STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI

COURSE PLAN (November 2024 – April 2025)

Department : **Bioinformatics**

Name/s of the Faculty : **Dr. R. Sagaya Jansi**

Course Title : **Applied Bioinformatics**

Course Code : **23BI/PC/AB44**

Shift : **II**

COURSE OUTCOMES (COs)

COs	Description	CL
CO1	apply the nutritional information to genomics and vice versa	K1
CO2	emphasise the application of bioinformatics and biological databases for the development of personalized medicine.	K2
CO3	imbibe the genome technologies to change breeding, monitor and protect the wild plant population	K3
CO4	evaluate the red data books, biodiversity registers and to interpret their morphological and molecular characterization	K4
CO5	describe the major clinical-translational areas of research in cancer biology and the goals of biomedical research in these areas	K5, K6

Week	Unit No.	Content	Cognitive Level	Teaching Hours	COs	Teaching Learning Methodology	Assessment Methods

Nov 18 – 25, 2024 (Day Order 1-6)	1	**Nutrigenomics** 1.1. Introduction-Background & Preventive Health. Applications - Nutrigenomics & gut health-prebiotics and probiotics. Nutrition linked to genes and phenotypes.	K1	5	1-5	Lecture, PowerPoint presentation and Animations	Case studies
Nov 26- Dec 3, 2024 (Day Order 1 to 6)	1	1.2. Role of folate, choline, and vitamins B2, B6 and B12, in gene regulation. Databases - SGMD, Barleybase and others.	K2-K3	4	1-5	Lecture, PowerPoint presentation and Animations	III Component Assignment-10 marks
Dec 4-11, 2024 (Day Order 1 to 6)	1	1.3 Tools-Use of BioConductor, Booly.	K4-K6	4	1-5	Lecture and PowerPoint presentation	Discussion
Dec 12-19, 2024 (Day Order 1 to 6)	2	**Pharmacogenomics** 2.1. Introduction to Pharmacogenomics, Application and Challenges in Pharmacogenomics, Genetic Variation, Types of Variants, SNPs, Insertion/Deletions.	K1-K2	4	1-5	Lecture and PowerPoint presentation	Discussion
Dec 20, 2024 (Day Order 1)	2	2.2. Databases - Pharmacogenomics Knowledge Base (PharmGKB), GWAS (Genome Wide Association study).	K4-K6	5	1-5	Lecture and PowerPoint presentation	Quiz/Puzzle
Jan 3 – 7, 2025 (Day Order 3 to 6)	2	2.3. Personalised medicine - The use of AI in personalized medicine. Database-PreMedKb	K3-K6	4	1-5	Lecture and PowerPoint presentation	III Component –Test (20 marks)

Jan 8 – 17, 2024 (Day Order 1 to 6)	3	**Agrigenomics** 3.1. Genomics application in Agriculture- The advantages and outcomes. Wheat genomics program. Seed saving techniques.	K1-K3	5	1-5	Lecture and PowerPoint presentation	Quiz/Puzzle
Jan 18 - 23, 2025	**C.A. Test - I**						
Jan 24 -31, 2025 (Day Order 1 to 6)	3	3.2. Genomic breeding, genetic engineering of plants. Development of high performance plants- Case study.	K3-K4	4	1-5	Lecture and PowerPoint presentation	Discussion
Feb 3-8, 2025 (Day Order 1 to 6)	3	3.3. Databases of interest -Integbio, NARO-(RAP-DB), Tools- Parentage Testing, Marker assisted backcrossing.	K5-K6	4	1-5	Lecture and PowerPoint presentation	Discussion
Feb 10– 18, 2025 (Day Order 1 to 4)	4	**Biodiversity Informatics** 4.1. Concepts of Biodiversity, Major drivers of biodiversity change; biodiversity management approaches, Endangered animals, Endemism and Red data books- Biodiversity registers	K1-K3	4	1-5	Lecture and PowerPoint presentation	Discussion
Feb 19- 26, 2025 (Day Order 1-6)	4	4.2. Software for identification of Accessing existing biodiversity databases on the WWW-Delta, MicroIS, AVIS, ICTV	K3-K4	4	1-5	Lecture, PowerPoint presentation and Practical demonstration	Group Discussion
Feb 27- Mar 6, 2025 (Day Order 1 to 6)	4	4.3. UNEP/GEF biodiversity data management project (BDM) – CBD and bioethics– General agreement on trade and traffics.	K4-K6	5	1-5	Lecture, PowerPoint presentation and Practical demonstration	III Component-Databases and tools (20 marks)

Mar 7 – 11, 2025 (Day Order 1 to 3)	5	**Cancer Genomics** 5.1. Carcinogenesis - chemical and physical carcinogenesis, molecular pathways in carcinogenesis, Apoptosis and cancer. Mutagens, genetic variants.	K1-K2	3	1-5	Lecture, PowerPoint presentation and Practical demonstration	Discussion
Mar 12 –17, 2025	**C.A. Test - II**						
Mar 18 – 20, 2025 (Day 4 to 6)	5	5.2. Databases and tools to analyse cancer data- TCGA, Bioportal, GTEX, HPA, Reactome, UALCAN, Oncomine, KM plotter, COSMIC. Kaplan meier survival plots. Analysing Big Data of Cancer Genomics.	K2-K3	5	1-5	Lecture, PowerPoint presentation and Animations	Quiz/Puzzle
Mar 21 - 28, 2025 (Day Order 1 to 6)	5	5.3. Application of next generation sequencing technologies in diagnosis and prediction of cancer genes. Identification of Methylation sites, Expression profiles, pathway analysis.	K3-K6	5	1-5	Lecture, PowerPoint presentation and Animations	Discussion
Mar 29- April 2, 2025 (Day Order 1 to 3)	**REVISION**						

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI

COURSE PLAN (November 2024 – April 2025)

Department : **Bioinformatics**

Name/s of the Faculty : **Dr. M. Sharanya**

Course Title : **Big Data Analysis**

Course Code : **23BI/PC/BD44**

Shift : **II**

COURSE OUTCOMES (COs)

COs	Description	CL
CO1	Collect meaningful values out of big biological data	K1
CO2	Describe the Big Data landscape including examples of real world big data problems	K2
CO3	Identify what are and what are not big data problems and be able to recast big data problems as data science questions	K3
CO4	Apply the skills of Hadoop and spark technology to solve the data science questions	K4
CO5	Create pipelines for data analysis and reusable methods	K5, K6

Week	Unit No.	Content	Cognitive Level	Teaching Hours	COs	Teaching Learning Methodology	Assessment Methods
Nov 18 – 25, 2024 (Day Order 1-6)	1	**Introduction to Big data** 1.1. Big data -characteristics, data structures and data repositories, Example of Big Data.	K1	4	1-5	Lecture and Discussion	MCQ's
Nov 26- Dec 3, 2024 (Day Order 1 to 6)	1	1.2. Machine and People Generated Data and Advantages. Characteristics of big data – 6 V's	K2-K3	4	1-5	Lecture and Discussion	Group Discussion
Dec 4-11, 2024 (Day Order 1 to 6)	1	1.3. Getting value out of big data using a 5-step process to structure your analysis.	K4-K5	4	1-5	Lecture and Discussion	Flow-Chart preparation
Dec 12-19, 2024 (Day Order 1 to 6)	2	**Big data in healthcare** 2.1. Data Science in Biomedicine and Healthcare. Sequence Processing, Medical Image Analysis, Natural Language, Processing.	K1-K2	5	1-5	Lecture and Discussion	Applications Discussion
Dec 20, 2024 (Day Order 1)	2	2.2. Network Modeling and Probabilistic Modeling. Concepts of Hadoop and spark, The Hadoop Distributed File System: A Storage System for Big Data, YARN: A Resource Manager for Hadoop.	K4-K6	5	1-5	Lecture, PowerPoint Presentation and Discussion	III Component - Assignment (10 Marks)
Jan 3 – 7, 2025	2	2.3. MapReduce: Simple Programming for Big Results. Introduction to Spark for big	K3-K6	5	1-5	Lecture, PowerPoint	Discussion

(Day Order 3 to 6)		data analysis. Pyspark in solving big data.				Presentation and Discussion	
Jan 8 – 17, 2024 (Day Order 1 to 6)	3	**Biological data analysis** 3.1. ChIPseq - Introduction and biological theories on ChIPseq analysis. DNA fragment evaluation. Peak identification. Two condition comparison. Saturation analysis. Motif finding and related theories.	K1-K3	4	1-5	Lecture, PowerPoint Presentation and Discussion	III Component - Problem Solving: Real-time data analysis (20 Marks)
Jan 18 - 23, 2025	**C.A. Test - I**						
Jan 24 -31, 2025 (Day Order 1 to 6)	3	3.2. ATAC sequencing, Bisulfite sequencing for big biological data.	K3-K4	4	1-5	Lecture, PowerPoint Presentation and Discussion	Discussions
Feb 3-8, 2025 (Day Order 1 to 6)	3	3.3. Integrating Multiomics big data. Seqware, distmap, read annotation pipelines.	K5-K6	5	1-5	Lecture, PowerPoint Presentation and Discussion	Discussion
Feb 10– 18, 2025 (Day Order 1 to 4)	4	**Computer clusters** 4.1. Introduction to essential computing, Distributed computing systems. An oversimplified, but useful, view of a computing cluster, Essential Unix/Linux Terminal Knowledge, Clusters, parallel, supercomputers, workstations, HPC.	K1-K3	4	1-5	Lecture, PowerPoint Presentation and Discussion	III Component – PowerPoint Presentation (20 Marks)

Feb 19- 26, 2025 (Day Order 1-6)	4	4.2. Cluster computing and the job scheduler, High performance computer clustering (HPCC), learning about the resources on HPCC	K3-K4	4	1-5	Lecture, PowerPoint Presentation and Discussion	
Feb 27- Mar 6, 2025 (Day Order 1 to 6)	4	4.3. Cloud computing - Cloud Primer, Cloud Foundations, Cloud Security and Migration. Cloud services – AWS or Google cloud.	K4-K6	4	1-5	Lecture, PowerPoint Presentation and Discussion	Group Discussion
Mar 7 – 11, 2025 (Day Order 1 to 3)	5	**Workflows and pipelines** 5.1. Introduction to Snake make and next flow- installation, rules, directives: input, output, shell, script, target files, best-practices of bioinformatics pipeline development.	K1-K2	4	1-5	Lecture, PowerPoint Presentation and Discussion	Test
Mar 12 –17, 2025	**C.A. Test - II**						
Mar 18 – 20, 2025 (Day 4 to 6)	5	5.2. History of containers, Containers vs. virtual machines. Docker -Concept of and the difference between Docker & Singularity containers	K2-K3	5	1-5	Lecture, PowerPoint Presentation and Discussion	Discussion
Mar 21 - 28, 2025 (Day Order 1 to 6)	5	5.3. Git and version control - github learning lab, git cheat sheet and best practices, REST-API.	K3-K6	4	1-5	Lecture, PowerPoint Presentation and Discussion	Practice- Git version control
Mar 29- April 2, 2025 (Day Order 1 to 3)	**REVISION**						

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI

COURSE PLAN (November 2024 – April 2025)

Department : **Bioinformatics**

Name/s of the Faculty : **Ms. Pujaa B**

Course Title : **Systems Biology**

Course Code : **23BI/PC/SM44**

Shift : **II**

COURSE OUTCOMES (COs)

COs	Description	CL
CO1	Understand the principles of integrative analysis methods for biological systemanalysis and interactions.	K1
CO2	Appreciate the model behaviour concepts	K2
CO3	Model gene expressions and integrate them with other omics	K3
CO4	Simulate the cell environments and model a cell	K4
CO5	Develop synthetic biology applications for omics	K5, K6

Week	Unit No.	Content	Cognitive Level	Teaching Hours	COs	Teaching Learning Methodology	Assessment Methods
Nov 18 – 25, 2024	1	**Introduction**	K1– K4	6	1-5	Lecture and	Group

(Day Order 1-6)		1.1. Introduction – Systems Biology is a Living Science 1.2. Properties of Models-Model Behaviour - Model development				PowerPoint presentation	discussion
Nov 26- Dec 3, 2024 (Day Order 1 to 6)	1	1.3. Systems Biology is Data Integration	K5- K6	6	1-5	Lecture and case study	Quiz
Dec 4-11, 2024 (Day Order 1 to 6)	2	**Standard Models and Approaches in Systems Biology** 2.1. Standard Models and Approaches in Systems Biology	K1- K2	6	1-5	Lecture and case study	III component Presentation - 20 marks
Dec 12-19, 2024 (Day Order 1 to 6)	2	2.2. Enzyme Kinetics and Thermodynamics-Metabolic Networks.	K3 - K4	3	1-5	Lecture and PowerPoint presentation	Group discussion and debate
Dec 20-21, 2024 (Day Order 1&2)	2	2.3. Structure of Intra- and Intercellular Communication-Receptor-Ligand Interactions	K5 - K6	1	1-5	Lecture and PowerPoint presentation	Group discussion and debate
Jan 3 – 7, 2025 (Day Order 3 to 6)	3	**Modeling of Gene Expression** 3.1. Modeling of Gene Expression-Modules of Gene Expression- Promoter Identification - General Promoter Structure	K1- K2	3	1-5	Role play	Assignment on gene structure
Jan 8 – 17, 2024 (Day Order 1 to 6)	3	3.2. Sequence Based Prediction of Promoter Representation of Gene	K3 - K4	6	1-5	Role play	III component Quiz - 15 marks

Jan 18 - 23, 2025	**C.A. Test - I**						
Jan 24 -31, 2025 (Day Order 1 to 6)	3	3.3. Network as Directed and Undirected Graphs, Bayesian Networks- Boolean Networks-Gene Expression Modeling with Stochastic Equations	K5 - K6	6	1-5	Group discussion	Puzzle solving
Feb 3-8, 2025 (Day Order 1 to 6)	4	**Integrating Networks** 4.1. Computer Simulation of the whole Cell. Human Erythrocyte Modeland its applications. Software for Modeling, ECELL, VCELL and GROMOS.	K1- K2	6	1-5	Group discussion	Puzzle solving
Feb 10– 18, 2025 (Day Order 1 to 4)	4	4.2. Simulation of cellular subsystems, network of metabolites andenzymes	K3 - K4	3	1-5	Lecture, Guided Protocol writing	Group discussion
Feb 19- 26, 2025 (Day Order 1-6)	4	4.3. Signal transduction networks, Gene 5 regulatory networks, metabolic pathways: databases such as KEGG, EMP, MetaCyc, AraCyc.	K5 - K6	5	1-5	Lecture, Guided Protocol writing	III component Assignment on metabolic networks - 15 marks
Feb 27- Mar 6, 2025 (Day Order 1 to 6)	5	**Introduction to Synthetic Biology** 5.1. General concepts and enabling technologies. Biological Parts. Modularity and Standardization.	K1- K2	6	1-5	Lecture, Guided Protocol writing	Quiz
Mar 7 – 11, 2025 (Day Order 1 to 3)	5	5.2. Part repositories DNA synthesis and assembly. Genome Editing	K3 - K4	1	1-5	Discussion of case study	Group discussion

							and debate
Mar 12 –17, 2025	**C.A. Test - II**						
Mar 18 – 20, 2025 (Day 4 to 6)	5	5.2. Controlling Gene Expression and Protein Production.	K3 - K4	1	1-5	Discussion of case study	Group presentation
Mar 21 - 28, 2025 (Day Order 1 to 6)	5	5.3. Gene synthesis and genetic engineering. Optogenetics. Gene therapy, Microbiome engineering, synthetic biosystems.	K5 - K6	6	1-5	Group discussion	Assignment on synthetic biosystems
Mar 29- April 2, 2025 (Day Order 1 to 3)	**REVISION**						

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI

COURSE PLAN (November 2024 – April 2025)

Department : **Bioinformatics**

Name/s of the Faculty : **Dr. R Sagaya Jansi and Ms. Pujaa B**

Course Title : **Clinical research Management**

Course Code : **23BI/PE/CR15**

Shift : **II**

COURSE OUTCOMES (COs)

COs	Description	CL
CO1	Evaluate critical global regulatory and health care issues that challenge and influence biopharmaceutical product development	K1,K2
CO2	Understand the drug development process and its importance in clinical trials	K2,K3
CO3	Forecast the resources necessary for regulatory submission and comprehend regulatory Affairs procedure in clinical research	K3,K4
CO4	Understand the basic statistical principles, concepts, and methods for clinical data analysis and reporting	K4,K5
CO5	Demonstrate advanced critical thinking skills necessary to enhance employmentopportunities or advance within the biopharmaceutical industry	K5,K6

Week	Unit No.	Content	Cognitive Level	Teaching Hours	COs	Teaching Learning Methodology	Assessment Methods

Nov 18 – 25, 2024 (Day Order 1-6)	1	**Clinical Research** 1.1. History of drug development - Pharmaco-epidemiology.	K1-K3	5	1-5	Lecture and PowerPoint presentation	Group discussion
Nov 26- Dec 3, 2024 (Day Order 1 to 6)	1	1.2. Issues in Clinical Trials. Nuremberg Code, Declaration of Helsinki, InternationalConference of Harmonization and Good Clinical Practice.	K2-K4	5	1-5	Lecture and case study	Quiz
Dec 4-11, 2024 (Day Order 1 to 6)	1	1.3. Clinical trials – History of clinical trials. Stages of Clinical trials.	K5-K6	5	1-5	Lecture and case study	III component Presentation – 20 marks
Dec 12-19, 2024 (Day Order 1 to 6)	2	**Pharmacology and Drug Development** 2.1. Introduction to Drug Discovery and Development, Approaches, Sources of Drugs,Databases for drug search.	K1-K3	5	1-5	Lecture and PowerPoint presentation	Group discussion
Dec 20-21, 2024 (Day Order 1&2)	2	2.2. Pharmacokinetics and pharmacodynamics, Toxicological requirements.	K2-K4	2	1-5	Lecture and PowerPoint presentation	Group discussion
Jan 3 – 7, 2025 (Day Order 3 to 6)	2	2.3. Emerging technologies in Drug Discovery**,** Preclinical Testing, Clinical Trials.	K5-K6	4	1-5	Role play	Assignment on clinical trials
Jan 8 – 17, 2024 (Day Order 1 to 6)	3	**Regulations in Clinical Research** 3.1. Evolution and History of Regulations in Clinical Research, US FDA Regulations,IND, NDA, ANDA,	K1-K3	5	1-5	Role play	III component Quiz – 15 marks

		FDA Audits and Inspections.					
Jan 18 - 23, 2025	**C.A. Test - I**						
Jan 24 -31, 2025 (Day Order 1 to 6)	3	3.2. European Regulatory Affairs, Organization and Functions.	K2-K4	5	1-5	Group discussion	Puzzle solving
Feb 3-8, 2025 (Day Order 1 to 6)		3.3. INDIAN Regulatory system, Schedule Y- Rules and Regulations, Post Drug Approval Activities, PMS.	K5-K6	5	1-5	Group discussion	Puzzle solving
Feb 10– 18, 2025 (Day Order 1 to 4)	4	**Clinical Trial Management** 4.1. Role of Ethics Committees and Institutional Review Boards. Special populations; women elderly and children.	K1-K3	3	1-5	Lecture, Guided Protocol writing	Group discussion
Feb 19- 26, 2025 (Day Order 1-6)	4	4.2. Designing of Protocol, SOP, ICF, Pharmacovigilance.	K2-K4	5	1-5	Lecture, Guided Protocol writing	III component Assignment - 15 marks
Feb 27- Mar 6, 2025 (Day Order 1 to 6)	4	4.3. Project management Documentation, Monitoring, Audits, Inspections, Fraud and Misconduct, Roles and Responsibilities of Clinical Research Professionals.	K5-K6	5	1-5	Lecture, Guided Protocol writing	Quiz
Mar 7 – 11, 2025 (Day Order 1 to 3)	5	**Clinical Data Management** 5.1. Importance of CDM in clinical research, Clinical Data Entry**,** CRF, e-	K1-K3	3	1-5	Discussion of case study	Group discussion and debate

		CRF.					
Mar 12 –17, 2025	**C.A. Test - II**						
Mar 18 – 20, 2025 (Day 4 to 6)	5	5.2. Statistical considerations at the design, analysis and reporting stage.	K2-K4	3	1-5	Discussion of case study	Group presentation
Mar 21 - 28, 2025 (Day Order 1 to 6)	5	5.3. Data validation, SAE reconciliation, Quality Assurance	K5-K6	5	1-5	Discussion of case study	Assignment on quality assurance
Mar 29- April 2, 2025 (Day Order 1 to 3)	**REVISION**						