

## AcSIR-CSIR Biological Sciences Course Work Syllabus

### 100 level courses

#### **BIO-NEIST-1-0001 (Core)**

**Biostatistics: 1-0-0-1**

**Faculty:** Dr M Lal, Dr HP Deka Boruah

Summarization of Data: measures of center, dispersion, skewness Dependence of variables: Correlation, linear regression, logistic regression, Basic probability distributions: Binomial, Normal, Chi-squares. Estimation of parameters: method of moments, maximum likelihood. Testing of hypotheses: (a) parametric tests: t-test, z-test, chi-squares test, ANOVA, (b) non-parametric tests: Mann-Whitney, Kruskal Wallis, Kolmogorov-Smirnov

#### **BIO-NEIST-1-0002 (Core)**

**Computation/bioinformatics: 1-0-0-1**

**Faculty:** Dr R Deka, Dr BS Bhau

Computers: Introduction, Evolution and Classification of computers. Fundamentals of computing. Bit and Byte, Introduction to types of Hardware and Software. Components of Computer. Introduction to operating systems. Introduction to Computer Viruses. Network: Introduction. Network structure and architecture, Hierarchical networks, Ethernet and TCP/IP family of protocols, transport protocol design. Types of network, Topologies of network, Router, Switch, Data Communication, Concept of Wireless networking, LAN, WAN, MAN, Security of the network, Fire-walls, Network Applications. Information Technology: Concepts of client Server Architecture, Concept of search Engine, Database search engines. Introduction to Internet. Introduction to Word, Powerpoint and Excel. Introduction to Bioinformatics: History of Bioinformatics, Genome sequencing projects, Human Genome Project, Applications of Bioinformatics. Introduction to databases, Type and kind of databases, Applications and limitations. Literature Search Databases, Nucleic acid and protein databases, Animal and plant databases, Ensembl Genome project TIGR database, Biotechnological databases, Motifs and Pattern Databases, Databases for species identification and classification, Structural databases. Database Retrieval and deposition systems. Web tools and resources for sequence analysis: Pairwise and multiple sequence Alignment, Sequence similarity search: BLAST, Pattern recognition, motif and family prediction, Restriction map analysis, primer design, Gene prediction, Phylogenetic Tree, Protein structure prediction and visualization.

**BIO-NEIST-1-0003 (Core)****Basic Chemistry: 1-0-0-1****Faculty:** Dr P Manna, Dr L Saikia

Thermodynamics Solutions and Ions Chemical bonding and molecular structure  
Chemical Kinetics Stereochemistry Introduction to drug discovery (Medicinal chemistry approach) Drug target, discovery and development (forward and reverse approach)

**BIO-NEIST-1-0004 (Core)****Research Methodology, Communication/ethics/safety: 1-0-0-1****Faculty:** Dr J Kalita, Dr SP Saikia

Introduction to research concept, identification, selection and formulation of research problem, justification, hypothesis, literature retrieval, survey, bibliography presentation, digital resource (internal), data collection, sampling techniques, collection, documentation, presentation and interpretation of data

**BIO-NEIST-1-3901 (Elective)****Laboratory safety: 1-0-0-1**

Team work culture in laboratory, General Safety and lab-safety procedures, Chemical, electrical and UV safety, safe handling of toxic and hazardous chemicals, storage and disposal of chemicals etc.

Common laboratory Instruments and applications: Principles and practices of instruments used in microbiology, biochemistry, molecular biology, genetics engineering, fermentation technology, bioremediation, plant biotechnology, ecology etc.

**200 level courses****BIO-NEIST-2-3901 (Elective)****Biodiversity and Environmental Studies: 1-0-0-1****Faculty:** Dr M Khongsai, Dr J Kalita

Overview of Biodiversity and conservation: types of protected area, protected areas of N E India, Environmental and Forest policies and Laws.

Scope of environmental studies, Environmental studies in a multidisciplinary approaches.

Ecosystems – major types, structure and functions, productivity of ecosystems and sustenance.

**BIO-NEIST-2-3902 (Elective)****Natural resources: 1-0-0-1****Faculty:** Dr D Banik, Dr SP Saikia

Types of resources, basics of conservation, natural resources of N E India, Traditional knowledge with reference to natural resources and their application potential.

**BIO-NEIST-2-3903 (Elective)****Advance Plant Physiology: 1-0-0-1****Faculty:** Dr SP Saikia, Dr HP Deka Boruah

Introduction to plant biology, physiological and molecular responses of plant to abiotic stress, advances in mineral nutrition, photosynthesis and ecological adaptation.

**BIO-NEIST-2-3904 (Elective)****Biotransformation & Bioremediation: 1-0-0-1****Faculty:** Dr SB Wann, Dr AK Singh

Microbial biotransformation, biodegradation of petroleum, xenobiotics, bioremediation and phyto-remediation, production of microbial enzymes and fermentation, physico-chemical parameters for maximum enzyme production, enzyme purification, characterization and immobilization of enzymes, enzyme use for biotransformation, chiral synthesis.

**BIO-NEIST-2-3905 (Elective)****Molecular Biology & Biotechnology: 1-0-0-1****Faculty:** Dr AK Singh, Dr BS Bhau

Isolation, purification and characterization of microbes. DNA Finger printing, Electrophoresis, PCR, Real Time PCR, Reverse Transcriptase PCR, Sequencing of DNA, basic knowledge and application of bioinformatics etc. Molecular basis of plant-microbe interactions and application of microbes in industry and agriculture

**BIO-NEIST-2-3906 (Elective)****Pharmacokinetics, Pharmacodynamics and toxicology: 1-0-0-1****Faculty:** Dr M Pal, Dr SB Wann

Pharmacokinetics: Drug absorption, distribution, biotransformation and elimination (ADME), bioavailability and bioequivalence (BA&BE) of drug products.

Pharmacodynamics: General aspects of receptor pharmacology, Structural and functional aspects of receptors, Regulation of receptors, Classification and characterization of receptors, Theories and forces involved in drug receptor interaction, forces. Receptor polymorphism, dimerization and its importance in drug design.

Physiochemical properties in relation to biological action and drug: Fundamentals of complex of events between drug administration and drug action, Solubility & partition coefficient, Basics of important physiochemical properties like isosterism, steric behaviour, ionization, hydrogen bonding, chelation, oxidation- reduction potential, surface actions.

Basic Toxicology: Principles of Toxicology, Fundamentals of acute, sub acute, chronic toxicity and special toxicity, LD50, ED50, TD50, IC50 determination, genotoxicity, carcinogenicity, teratogenicity and mutagenicity studies, General principles of treatment of poisoning.

**BIO-NEIST-2-3907 (Elective)****Basics of analogue drug design, preclinical and clinical design: 1-0-0-1****Faculty:** Dr P Manna, Dr P Pahari

Basic considerations of drug design: De- novo drug design, lead seeking methods, rational drug design, Prodrug concepts.

A general treatment of the approaches to drug design: including the methods of variation, study of the use of biochemical and physiological information involving new drugs.

New approaches in drug discovery: a. Combinatorial chemistry; b. Pharmacogenomics; c. Proteomics; d. Array technology. Rational drug design Fundamentals of QSAR- objectives, expressions of biological activity, Principles of Computer aided drug design, Docking and High throughput screening, Guidelines: CPCSEA, OECD, FDA, ICH, WHO ethics and animal experimentation. Importance of alternative experimental models, its advantages and disadvantages. Preclinical & Clinical trials: Basics of Preclinical trials and Clinical trials of drugs, design of clinical trials and testing of drugs in humans.

**BIO-NEIST-2-3908 (Elective)****Plant Breeding: 1-0-0-1****Faculty:** Dr M Lal, Dr BS Bhau

Principle of genetics : Laws of inheritance, linkage, crossing over, recombination analysis, genotyping concepts for genetic mapping, construction of genetic linkage map for gene and qualitative trait loci (QTL) mapping.

Introduction to linkage mapping software packages and interfaces breeding by design.

Methods of plant breeding, self incompatibility and their sequences. Heterosis breeding, Mating design, stability parameters, pure line, back cross, pedigree methods and SSD.

**BIO-NEIST-2-3909 (Elective)****Commerical Entamology: 1-0-0-1****Faculty:** Dr J Kalita, Dr M Bhuyan

Bee keeping-General colony management during different seasons. Seasonal management. Managing colonies for honey production and pollination. Artificial queen rearing. Pests and diseases of honey bees. Bee poisoning. Production and marketing of quality honey and value added honey products. Establishment and maintenance of apiaries.

Study of different species of silkworms, characteristic features, moriculture, silk and its uses, pests and diseases of silkworms, rearing and management of silkworms. Lac insect- natural enemies and their management.

Economic and public health importance of insect pests in human habitation and habitats, biology, damage and control of mosquitoes, houseflies, bed bugs, ants, termites, cockroaches, flies, silverfish, head and body lice, carpet beetles, cloth moths, crickets, wasps, house dust mites, insect pests of cattle, poultry, pet animals and their management.

### 300 level courses

#### **BIO-NEIST-3-3901 (Elective)**

##### **Microbial Biotechnology: 1-0-0-1**

**Faculty:** Dr AK Singh, Dr M Khongsai

Isolation, screening of microbes for industrial and agriculture application, production of bioactive metabolites for pharmaceutical and industrial lead/hits, DNA fingerprinting, DNA sequencing, Molecular characterization of genes and traits responsible for biological activity, enzyme production, isolation, purification, characterization and applications. Exploitation of microbes for bioremediation & biotransformation.

#### **BIO-NEIST-3-3902 (Elective)**

##### **Advances in physiological and molecular responses to abiotic stress: 1-0-0-1**

**Faculty:** Dr SP Saikia, Dr R Saikia

Plant ecology and stress physiology with basic concepts and approaches applicable to all types of plants. Emphasis on the relationship between environmental parameters (radiation, temperature, water, nutrients), heavy metals, and their effect on development, membranes, phytohormones, carbon balance, and the use of stable isotopes in stress, physiological processes (photosynthesis, respiration, cellular and molecular responses, mineral nutrition), and plant responses (leaf expansion, partitioning of dry mass, water status, and transpiration). Integration of plant responses into models for better understanding and predict growth and yield.

#### **BIO-NEIST-3-3903 (Elective)**

##### **Biodiversity and conservation: 1-0-0-1**

**Faculty:** Dr M Lal, Dr T Goswami

Concept and definition of Biodiversity, existing regulations, laws and NBA, Bio-profiling, in-situ- and ex-situ preservation, Bio-prospection and utilization, Methods and Approaches for value additions, Role and Relevance of Biodiversity, Technology development and dissemination, Ecology and socio-economic impact of local resources on stock-holders. Biotic and abiotic interaction, Impact of stress factors on Life forms, Climatic changes and agro biology, Adaptation Biology and Evolution, Ecotourism managements.

#### **BIO-NEIST-3-3904 (Elective)**

##### **Eco-restoration: 1-0-0-1**

**Faculty:** Dr D Kalita, Dr AK Singh

Ecology and nature of environmental degradation of ecosystems due to natural and manmade activity and different measures adopted for ecological restoration. Phenocopies and Ecotypes; genetic Assimilation and natural selection; Phenotypic Accommodation; Evolutionary considerations; Developmental mechanisms of phenotypic accommodation; Reciprocal accommodation, Niche construction

**BIO-NEIST-3-3905 (Elective)****Ethnobotany and Traditional Knowledge: 1-0-0-1****Faculty:** Dr D Banik, Dr M Khongsai

Ethnobotany, definition and scope, Role and relevance of Ethnobotany, Ethnobotany and medical botany, Interdisciplinary nature of Ethnobotany, Medical botany and drug development, Methods and approach of ethnobotany, Ethnobotany and plant taxonomy, Ethnobotany and bioprospection, Validation of Ethnobotanical knowledge, Cross cultural Ethnobotany, Plant folk medicines and NE India, Ethnobotany and biopiracy, Documentation and development of database.

**BIO-NEIST-3-3906 (Elective)****Plant - Insect Interaction and Herbivore Managements: 1-0-0-1****Faculty:** Dr M Bhuyan, Dr J Kalita

Herbivore-Plant Interaction. Tritrophic interactions of plant-insect & parasitoids, Plant defence Secondary plant metabolites, Botanical Pesticides past, present and future Plant-Pollinator interactions. Insect as pollinator- Honey bee & Butterfly as pollinator- Honeybee & crop production pollination Biology Butterfly as environmental indicator. Butterfly biodiversity, Host range, conservation Herbivores-induced plant defence. Induced biosynthesis of plant defense compounds-use of plant signal in agricultural crops- Transgenic plants.

Insect behaviour. Manipulation of insect behaviour for insect pest management- Evolution of insect behaviour.

Novel methods of Insect-pest management. IPM- Concept & Evolution, Ecology of pest- IPM of major pests, Resistance, Biocontrol/Biocides, Molecular approaches in Insect-pest Management.

**BIO-NEIST-3-3907 (Elective)****Advances in Plant Microbes Interactions: 1-0-0-1****Faculty:** Dr BS Bhau, Dr SB Wann

Biology and Ecology of Plant Pathogens and Endophytes. Biology and ecology of major group of plant pathogens viz. fungi, bacteria, viruses, nematodes and mollicutes and endophytes. Concepts of plant diseases, etiology, microbial communities, virulence and resistance, population biology, disease development and epidemiology.

Genetics of Host Pathogen interaction and Mechanism of Host Defence. Genes and plant diseases, genetics of resistance and pathogenicity, recognition mechanisms in host pathogen interaction. Pathogenesis and host defence, passive and active defence mechanisms- structural and biochemical defences, systemic acquired resistance.

Advances in Plant Disease Management. Introduction to biology of the pathogens that cause plant diseases, disease diagnosis. Topics include principles and practices of plant disease management including physical methods, regulatory methods, biological and chemical methods, host resistance and integrated plant disease management (IPDM).

Biotechnology of Edible and Medicinal Mushroom. Prospects of edible and medicinal mushrooms, biochemistry of mushroom fructification, nutritive and medicinal values,

spawn and spawn preparation, agrotechnology , pest and diseases ,genetic improvement.

**BIO-NEIST-3-3908 (Elective)**

**Advance Plant Physiology: 1-0-0-1**

**Faculty:** Dr R Saikia, Dr SP Saikia

Overview of Essential Concepts. Plant and cell Architecture, Energy and Enzymes Transport and Translocation of Water and Solutes. Water and Plant Cells, Water Balance of the Plant, Mineral Nutrition, Solute Transport.

Biochemistry and Metabolism. Photosynthesis: The Light Reactions, Photosynthesis: Carbon Reactions, Photosynthesis: Physiological and Ecological Considerations, Translocation in the Phloem, Respiration and Lipid Metabolism, Assimilation of Mineral Nutrients, Plant Defences: Surface Protection and Secondary Metabolites.

Growth and Development. Signal Transduction, Cell Walls: Structure, Biogenesis, and Expansion, Growth, Development, and Differentiation, Phytochrome, Blue Light, Responses: Stomatal Movements and Morphogenesis, Growth Hormones, the Control of Flowering, Stress Physiology

**BIO-NEIST-3-3909 (Elective)**

**Insect Biotechnology: 1-0-0-1**

**Faculty:** Dr J Kalita, Dr M Bhuyan

Insect cell and tissue culture: History and scope of animal cell and tissue culture; advantages and disadvantages. Primary culture - cell lines and cloning: Disaggregation (enzymatic and mechanical) of tissue and primary culture - cultured cells and evolution of cell lines – maintenance of cultures – large scale cell cultures - somatic cell fusion.

Isolation of protein/hormone from insects, insect tissues, In Vitro and In Vivo assays, Metabolism of Proteins, carbohydrates and silk protein biosynthesis, enzymes kinetics, microbial protein based products and process.

**BIO-NEIST-3-3910 (Elective)**

**Molecular and cell biology: 1-0-0-1**

**Faculty:** Dr P Manna, Dr M Pal

Introduction to Molecular Biology, Historical background (Vital force theory, the scientific approach, classic experiments), Physico-chemical approach to biology,(Schrodinger's book, theory of the chemical bond,

crystallography), Biomolecules and replication (DNA, RNA, protein, background to their discovery and analysis, roles played in biology,

replication machinery in prokaryotes and eukaryotes, problem of packaging genetic information)., Flow of genetic information (Central dogma, adaptor hypothesis, operon concept, transcription, translation), Gene expression and control (Operon, cistron,

polycistronic/monocistronic messages, transcriptional control, RNA processing, chromosomal histone modification, cell cycle), Evolution (organismal,bacterial, molecular, Darwin to Oparin, Hardy- Weinberg law, analysis of evidence, C-value paradox in eukaryotes, cot value), Cells and Biomolecules, Prokaryotic and eukaryotic cells overview and

comparisons, Techniques for the study of cell structure and function (Histology, staining, karyotyping, freeze fracture, microscopy, FISH, flow cytometry, patch clamp, live cell imaging, probing with toxins), Microbial and phage genetics, (Discovery of the genetic material, Classic experiments in microbial and phage genetics - phage lysogeny, restriction and modification, bacterial conjugation, transformation, transduction) Cell components (cell wall, membrane, nucleus, mitochondria, chloroplasts, lysosomes, vacuoles, cytoskeleton), Protein sorting and secretion, biotechnological considerations (Golgi and ER, targeting of proteins, use of principles in high-expression systems)

**BIO-NEIST-3-3911 (Elective)**

**Molecular Markers and Breeding: 1-0-0-1**

**Faculty:** Dr BS Bhau, Dr M Lal

Genome Organization Organellar genome and Nuclear Genome: Unique sequences, Repeat DNA sequences, Classification of Repeat DNA (Tandem repeats, Interspersed repeats, Micro-satellites, Minisatellites, midi-satellites, VNTRs), The dynamic genome: Polymorphisms and Sources of Genetic variation, Overview of Genetic Markers: Phenotypic Markers, Biochemical markers, DNA based markers Molecular marker and DNA fingerprinting techniques: Concepts, classification and methodologies: Hybridization based markers (viz. Restriction Fragment Length Polymorphism, Oligonucleotide fingerprinting), PCR based markers (viz. DNA Amplification Fingerprinting, Arbitrarily Primed PCR, Randomly Amplified Polymorphic DNA, SSRs, STMS, SCARs, Inter-SSRs, Multiple Arbitrary Amplicon Profiling, Amplified Fragment Length Polymorphism, electively Amplified Microsatellite Polymorphic Loci, Inter retrotransposon amplified polymorphism, retrotransposon-microsatellite amplified polymorphism, Diversity Array Technology (DArTs), SNPs and SNP based assays for high-throughput genotyping, EST based markers, Sequencing by Hybridization (SBH), Molecular Markers and Assessment of genetic diversity: Principles of Numerical taxonomy, binary matrix to phonetic dendograms, Structure analysis, Case Studies and examples, Molecular Markers for genome mapping: Marker Assisted Selection (MAS), gene introgression and pyramiding, BSA Genotyping for Physical mapping: Fingerprinting for BAC assembly, Types of Mapping populations in Plants: F2 populations, RILs (recombinant inbred lines), Backcross lines, NILS (Near Isogenic Lines), HIF (Heterogenous Inbred Families), AILs (Advanced Intercross Lines), Other Application of Molecular Markers: Genotyping tools as plant variety protection, hybrid purity tests, diagnostics (transgenics, forensics) Other Mapping tools and Methodologies: Introduction to Cytogenetic maps, Radiation Hybrid Maps, HAPPY mapping, Physical Maps, Comparative/Syteny mapping.

**BIO-NEIST-3-3912 (Elective)**

**Functional Genomics: 1-0-0-1**

**Faculty:** Dr AK Singh, Dr BS Bhau

Gene Expression and the transcriptome analysis

Medium throughput techniques. Northern, Quantitative RT-PCRs, RACEs, cDNA-AFLP, Inventories for gene discovery and annotation: EST databases, full-length cDNA /ORF clones



Hi through put-genome wide Analytical Platforms. Microarrays: Whole Genome arrays, cDNA arrays and Tiling Arrays: Concept, designing, fabrication, probing, and data analysis, Applications: Global gene expression profiling, discovery of novel genetic pathways and targets, Genotyping for DNA polymorphism, Mapping genome wide epigenetic states, alternative splicing, miRNA microarrays, ChIPchips for identifying DNA binding sites.

Hi through put-genome wide Profiling Platforms. Serial Analysis of Gene Expression, Digital Northern, Massively Parallel Signature

Sequences, Roche's 454-FLX Sequencer, Solexa/Illumina's 1G Genome Analyser Proteomics and integrative genomics. Protein separation and 2-D PAGE, Mass Spectrometry and protein identification: N-terminal sequencing, MALDI -TOF, LC-MS/MS, Tandem-MS/MS. SELDI-TOF, ICAT, I TRAQ, MUDPIT, Protein interaction maps, analysis of cellular constituents, metabolomics.

Reverse genetics-Navigating from structure to Function Mutant analysis. Forward versus reverse genetic approaches, Mutagens and methodologies for Reverse genetic systems: Random and Targeted mutagenesis, Insertional Mutagenesis viz. T-DNA tagging, Ac/Ds system for Transposon Tagging, TILLING, Deletegene, Activation mutagenesis (Gene traps, Enhancer Traps and Promoter Traps), mis-expressions (viz ectopic expression, two component systems for tissue specific gene expression), RNAi based Silencing Techniques (viz. Antisense RNA, co-suppression, artificial miRNA, tissue or stage specific knockouts) Zinc-finger nucleases, Homologous Recombination, Genome-wide Mutant Libraries and resources.

Genetic screens for molecular genetic analysis. Enhancer, suppressor and dominant modifier screens, Core-collections and germplasm resources for Reverse Genetics Natural Genetic Variation. Discovery of novel genes and alleles, Case studies from Rice and Arabidopsis

Elucidation of molecular genetic Pathways and Processes. Flowering Time Control and flower development in Arabidopsis, Stress response and SOS pathways in Arabidopsis, Caenorhabditis elegans and Drosophila development, AtGenExpress: Transcriptome atlas of Arabidopsis thaliana-Case Study

### **BIO-NEIST-3-3913 (Elective)**

#### **Plant Biotechnology Management and Regulatory Issues: 1-0-0-1**

**Faculty:** Dr BS Bhau, Dr HP Deka Boruah

Constitution, Statutes, Rules, Regulations, Judicial System, Judicial Review, Administrative set up. International Law, Sources, Treaties

Principles of Regulation Competing Models of Risk Assessment, Models of risk consideration: Scientific rationality trajectory and Social rationality trajectory. Risk Analysis Framework Risk Assessment, Risk Management and Risk Communication. The Concept of Precaution in Regulation

Precautionary principle and precautionary approach Country Comparisons about Approaches to Biotechnology Regulation The U.S. and E.U. approaches on Biotechnology research, Intentional introduction into environment, GM Food, labelling etc.

Multilateral Agreements. Convention on Biological Diversity, Cartagena Protocol on Biosafety, WTO Agreements, Codex Alimentarius, Plant Genetic Resources for Food and Agriculture.

Regulatory Systems in India. Environment Protection Act, 1986 Rules for the manufacture, use, import, export and storage of hazardous microorganisms, genetically engineered organisms or cells. Institutional Structure, Powers and Functions Relevant Guidelines and Protocols. Other relevant laws Plant Quarantine order Biological Diversity Act Protection of Plant Varieties and Farmer's Rights Act Drugs and Cosmetics Act, Policy and the rules Seed Policy DGFT Notification Recent Initiatives Draft National Biotechnology Regulatory Bill 2008 IPRs Introduction. A Brief history of IP protection, Rationale for IPR, Types of IPRs, Patents, Copyright, Trademarks, Trade Secrets, Plant, Variety protection, Geographical Indications, Farmer's, Rights, Traditional Knowledge Patents and Agricultural Biotechnology. Patentability criteria, Relevant Case law, Indian Patent Act, 1970, TRIPS, Amendments to Indian Patents Act (2005), IP applications and Procedures Patent drafting, Patent and prior art searches etc. Management of IPR Assets, Licensing and contracts, Negotiations, Valuation of patents, IPR Enforcement

### **BIO-NEIST-3-3914 (Elective)**

#### **Molecular and Immuno Pharmacology: 1-0-0-1**

**Faculty:** Dr M Pal, Dr P Manna

Molecular pharmacology: Introduction to cell structure and function, Cell signaling, organization of signal transduction pathway and biosensors, Protein structure prediction and molecular modeling, Gene expression, regulation and gene mapping, Recombinant DNA technology, Gene cloning, Genetic recombination, pharmacogenomics, pharmacogenetics, chrono pharmacology. Gene transfer technologies (viral and non viral vectors), Clinical application of gene therapy. Disease targets for gene therapy, pharmacokinetics of peptide and protein drugs.

Novel target sites: Caspase, Rho kinase, Peroxisome proliferator's activator receptors, Protein kinase, Phosphodiesterases, Phosphoinositide 3-kinase, Poly (ADP-ribose) polymerase (PARP), AMP activated protein kinase, Application of molecular pharmacology to drug design.

Immuno Pharmacology: Hybridoma technology and its application, General principles of immunoassay, theoretical basis, optimization of immunoassay Production of Immunoassay reagents: Introduction, receptors or binders, unlabelled ligands calibrators, labelled ligands and receptors, separation techniques. Immunoassay methods evaluation: Protocol outline, evaluation of precision, standard tracer, sensitivity, accuracy, antibody characteristics monitoring, reaction conditions, clinical evaluation, Fc receptors, Fc8R family. Immunotoxins, Cell and biochemical mediators involved in allergy, immunomodulation and inflammation. Classification of hypersensitivity reactions and diseases involved, therapeutic agents for allergy, asthma, COPD and other immunological diseases.

### **BIO-NEIST-3-3915 (Elective)**

#### **Biochemical Toxicology and free radicals pharmacology: 1-0-0-1**

**Faculty:** Dr P Manna, Dr M Pal

Biochemical pharmacology: Cell injury, oxido reductive stress, reactive oxygen species, antioxidant defense mechanisms, apoptosis and necrosis, acute and chronic inflammation, Cytokines and chemokines, Growth factors, biology of vascular

endothelium, neuropeptides, transport proteins, cell adhesion molecules and matrix proteins, oxygen intermediates, atrial peptides

Toxicology and Free Radicals Pharmacology: Details of Heavy metals and heavy metal antagonists, Abnormal action of drugs such as tolerance, addiction, habituation, idiosyncrasy, allergy, hypersensitivity, antagonism, synergism, potentiation, tachyphylaxis, Adverse drug reactions and its monitoring. Hepatotoxicity and drugs used to correct hepatic function, Immunotoxins, OECD guidelines for toxicity evaluations and in-vitro screens for specific toxicities. Protocols in organ and other toxicology studies. Generation of free radicals, role of free radicals in etiopathology of various diseases, protective activity of antioxidants.

### **BIO-NEIST-3-3916 (Elective)**

#### **Sericulture and seribiotechnology: 1-0-0-1**

**Faculty:** Dr J Kalita, Dr SB Wann

Biodiversity of mulberry and non mulberry silkworms. Applications of biotechnology in conservation of seri-biodiversity.

Studies to develop new/superior varieties of non mulberry host plants having more nutritional properties, more foliage production, resistant to pests and diseases. Studies on various types of diseases in non mulberry silkworm and diagnostic kits for important diseases.

Studies of Genetic manipulation of silk protein genes for increased production of silk and to identify specific genes to be responsible for disease resistance, temperature tolerance, better digestibility and high yielding varieties of non mulberry silkworms, Gene transfer methods in plants; Target cells for transformation; Gene transfer techniques using Agrobacterium. Selectable and scorable markers; Agro infection and gene transfer; DNA mediated gene transfer (DMGT). Transgenic plants for mulberry crop improvement, molecular farming and regulated gene expression.

Studies of preparation of artificial diets for indoor rearing of non mulberry silkworms.

### **400 level courses**

#### **PHY-NEIST-4-0001 (Core)**

Project Proposal writing & Presentation: 0-0-4-2

#### **PHY-NEIST-4-0002 (Core)**

Review Article Writing & Presentation: 0-0-4-2

#### **PHY-NEIST-4-0003 (Core)**

CSIR-800 Societal Programme: 0-0-8-4