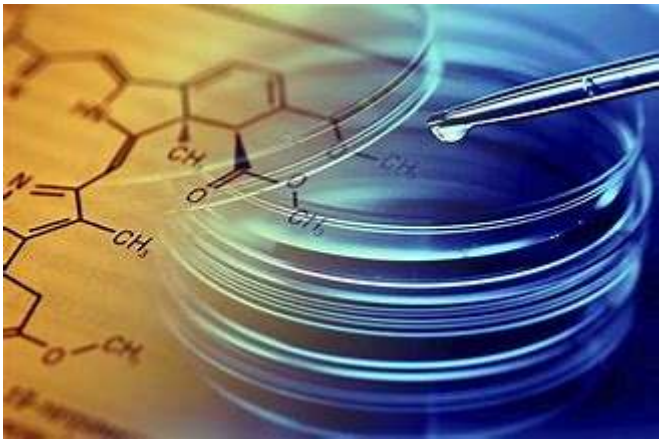
COURSE CURRICULUM FOR BIOTECHNOLOGY (AUDIT)



NAME OF THE PROGRAMME: Biotechnology Audit Course

JAGANNATH BAROOAH COLLEGE, JORHAT (ASSAM)

SYLLABUS

UNDER CHOICE BASED CREDIT SYSTEM

BIOTECHNOLOGY (AUDIT)

Objective of the Programme:

- **To provide quality education and in-depth knowledge in the field of Biotechnology**
- **To inculcate the spirit of conservation of resources, biodiversity and their interaction with environment and love for nature.**
- **To provide quality education offering skill-based programme and motivate the students for selfemployment.**
- **To enhance academic standards and quality of higher education system of our country.**

Expected Outcome of the Course:

- **More and more students will get admission in PG programs in higher institutes of learning.**
- **Interested students may take up entrepreneurship in biological sciences**

Course Structure- BIOTECHNOLOGY (Audit)

Sem	Course No	Course Code	Course Title	Course Type	Marks Distribution				
					TH	TH-IA	PR	PR-IA	Total
1st	BT-01	BTCA-101	Biochemistry and Cell Biology	Theory (TH) + Practical (PR)	50	15	30	15	100
2nd	BT-01	BTCA-201	Genetics and Molecular Biology	TH + PR	50	15	30	15	100
3rd	BT-01	BTCA-301	Microbiology and Immunology	TH + PR	50	15	30	15	100
4th	BT-01	BTCA-401	Recombinant DNA Technology and Plant & Animal Biotechnology	TH + PR	50	15	30	15	100

Detailed Syllabus for Audit Courses
Sub: Biotechnology

Semester-I
Course Title : Biochemistry and Cell Biology
Course Code : BTCA-101 **Course No : BT- 01**
Credits : 05 (03-Theory, 02 Practical) **No. of Classes : 84 (36+48)**
Total Marks-100
Theory Marks : 65 **End Semester : 50** **In Semester : 15**
Practical Marks :35 **End Semester : 30** **In Semester : 05**

Course objective: To provide the concepts of Biochemistry and Cell Biology

Theory	**No. of 1hr Classes**	**Marks**
Biochemistry		
Unit-1. Biochemical Basis of Life 1. Importance of Biochemistry 2. General properties, Classification, Structure and function of Carbohydrates - Monosaccharide, Oligosaccharide and Polysaccharide. 3. Protein - Classification and structures of amino acids. Physical and chemical properties of amino acids. Essential and non-essential amino acids. Structure (Primary, Secondary, Tertiary and Quaternary) and Classification of proteins, 4. Lipids: Definition and classification. Fatty acids: classification, nomenclature, structure and properties of saturated and unsaturated fatty acids. Essential fatty acids. 5. Nucleic acids – Properties of DNA and RNA, building blocks of nucleic acids - Structure: Purines and pyrimidines, Nucleosides, Nucleotides.	10	13
Unit-2. Biophysical techniques to study Biochemistry 1. pH and buffers, Handerson Hasselbalch equation, pK and pI values of buffers, Basic principle of pH meter 2. Principle and law of spectrophotometry (visible, UV, infrared), 3. Introduction to the principle and use of chromatography in life sciences: Paper chromatography, Thin layer chromatography, Column chromatography, gel filtration, affinity & ion exchange chromatography, gas chromatography and HPLC	8	12
Cell Biology		
Unit – 3. Cell Structure 1. Cell as the basic unit of living system and the cell theory 2. Prokaryotic versus Eukaryotic cells 3. Ultra-structure and chemical composition of cellular components of prokaryotic and eukaryotic cells (Cell wall, Plasma membrane, Cytoplasm, Chloroplast, Mitochondria, Ribosome, SER & RER, Golgi complex, Cytoskeleton, Nucleus, Lysosome, Vacuole, Peroxisome etc)	7	9
Unit – 4. Cell Division, signalling and some diseases 1. Cell Division – Mitosis and Meiosis, 2. Cell Cycle and its regulation, 3. Cell signalling – Signal transduction pathways and G-protein mediated signalling, Apoptosis, Cancer	6	8
Unit – 5. Biophysical Techniques to study cell 1. Principles and Biological application of Bright field (Simple and compound) and Dark field microscopy 2. Fixation and Staining of cells/tissue 3. Centrifugation techniques and separation of sub-cellular organelles 4. Cell fractionation techniques 5. Techniques of Cell lysis and disintegration	5	8

Biochemistry		
Content	**No of 2 hr Classes**	**Marks**
Preparation of Buffer and pH adjustment	1	5
Qualitative analysis of Carbohydrates	2	10
Qualitative test for detection of Lipids and Proteins	2	10
Separation and detection of Amino acid by paper chromatography	2	10
Principles of Colorimetry: To study relation between absorbance and % transmission	1	5
Quantitative estimation of Sugar, protein and nucleic acids	2	10
Extraction and determination of Enzyme activity (Urease / Phosphatase)	2	10
Cell Biology		
Mitosis and the Cell Cycle in Onion Root-Tip Cells	3	10
Meiosis in Onion Flower bud /Tradescantia Flower bud /Grasshopper testes	3	10
Buccal smear – Identification of Barr Body	2	5
Histochemical localization of Protein and Lipid	2	5+5
Anatomical studies of different types of cell & tissue (Histology): • Plant: Leaf of monocot & dicot, Stem of monocot & dicot, Root of monocot & dicot, Stomata • Animal: Simple epithelium, Squamous epithelium, Columnar Epithelium, Stratified	2	5 in each

Detailed Syllabus for Audit Courses
Sub: Biotechnology

Semester-II
Course Title : Genetics and Molecular Biology
Course Code : BTCA-201 **Course No : BT- 02**
Credits : 05 (03-Theory, 02 Practical) **No. of Classes : 84 (36+48)**
Total Marks-100
Theory Marks : 65 **End Semester : 50** **In Semester : 15**
Practical Marks :35 **End Semester : 30** **In Semester : 05**

Course objective: To provide the concepts of Genetics and Molecular Biology

Theory	No. of 1hr Classes	Marks
Genetics		
Unit-1. Basic Genetics 1. Genetics: Mendelian laws of inheritance and Chromosomal theory of inheritance 2. Deviation from Mendel's ratios- Incomplete dominance and codominance, complementary factor, supplementary factor, epistasis, Multiple alleles, Lethal alleles, Pleiotropy 3. Inheritance of Sex-linked characters 4. Inheritance pattern of qualitative and quantitative characters	7	10
Unit-2. Chromosome 1. Chemical composition, 2. Structural organization of chromatid: Euchromatin and heterochromatin, 3. Special chromosomes: Polytene and lampbrush Chromosome, 4. Linkage and Crossing over	6	7
Unit – 3. Mutation and transposable elements 1. Mutations: Occurrence, types of Mutation: spontaneous & induced Mutation, point mutation & frameshift mutation, mis-sense, non-sense & neutral mutations, mutagens, Lethal Mutations, Phenotypic effects of Mutation, Molecular basis of Mutation 2. Chromosomal aberration (Structural and numerical) 4. Genetic syndromes and hereditary defects 5. Population genetics and Hardy Weinberg Equilibrium 3. Transposable elements: class I & class II transposons	5	8
Molecular Biology		
Unit – 4. Molecular understanding the Genome 1. DNA as genetic material – Experiments of Griffiths, Avery, Mc Leod and Mc Carty, and Hershey and Chase, experiment to prove Semiconservative nature of DNA replication, 2. Central dogma of molecular biology, 3. DNA replication, 4. DNA damage, repair and homologous recombination, 5. Transcription and RNA processing, 6. Translation and post translational modification in Protein 7. Regulation of gene expression in prokaryotes and eukaryotes	9	13
Unit – 5. Methods to study Genome at molecular level 1. Principle & procedure of DNA, RNA and Protein extraction methods 2. Principle and procedure of electrophoresis; types of electrophoresis: agarose gel electrophoresis, PAGE and SDS-PAGE, and their applications. 3. Principle, technique and application of Southern, Northern and Western hybridization, Polymerase Chain Reaction, DNA sequencing, DNA Fingerprinting	9	12

PRACTICAL (CREDITS 2)

Genetics		
Content	**No of 2 hr Classes**	**Marks**
Preparation of Karyotype	2	10
Preparation of Ideogram	2	10
To study Chromosome banding.	3	10
Pedigree charts of some common characters like blood group, colour blindness	2	10
Study of polyploidy in plant cells by colchicine treatment.	3	10
Molecular Biology		
Preparation of buffers & solutions for Molecular Biology experiments.	3	5
Isolation of genomic DNA from bacterial cells, Plant and Animal Tissue	6	10 each
Agarose gel electrophoresis of genomic DNA	3	10

Detailed Syllabus for Audit Courses
Sub: Biotechnology

Semester-III
Course Title : Microbiology and Immunology
Course Code : BTCA-301 **Course No : BT- 03**
Credits : 05 (03-Theory, 02 Practical) **No. of Classes : 84 (36+48)**
Total Marks-100
Theory Marks : 65 **End Semester : 50** **In Semester : 15**
Practical Marks :35 **End Semester : 30** **In Semester : 05**

Course objective: To provide the concepts of Microbiology and Immunology

Theory	No. of 1hr Classes	Marks
Microbiology		
Unit – 1. Fundamentals of Microbiology 1. History and Evolution of Microbiology. Classification of microorganisms: Microbial taxonomy, criteria used including molecular approaches, Microbial phylogeny and current classification of bacteria. 2. Three domains of life, Microbial Diversity: Morphology and cell structure of major groups of microorganisms e.g. Bacteria, Algae, Fungi & Protozoa and Unique features of viruses. 3. Principle of Gram's staining technique, difference between gram positive & gram-negative bacteria, bacterial antigens and serotyping of bacteria	7	10
Unit – II. Sterilization and Cultivation of Microbes 1. The concept of sterilization, Methods of sterilization (Dry heat, Moist heat, Irradiation, filtration and chemical disinfection) 2. Cultivation and Maintenance of microorganisms: Nutritional categories of micro-organisms, methods of isolation, Purification and preservation of bacterial culture.	6	7
Unit – III. Methods of Microbiology and Economic aspects 1. Bacterial growth: Growth curve, Generation time, synchronous batch and continuous culture, measurement of growth and factors affecting growth of bacteria. 2. Basic bacterial genetics, auxotroph, replica plating technique, transformation, conjugation and transduction. 3. Use of Microorganisms in Agriculture, sewage treatment and bioremediation, production of antibiotics and food	5	8
Immunology		
Unit – IV. Basic Immunology 1. Immune Response - An overview, components of mammalian immune system, Innate versus Acquired immunity, active & passive immunity 2. Immunoglobulins - basic structure, classes & subclasses of immunoglobulins, Humoral & Cellular immune responses, B & T-lymphocytes & immune response (cytotoxic T-cell, helper T-cell, suppressor T-cells), 3. T-cell receptors, genome rearrangements during B-lymphocyte differentiation	9	13
Unit – V. Techniques of Immunology 1. Hybridoma technology and monoclonal antibody production 2. Vaccines & Vaccination – adjuvants, cytokines, Conventional vaccines: live, attenuated and inactivated or killed vaccines, DNA vaccines, recombinant vaccines, passive & active immunization. 3. Introduction to immunodiagnostics – agglutination & precipitation, haemagglutination & haemagglutinal inhibition, ELISA.	9	12

PRACTICAL (CREDITS 2)

Content	No of 2 hr Classes	Marks
Microbiology		
Demonstration on cleaning and sterilization of glassware	1	10
Preparation of bacteriological media – Nutrient Agar, LB Broth, Potato Dextrose Agar and Sterilization by autoclaving	2	10
Isolation of pure culture of Bacteria and Fungi & maintenance of culture.	3	10
Gram staining of bacteria isolated from skin swab and curd/milk	2	5
To determine bacterial growth kinetics by turbido-metric method	2	10
Antibiotic sensitivity testing of microbes	2	5
Immunology		
Determination of Blood group	2	5
Separation of Blood Serum	2	10
Differential leucocytic count	3	10
Total leucocytes count	3	10
Total RBC count	2	5

Detailed Syllabus for Audit Courses
Sub: Biotechnology

Semester-IV
Course Title : Recombinant DNA Technology and Plant & Animal Biotechnology
Course Code : BTCA-401 **Course No : BT- 04**
Credits : 05 (03-Theory, 02 Practical) **No. of Classes : 84 (36+48)**
Total Marks-100
Theory Marks : 65 **End Semester : 50** **In Semester : 15**
Practical Marks :35 **End Semester : 30** **In Semester : 05**

Course objective: To provide the concepts of Recombinant DNA Technology and Plant & Animal Biotechnology

Theory	**No. of 1hr Classes**	**Marks**
Unit – 1. Fundamentals of rDNA Technology 1. Molecular tools and applications- restriction enzymes, ligases, polymerases, alkaline phosphatase. 2. Insertion of foreign DNA into host cells: Transformation, Episomes, Plasmids, cosmids and other cloning vectors (Bacteriophage-derived vectors, artificial chromosomes), Microinjection, Electroporation, Ultrasonication, 3.	9	13
Unit – II. Techniques to study DNA at molecular level 1. DNA Sequencing by Sanger's Dideoxy method, Genome mapping, DNA fingerprinting, Applications of Genetic Engineering 2. PCR primer-designing, Applications of Polymerase chain reaction (PCR), and RT- (Reverse transcription) PCR in rDNA technology	9	12
Topic – 2 - Plant & Animal Biotechnology (22 Classes; 25 Marks)		
Unit – III. Genetic engineering in plants: 1. Use of *Agrobacterium tumefaciens* and *A. rhizogenes*, Ti plasmids, 2. Strategies for gene transfer to plant cells, Direct DNA transfer to plants, 3. Basics of Plant tissue culture (Callus Culture, somatic embryogenesis, micropropagation, haploid production)	9	13
Unit – III. Genetic engineering in animals: 1. Production and applications of transgenic mice 2. Therapeutic products produced by genetic engineering-blood proteins, human hormones, immune modulators and vaccines (one example each).	9	12

PRACTICAL (CREDITS 2)

Recombinant DNA Technology		
Content	**No of 2 hr Classes**	**Marks**
Plasmid DNA isolation and DNA quantitation.	4	10
Preparation of restriction enzyme digests of DNA samples	2	5
Agarose gel-based separation of restriction enzyme digested DNA	2	5
Practical Demonstration of PCR with gene specific and RAPD/ISSR Primers	4	10
Plant & Animal Biotechnology		
Preparation of Media for plant tissue culture	2	5
Demonstration on Initiation of Callus	4	10
Isolation of DNA from Plant and Animal Cells	3	10
Demonstration on steps of transgenic mice production with the help of photographs	3	10