Darrang College (Autonomous), Tezpur-784001

Syllabus for FYUGP B.Sc. Biotechnology (Minor)

Approved by :

Board of Studies (Biotechnology) meeting held on 26-12-2025 &

&

Academic Council vide Resolution no. 2, dated 29-12-2025

Course eligibility:

The student should have passed Class XII with 1st Division in Biology, Physics, and Chemistry

YEAR	SEM	PAPER CODE	PAPER NAME
1st	1st	BIT-MN-01014	Introduction to the living world
	2nd	BIT-MN-02014	Biomolecules
2nd	3rd	BIT-MN-03014	Plant and Animal Physiology
	4th	BIT-MN-04014	Cell Biology
3rd	5th	BIT-MN-05014	Immunology
	6th	BIT-MN-06014	Bio-analytical Tools

MINOR PAPERS OFFERED FOR FYUGP BY THE DEPARTMENT OF BIOTECHNOLOGY	
Detailed Syllabus of Ist Semester FYUGP Biotechnology (as Minor)	
Title of the Course	**Introduction to the living world**
Course Code	**Paper Code: BIT-MN-01014**
Total Credit (Theory+ Practical)	**Theory Credit:** 03 **Practical Credit:** 01 **No. of Required Classes:** 75 (Theory: 45; Practical: 30)
Contact Hours/Classes Required	75 (Theory Class: 45; Practical Class : 30)
Distribution of Marks	**External (Theory + Practical): 70 (45+25)** **Internal: 30** Sessional Exam: 15 marks, Home Assignment: 6 marks, Class Test: 5 marks, Attendance: 4
Course Outcome (CO)	After completion of this course/module, students will be able to: **CO1:** Understand the concept of different forms of life in biosphere and their basic life processes. **CO 2:** Understand the collection of biological samples and their systematic identification and implement the methods in future for research/experimental work. **CO 3:** Collect insights on various applications of life forms and their basic structures which will help them for innovation. Interpret and analyze experimental data using appropriate scientific methodology. **CO 4**: Develop problem-solving skills through troubleshooting of experimental errors and optimizing analytical methods. **CO 5:** Evaluate the impact of biological diversity on environment and its scope of applications for human welfare.
Course Designer	Dr. Manika Das Kataki, Asstt. Professor, Dept. of Biotechnology, Darrang College (Autonomous), Tezpur. Email id: mkdas116@gmail.com Ms. Minakshee Sarmah, Asstt. Professor, Dept. of Biotechnology, Darrang College (Autonomous), Tezpur Email id: minakshee164@gmail.com Dr. Pranjal Pratim Das, Asstt. Professor, Dept. of Biotechnology, Darrang College (Autonomous), Tezpur Email id: cicibiotech@gmail.com

Reference Books	1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2006). Principles of Genetics. VIII Edition John Wiley & Sons. 2. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc. 3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. IX Edition. Benjamin Cummings. 4. Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings. 5. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company. 6. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005). General Microbiology. 5th edition. McMillan. 7. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9 th edition. Pearson Education.

Semester-I (Theory Credit:03)					
UNIT	**CONTENT**	**L**	**T**	**P**	**TOTAL HOURS**
I	The Plant, Animal and the Microbial world: Diversity, nomenclature, Taxonomy, Cell as fundamental unit of life: structural organization, dimensions, cellular membrane and organelles.	**5**	**3**	**-**	**08**
II	Life Processes: Nutrition, Digestion, Absorption, Assimilation, Respiration, Growth And Reproduction, Excretion Genetics: Basic principles of inheritance, Testcross, Back cross, Mapping population, Epigenetics, Polyploidy, Aneuploidy, Double Haploids, Hybrids Structure of Nucleic Acid and Chromosome, Molecular Basis of Inheritance	**6**	**3**	**-**	**09**
III	Introduction to Ecosystem, Environment and Evolution: Functions of Ecosystem, Terrestrial and Aquatic Ecosystem, Biodiversity: Plants, Animals & Marine organisms. Biomes and Biomass, Niche, habitat, stratification, Biotic and Abiotic factors, Energy flow, Productivity, Nutrient Cycle, Adaptations, Population, Population interactions, Ecological successions.	**6**	**2**		**08**
IV	Plants, Animals and Microbes in Human welfare; Plant and animal breeding (Introductory), High yielding crops and breeds, Agriculture practices- Psiciculture, Apiculture, and Sericulture (Introductory), Plant Tissue Culture (Introductory), Single cell proteins. Food processing and methods, Production of fermented foods (Cheese, curd, and brewing alcohol), Biopesticide and biofertilizers. Biopharmaceuticals: Antibiotics Sewage treatment and Swastha Bharat campaign.	**7**	**3**		**10**

V	Natural resources and sustainable management: Renewable and non-renewable resources (Air, water, soil, sunlight, plants, animals, microbes, fossil fuel), Sustainable exploitation of resources, Three Rs-Reduce, Recycle, and Reuse. Biotechnological solutions to challenges faced by humankind- bioremediation, Genetically modified organisms-Superbug, GM-crops, Vaccines, Novel Proteins. United Nation sustainable developmental Goals	**6**	**4**		**10**

Semester-I (Practical Credit:01)					
UNIT	**CONTENT**	**L**	**T**	**P**	**TOTAL HRS**
Lab Experiment	1. Concept of biological laboratory(Instruments, tools, and appliances) ‘ 2. Preparation of buffer using Henderson-Hassel balch equation. 3. Slide preparation for study of bacteria, fungi and cyanobacteria 4. Study and use of light microscope 5. Study of meristematic tissue of dicot and monocot plants 6. Study of nitrogen fixing bacteria from leguminous plants. 7. Preparation of bio-fertilizer 8. Estimating population-Plants & Microbes by Random/Non-random sampling methods. 9. Measuring biodiversity of an area: plants, animals, birds, insects, microbes. 10. To demonstrate the fermentation process and factors influencing its rate.	-	-	**30**	**30**

Detailed Syllabus of IInd Semester FYUGP Biotechnology (as Minor)	
Paper-Biomolecules	
Title of the Course	**Biomolecules**
Course Code	**Paper Code: BIT-MN-02024**
Total Credit (Theory+ Practical)	**Theory Credit:** 03 **Practical Credit:** 01 **No. of Required Classes:** 75 (Theory: 45; Practical: 30)
Contact Hours/Classes Required	75 (Theory Class: 45; Practical Class : 30)
Distribution of Marks	**External (Theory + Practical) 70 (45+25)** **Internal 30** [Sessional Exam: 15 marks, Home Assignment: 6 marks, Class Test: 5 marks, Attendance: 4 marks]
Course Outcome (CO)	After completion of this course/module, students will be able to: **CO1.** Understand the attributes of different chemical, physical, physiological, and nutritional properties of biological building blocks and their polymers. **CO2.** Contextualize the structural interactions supporting life processes. **CO3.** Gain the skills to practically assess the composition of biomolecules present in different biological sources and its application in research work
Course Designer	Dr. Manika Das Kataki, Asstt. Professor, Dept. of Biotechnology, Darrang College (Autonomous), Tezpur. Email id: mkdas116@gmail.com Ms. Minakshee Sarmah, Asstt. Professor, Dept. of Biotechnology, Darrang College (Autonomous), Tezpur Email id: minakshee164@gmail.com Dr. Pranjal Pratim Das, Asstt. Professor, Dept. of Biotechnology, Darrang College (Autonomous), Tezpur Email id: cicibiotech@gmail.com
Reference Books	1. Nelson, D.L., Cox, M.M. (2004) Lehninger Principles of Biochemistry, 4th Edition, WH Freeman and Company, New York, USA. 2. Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition. W.H Freeman and Co. 3. Microbiology- by Prescott, Harley, klein. 4. Molecular Biology of the Gene, Watson, CSH publishing. 5. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.

Semester-II (Theory Credit: 03)					
UNIT	**CONTENT**	**L**	**T**	**P**	**TOTAL HRS**

I	**Biomolecules and Water** Biomolecules: Introduction, types and its significance for life. Structure and ionization of water, chemical and physical properties of water in different forms, weak acids and bases, pH, Henderson-Hasselbalch equation, pKa.	**4**	**2**	**-**	**06**
II	**Carbohydrates** Carbohydrates sources (Plants, animals, microbes, and marine), nomenclature and structural types (Different carbon number, monomers, dimers, oligomers, and polymers), functional types (Aldoses and ketoses), reducing and non-reducing sugars, anomers, structural conventions (Haworth projection, Fischer model, boat and chair configuration, cyclization, and isomerization), optical properties (α and β, D and L, enantiomers, and epimers) Physical & Chemical Properties of carbohydrates, and its nutritional importance.	**6**	**3**	**-**	**09**
III	**Lipids** Fatty acids sources (Plants, animals, microbes, and marine), structure and configuration (Saturated, unsaturated, and *trans* fatty acids), structural types (Short, medium, and long chain). Triglyceride, phosphoglyceride, and sphingolipid sources (Plants, animals, microbes, and marine), nomenclature and structural types. Derived lipids- phospholipids and glycolipids. Waxes and long chain fatty alcohols. Conjugated lipids- structural composition, types, and biological significance (Chylomicrons and lipoproteins). Sterol- sources, types, and their biological significance, steroids and steroid derived vitamins, prostanoids and eicosanoids and their biological significance. Lipid soluble antioxidants.	**7**	**3**	**-**	**10**
IV	**Amino acids and proteins** Structure and classification (based on structure, polarity, nutritional importance, metabolic fate and others), optical properties (D and L, chirality), chemical properties of amino acids, isoelectric point. Peptide bond, dipeptide characteristics, dihedral angles, Ramachandran plot, structural levels of proteins (Primary, secondary, tertiary, and quaternary), super secondary structure, peptide plan, helicity, hydropathy and hydrophilicity indices, domains and motifs, protomer, Types of proteins (fibrous and globular), protein folding- chaperones and chaperonins. Protein separation and purification. Conjugated proteins.	**7**	**4**	**-**	**11**
V	**Nucleic acids** Structures of purines and pyrimidines, nucleotides, nucleosides, forces stabilizing DNA and RNA structures, different types of bonds, base pairing-Hoogsteen pairing, stacking, helicity, forms, supercoiling, twists and bends. Isomorphic, anisomorphic, and cruciform structures in DNA, palindromic sequence. Spectral characteristics (Melting curves, Cot values, and chromacity), RNA	**6**	**3**	**-**	**09**

	types (hn-RNA, r-RNA, m-RNA, t-RNA, mi-RNA, and ribo-switches), polycistronic m-RNA. t-RNA structure, ribozymes. DNA-DNA and DNA-protein interactions, organization of DNA into chromosomes. Significance of nucleic acids in Genetic Inheritance.				

Semester-II (Practical Credit: 01)

UNIT	CONTENT	L	T	P	TOTAL HRS
Lab Experiments	1. Preparation of biological buffers. 2. Preparation of standard curve of glucose by Anthrone method and determination of sugar concentration of unknown samples. 3. Preparation of BSA standard curve using Folin-Lowry reagent / Bradford method and determination of unknown protein concentrations. 4. Preparation of standard curve of DNA by diphenylamine reaction and estimation of unknown DNA by spectrophotometer. 5. Separation of a mixture of amino acids through thin layer chromatography/paper chromatography. 6. Extraction of DNA/RNA from plant/animal tissues and their estimation through agarose gel electrophoresis 7. Lipid extraction by Folch method/solvent extraction and their separation by silica-based adsorption chromatography.	**0**	**0**	**30**	**30**

Detailed Syllabus of IIIrd Semester FYUGP Biotechnology (as Minor)	
Title of the Course	**Plant and Animal Physiology**
Course Code	**Paper Code: BIT-MN-03014**
Total Credit (Theory+ Practical)	**Theory Credit:** 03 **Practical Credit:** 01 **No. of Required Classes:** 75 (Theory: 45; Practical: 30)
Contact Hours/ Classes Required	75 (Theory Class: 45; Practical Class : 30)
Distribution of Marks	**External (Theory + Practical)** **70 (45+25)** **Internal** **30** [Sessional Exam: 15 marks, Home Assignment: 6 marks, Class Test: 5 marks, Attendance: 4 marks]
Course Outcome (CO)	After completion of this course/module, students will be able to: Understand the principles of physiology of plant and animals. Understand the concepts and mechanisms of integration in the different functional systems of the plants and animals.

	Able to examine life processes of animals and plants, metabolism, nutrition and digestion, excretion, endocrine function, circulation, respiration and temperature regulation and their inter-relation.
Course Designer	**As per FYUGP Syllabus for Biotechnology of Gauhati University** Dr. Debashree Saikia, Asstt. Professor, Dept. of Biotechnology, Darrang College (Autonomous), Tezpur.
Reference Books	1. Nelson, D.L., Cox, M.M. (2004) Lehninger Principles of Biochemistry, 4th Edition, WH Freeman and Company, New York, USA. 2. Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition. W.H Freeman and Co. 3. Microbiology- by Prescott, Harley, klein. 4. Molecular Biology of the Gene, Watson, CSH publishing. 5. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.

Semester-III (Theory Credit: 03)					
UNIT	**Plant Physiology**	**L**	**T**	**P**	**Total hrs**
I	**Plant Cell Structure** Nature of plant cell wall, Plant tissue- meristematic tissue, permant tissue, secretory and secondary meristem (Apical cell theory, Histogen theory, Tunica-Corpus theory, histogen theory and Korper-Kappe theory).	3	1	-	4
II	**Differentiation** Differentiation of root, stem and leaf, Types of vascular bundles and Vascular cambium, Origin, development, Structure of Dicot and monocot root, Structure of Dicot and monocot stem, Structure of Dicot and monocot leaf, Structure and function of Stomata, Stomatal types.	3	1	-	4
III	**Morphogenesis and reproduction** Differentiation and cell polarity in Unicellular and multicellular system, root hair and stomata formatio), Shoot Apical meristem (SAM): Origin, structure and function and ultrastructure of meristems. Organogenesis: Differentiation of root, stem, leaf and axillary buds. Structure and function of root apical meristem (RAM): Root cap, quiescent centre and origin of lateral roots. Microsporogenesis, Microgametogenesis, Megagametogenesis, Pollination and fertilization in plants.	10	2	-	12
Animal Physiology					
IV	**Digestion and Respiration** Digestion: Mechanism of digestion and absorption of carbohydrates, Proteins, Lipids and nucleic acids. Composition of bile, Saliva, Pancreatic, gastric and intestinal juice, Respiration: Exchange of gases, Transport of O_2 and CO_2, Oxygen dissociation curve, Chloride shift.	5	1	-	6
V	**Circulation** Composition of blood, Plasma proteins and their role, blood cells, Haemopoiesis, Mechanism of coagulation of blood. Mechanism of working of heart: Cardiac output, cardiac cycle, Origin and conduction of heart beat.	7	1	-	8
VI	**Muscle physiology and Excretion** Structure of cardiac, smooth and skeletal muscle, threshold stimulus, All or None rule, single muscle twitch, muscle tone, isotonic and isometric contraction. Excretion: modes of excretion, Ornithine cycle, Mechanism of urine formation.	4	1	-	5
VII	**Nervous and Endocrine coordination** Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers; Structure of synapse, Types of synapse, Synaptic transmission, Neurotransmitters. Types of glands: Exocrine and endocrine; Autocrine, Paracrine and Endocrine glands; Different endocrine glands– Hypothalamus, pituitary, pineal,	5	1	-	6

	thymus, thyroid, parathyroid and adrenals, hypo and hyper-secretions.				
Semester-III (Practical Credit: 01)					
UNIT	**CONTENT**	**L**	**T**	**P**	**Total hrs**
Lab Experiments	1. Study of meristem (Permanent slides/ Photographs). 2. Study of Simple Tissues (Parenchyma, Collenchyma and Sclerenchyma) and Complex tissues (xylem and phloem). 3. Determination of clotting time and bleeding time of blood. 4. Preparation of blood smears and identifying various WBC. 5. Determination of human blood groups. 6. Determination of specific gravity of blood. 7. Measurement of blood pressure.	-	-	**30**	**30**

Detailed Syllabus of IVth Semester FYUGP Biotechnology as Minor	
Paper Name	**Cell Biology**
Paper Code	**Paper Code: BIT-MN-04014**
Total Credit (Theory+ Practical)	**Theory Credit:** 03 **Practical Credit:** 01 **No. of Required Classes:** 75 (Theory:45; Practical:30)
Contact Hours/Class es Required	75 (Theory Class: 45; PracticalClass:30)
Distribution of Marks	**External (Theory + Practical) 70 (45+25)** **Internal 30** SessionalExam:15marks,HomeAssignment:6marks,ClassTest:5marks, Attendance:4
Course Outcome (CO)	**After completion of this course/module, students will be able to:** **CO1**: Understand the basic structure and functions of cell and cell organelles. **CO2**: Know about skill to isolate, appreciate the architecture and identify different sub-cellular components.
Course Designer	**As per FYUGP Syllabus of B.Sc. Biotechnology, GU** Dr. Debashree Saikia, Asstt. Professor, Darrang College (Autonomous), Tezpur

Reference Books	1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc. 2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology.8th edition. Lippincott Williams and Wilkins, Philadelphia. 3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA. 5. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. 7thedition. Pearson Benjamin Cummings Publishing, San Francisco. 6. T.Devasena2012.CellBiology.OxfordUniversityPress.

Semester-IV (Theory Credit: 03)					
UNIT	**CONTENT**	**L**	**T**	**P**	**Total hrs**
I	**Cellular construction** Cell type: History and origin. Prokaryotic and Eukaryotic cell. Difference between Prokaryotic and Eukaryotic cell. Plasma Membrane: History, Ultra structure, and chemical composition of plasma membrane (fluid mosaic model). Transport across the membrane. An insight into the organization of the trans-membrane proteins.	08	03	-	11
II	**Membrane and membranous bodies** Membrane vacuolar system, Cytoskeleton and its different types, Cytoplasmic streaming and Cell motility: Structure, function and importance of cell organelles: Endoplasmic reticulum, Golgi complex, Lysosomes, Ribosomes, Mitochondria and Chloroplasts.	07	04	-	11
III	**Nucleus and chromosomes** Nucleus: Structure and function, chromosomes and their structure, nucleolus. Chromosomes: History, types and functions of chromosomes. Giant chromosomes, Polytene chromosome and Lampbrush chromosome.	07	04	-	11
IV	**Extracellular matrix** Extracellular Matrix: Composition, molecules that mediate cell adhesion, membrane receptors, receptor ligand interactions and their function. Signal transduction- basic concept. Basics of apoptosis.	08	04	-	12
PRACTICAL					
Semester-IV (Practical Credit: 01)					
UNIT	**CONTENT**	**L**	**T**	**P**	**Total hrs**

Lab Experiments	1. Demonstration of dialysis/plasmolysis and the effect of temperature and organic solvents on semi permeable membrane. 2. Demonstration of different stages of mitosis and meiosis using onion root tip. 3. Study of structure of blue green algae, algae, fungi and yeast (using permanent slides/photographs) 4. Microtomy: the process (demonstration). 5. Preparation of nuclear, Mitochondrial & cytoplasmic fractions by density gradient centrifugation.	**-**	**-**	**30**	**30**

Detailed Syllabus of Vth Semester FYUGP Biotechnology (as Minor)	
Title of the Paper	**Immunology**
Paper Code	**BIT-MN-05014**
Total Credit (Theory+ Practical)	**Theory Credit:** 03 **Practical Credit:** 01 **No. of Required Classes:** 75 (Theory:45; Practical:30)
Contact Hours/Classes Required	75 (Theory Class: 45; Practical Class: 30)
Distribution of Marks	**External (Theory + Practical)** **70 (45+25)** **Internal** **30** Sessional Exam:15marks, Home Assignment: 6marks,Class Test:5marks, Attendance:4
Course Outcome (CO)	After completion of this course/module, students will be able to: **CO1.** Describe the basic concepts and scope of immunology, including the historical development of the field and the organization of the immune system. **CO2.**Explain the structure, types, and functions of immune cells, tissues, and organs**,** and their roles in innate and adaptive immunity. **CO3.**Differentiate between humoral and cell-mediated immune responses**,** and outline the mechanisms of antigen recognition, processing, and presentation. **CO4.** Illustrate the structure and function of immunoglobulins (antibodies)**,** antigen–antibody interactions, and principles of immunodiagnostic techniques. **CO5.**Discuss the molecular and cellular basis of immune regulation**,** including cytokines, complement system, hypersensitivity, autoimmunity, and Immunodeficiency disorders.
Course Designer	Ms. Minakshee Sarmah, Asstt. Professor, Dept. of Biotechnology, Darrang College (Autonomous), Tezpur
Reference Books	1. Kuby Immunology by Jenni Punt, Sharon Stranford, Patricia Jones, Judith A Owen. 2. The elements of immunology by Fahim Halim Khan 3. Cellular & Molecular Immunology—Abul K. Abbas; Andrew H.H.Lichtman; Shiv Pillai. 10th Edition. Elsevier Health Sciences, 2021. 4. Immunology: A Short Course—Richard Coico; Geoffrey Sunshine.7thEdition. Wiley-Blackwell, 2015

Semester-V (Theory Credit: 03)					
UNIT	**CONTENT**	**L**	**T**	**P**	**Total hrs**
I	**Introduction:** Scope of Immunology, Historical background of Immunology, Biological aspects of Immunology, Self and non-self recognition, specificity, memory of immune system. Antigens: Essential features of Ag, haptens, Carrier molecule, Immunological valence, Antigenic determinants. Adjuvants: Freund's complete and incomplete. Antibodies: Properties, Primary structure of immunoglobulins. Classification of Immuno globulins and its types, Basics of VDJ recombination.	**8**	**3**	**-**	**11**
II	**Immunity:** Types: Active and passive immunity. Cell mediated immunity, humoral immunity, immune response; primary and secondary response. Phagocytosis, mechanism of phagocytosis. Interferon: Types of Interferons. Natural Killer cells. Complement system: Properties and components of compliment, Pathways: Classical and alternative pathways, Immunodeficiency and immunosuppression	**8**	**4**	**-**	**12**
III	**Hypersensitivity(HS):**Type I:Allergies and anaphylaxis -IgE, Mast cell degranulation. Type II: Antibody mediated HS reactions; Mechanism, pathogencity and cases of type II reactions; Type III: Immune complex mediated HS reactions: Mechanism & pathogenecity of type III reactions. Type IV: Delayed type (or) cell- mediated HS reactions; Mechanisms and pathogenecity, Type V: Stimulatory HS reactions. Mechanism and pathogenecity, Autoimmunity: Introduction, Auto-recognition, classes of auto-immune diseases.	**7**	**3**	**-**	**10**
IV	**Immunological techniques:** Precipitin curve and Immuno diffusion, Rocket immuno- electrophoresis.: Direct and Indirect Agglutination, Widal test, VDRL test. Radioimmunoassay: ELISA – Principle, Types, Methodology and applications. Immuno-fluorescence, *In- situ* localization techniques	**8**	**4**	**-**	**12**
PRACTICALS					
Semester-V (Practical Credit: 01)					
UNIT	**CONTENT**	**L**	**T**	**P**	**Total hrs**
Lab Experiments	1. Separate serum/plasma from the blood sample 2. Total and/or differential Leukocyte Count of the given blood sample. 3. Identification of human blood groups 4. Demonstration of ELISA using dot-ELISA method 5. Rocket immune-electrophoresis	**-**	**-**	**30**	**30**

Detailed Syllabus for VIth Sem FYUGP Biotechnology as Minor	
Title of the Paper	**Bio-analytical Tools**
Paper Code	**BIT-MN-06014**
Total Credit (Theory+ Practical)	**Theory Credit:** 03 **Practical Credit:** 01 **No. of Required Classes:** 75 (Theory:45; Practical:30)
Contact Hours/ Classes Required	75 (Theory Class: 45; Practical Class: 30)
Distribution of Marks	**External (Theory + Practical) 70 (45+25)** **Internal 30** Sessional Exam:15marks, Home Assignment: 6marks,Class Test:5marks, Attendance:4
Course Outcome (CO)	After completion of this course/module, students will be able to: Understand the working principles of Instruments Know the applications of Biotechniques Handle and operate Instruments
Course Designer	**As per FYUGP Syllabus for Biotechnology, Gauhati University** Dr. Debashree Saikia, Asstt. Professor, Darrang College (Autonomous), Tezpur
Reference Books	1. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia. 2. Biochemical methods by Sadasivam and Manickam, Third edition, New Age International Publishers, New Delhi. An introduction to practical biochemistry by David T. Plummer. McGraw Hill Education, 3rd Edition. 3. Spectroscopy: Fundamentals and Data interpretation by Neeraj Kumar Fuloria, Shivkanya Fuloria. 4. Computer Assisted Microscopy: The Measurement and Analysis of Images by John C Russ, 2011. Springer Verlag.

Semester-VI (Theory Credit: 03)					
UNIT	**CONTENT**	**L**	**T**	**P**	**Total hrs**
I	**Microscopy:** Principle of operation and Instrumentation, Light microscopy, Bright & Dark Field microscopy, Fluorescence microscopy, Phase Contrast microscopy, electron microscopy (TEM, SEM).	7	3	-	10

II	**Centrifugation:** Basic principles of sedimentation – Types of centrifuges and their uses –Preparative and Analytical centrifuge, rpm and rcf, cell fractionation techniques, isolation of sub-cellular organelles and particles.	5	3	-	08
III	**Spectroscopy:** General principles and law of absorption, Types of spectra and their biochemical applications, fluorimetry, colorimetry, spectrophotometry (visible, UV, infrared), IR spectroscopy, CD spectroscopy, NMR, X-ray diffraction: Principles and Application.	6	2	-	08
IV	**Chromatography**: Concept of Chromatography, Working principles and applications: Partition Chromatography, Adsorption Chromatography, Paper Chromatography, thin layer chromatography, Gel Filtration Chromatography, Ion Exchange Chromatography, Affinity Chromatography, gas chromatography, Liquid Chromatography.	6	4	-	10
V	**Electrophoresis:** General principles – apparatus, methods and applications, Agarose gel electrophoresis, SDS-PAGE, immuno-electrophoresis, isoelectric focusing, Blotting techniques.	6	3	-	9

PRACTICALS

Semester-VI (Practical Credit: 01)

UNIT	CONTENT	L	T	P	Total hrs
Lab Experiments	1. Light microscope, principles, components, functions, and operations 2. Principles and operations of centrifuge 3. Quantitative analysis of biological samples by spectrophotometric methods 4. Separation of amino acids by paper chromatography 5. Electrophoretic separation of nucleic acids/proteins	-	-	**30**	**30**