

SRI KRISHNA ARTS AND SCIENCE COLLEGE

An Autonomous College, Affiliated to Bharathiar University
Coimbatore – 641 008, Tamil Nadu, India.

LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)

M.Sc. BIOINFORMATICS (III to IV Semester)

for 2022-23 admitted students

DEPARTMENT OF BIOSCIENCE



SRI KRISHNA ARTS AND SCIENCE COLLEGE
COIMBATORE – 641008
DEPARTMENT OF BIOINFORMATICS

I. Programme Educational Objectives (PEOs)

Post Graduates from the Bioinformatics Programme are expected to achieve the following PEOs within three to five years of graduation

PEO 1	Graduates will acquire knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics.
PEO 2	Graduates with an ability to use software effectively to extract information from large databases and to use this information in computer modelling.
PEO 3	Graduates will have problem-solving skills, including the ability to develop new algorithms and analysis methods.
PEO 4	Graduates will understand of the intersection of life and information sciences, the core of shared concepts, language and skills the ability to speak the language of structure-function relationships, information theory, gene expression, and database queries.

II. Programme Learning Outcomes (PLOs)

The following Programme Learning Outcomes have been identified for M.Sc. Bioinformatics:

PLO 1	Knowledge: By understanding the broad principles of science and technology and apply them in varied contexts. (Cognitive)
PLO 2	Critical Thinking: Contribute to the advancement of science, through formulating clear study goals or hypotheses and designing research to meet the goals (Cognitive)
PLO 3	Practical Skills: Develop a passion for hardware and software design and be part of the electronic design industry/software company to become leaders in indigenous product development. (Psychomotor)
PLO 4	Team-work Skills: Demonstrate capability to locate, evaluate, manage, and use information/data and research to develop and guide their own knowledge, learning and practice. (Affective)
PLO 5	Communication Skills: Communicate ideas clearly and effectively to diverse audiences in visual, written, oral, and computational formats. (Affective)
PLO 6	Digital Skills: Will be able to use of computers to collect, analyse and interpret biological information at the molecular and proteome level. (Affective)
PLO 7	Numeracy Skills: Establish the literacy and numeracy skills necessary to understand and interpret information/data and communicate according to the context. (Cognitive)
PLO 8	Leadership Skills: Function effectively as a leader and as well as team member in diverse/ multidisciplinary environments. (Affective)
PLO 9	Lifelong Learning: Develop pipelines of analysis tools to analyse real-world biological data sets, and show familiarity with the syntax and options required to generate meaningful interpretations. (Affective)
PLO 10	Entrepreneurial Skills: To inculcate the scientific temperament in the students and outside the scientific community to be a researcher, academician or entrepreneur. (Affective)
PLO 11	Ethics & Professionalism: Model ethical professional behaviour, including transparency and honesty in analysis and reporting of results, ethical reasoning during study design, and engaging respectfully with others. (Affective)

III. Programme Learning Outcomes Vs Graduate Attributes Vs Taxonomy of Verbs

PLO	Graduate Attributes											Blooms		
	Knowledge	Critical Thinking	Practical Skills	Teamwork Skills	Communication Skills	Digital Skills	Numeracy Skills	Leadership Skills	Lifelong Learning	Entrepreneurial Skills	Ethics & Professionalism	Cognitive	Psychomotor	Affective
1	✓											✓		
2		✓										✓		
3			✓										✓	
4				✓										✓
5					✓									✓
6						✓								✓
7							✓					✓		
8								✓						✓
9									✓					✓
10										✓				✓
11											✓			✓

IV. Mapping of PEOs and PLOs

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11
PEO1	3		3			3					
PEO2		3					3				
PEO3				3				3		2	3
PEO4					3				2		

V. Additional Programme Outcomes (APOs)

The Additional Programme Outcomes for M.Sc. Bioinformatics are:

APO 1	Graduates will be introduced to the concepts of Bioinformatics and its significance in Biological data analysis.
APO 2	Graduates will gain knowledge about various Biological databases that provide information about nucleic acids and protein.
APO 3	Graduates will gain knowledge about various concepts employed in drug discovery and its applications towards personalized medicine which involves specific analysis of genes important for drug response and drug effect.
APO 4	Graduates will be exposed to computational methods, tools and algorithms employed for Biological Data Interpretation
APO 5	Graduates will be provided with hands on training on various computational tools and techniques employed in Biological sequence analysis

VI. Programme Specific Outcomes (PSOs)

On the completion of M.Sc. Bioinformatics, the graduates will be able to

PSO 1	Graduates will be able to comprehend about a system level understanding of complex interactions within biological systems and to model the biological systems employing computational and mathematical concepts.
PSO 2	Graduates will be able to analyse about various approaches used in the simulation of metabolic pathways Explain about gene regulatory networks
PSO 3	Graduates will be able to find about the various methods and tools used for the study of genetic diversity and phylogenetic analysis

VII. Curriculum Structure for M. Sc. Bioinformatics**Course Components, Credits & Marks Distribution**

Course Type	Number of Courses	Credits per Course	Total Credits	Marks	Semester
Discipline Specific Courses (DSC)	19	2-6	75	1850	I to IV
Discipline Specific Elective Courses (DSE)	2	4	8	200	II & III
Generic Electives Courses (GEC)	2	4	7	200	II & III
DTC – Drive Through Courses (SWAYAM-NPTEL, Coursera, Any courses certified by statutory bodies, etc.)	Additional 4 Credits per Course will be given on submission of Certificate				I to IV
Total			90	2250	

1. Discipline Specific Courses (DSC)

These courses are to be studied compulsorily by the students as a core requirement. The students are required to take DSCs across four semesters. The courses designed under this category aim to cover the basics that a student is expected to imbibe in the particular discipline.

S. No.	Course Code	Course Title	Semester	Contact Hours	Credits	Marks
1	22BIP01	Fundamentals of Biological Sciences	I	4	4	100
2	22BIP02	Biological Data Analytics	I	4	4	100
3	22BIP03	Computer Programming in C	I	4	4	100
4	22BIP04	Sequencing Technologies	I	4	4	100
5	22BIP05	Perl Programming	I	4	4	100
6	22BIP06	Lab in Biological Techniques	I	5	4	100
7	22BIP07	Lab in C Programming	I	5	4	100
8	22BIP08	Biomolecular Structure and Interaction	II	5	5	100
9	22BIP09	Web Designing	II	4	4	100

10	22BIP10	Lab in Web Designing	II	3	3	100
11	22BIP11	Lab in Biological Data Analytics	II	5	4	100
12	22BIP12	Machine Learning in Bioinformatics	II	5	4	100
14	22BIP15	Genomics and Proteomics	III	4	4	100
15	22BIP16	Algorithms in Bioinformatics	III	4	4	100
16	22BIP17	Molecular Modelling and Drug Designing	III	4	4	100
17	22BIP18	Lab in Computer Aided Drug Design	III	4	4	100
19	22BIP19	Applied Bioinformatics	III	5	5	100
20	22BIP22	Internship Training	III	-	-	Completed
21	22BIP23	Project Work and Viva Voce	IV	25	6	150
Total					75	1850

Project Work and Viva Voce

During the Fourth Semester, each of the students has to undertake a Project Work individually. A guide will be allotted to each student by the department. Student can select any relevant topic in discussion with the guide. The project report shall be subject to internal evaluation followed by a viva-voce. The project should be demonstrated at the time of examination.

3 Reviews	– 60 Marks
Report	– 20 Marks
Attendance	– <u>20 Marks</u>
Total	– 100 Marks will be converted to 75 (Internal) Marks

End Semester Viva-Voce will be conducted for 75 (External) Marks.
(Dissertation - 50 Marks & Viva-voce - 25 Marks)

2. Discipline Specific Electives (DSE) (2 Courses)

Discipline Specific Elective Courses offered under the main discipline of study which may be specialized or advanced or supportive to the discipline of study. Students can choose any TWO courses from the following list.

Students can opt one course from each group.

S. No.	Course Code	Course Title	Semester	Contact Hours	Credits	Marks
1	22BIP13	rDNA Technology	II	4	4	100
2	22BIP14	Metabolomics				
3	22BIP20	Biophysics and Crystallography	III	4	4	100
4	22BIP21	Pharmacogenetic Analysis				
Total					8	200

3. Generic Elective Courses (GEC) (2 Courses)

Generic Elective Courses are interdisciplinary in nature. They are additional courses based on expertise, specialization, requirements, scope, and need of the department. The students will have the choice of taking TWO GECs.

Group	Course Code	Course Title	Semester	Contact Hours	Credits	Marks
I	22GEP02	Biological Statistics and Research Methodology	II	4	3	100
	22GEP05	Quantitative Aptitude				
II	22GEP07	Data Mining	III	4	4	100
	22GEP38	Data Analytics Using R				
Total					7	200

4. Drive Through Course (DTC)

i. (DTC) I & II – Online Certification - Additional Credits

These courses are intended to bring out and promote the self-learning initiative of the students – where their own motivation is what drives them to complete the course and not external compulsions. This fosters the habit of keeping oneself updated always by means of self-study. It gives opportunities to the students to explore new areas of interest and earn additional credits. Students can take any number of courses under this cafeteria system. The credits will not be taken for CGPA calculation. Additional 4 credits per Course will be given on submission of certificate.

- SWAYAM - NPTEL
- Coursera
- Any courses certified by statutory bodies.

ii. (DTC – III) – Article Publication - To Be Completed

Students individually or with the maximum of four members per batch are asked to publish article in Scopus or Web of Science Journals (Or) Publish Book Chapters. Additional 4 Credits per Course will be given on submission of proof of the published paper (or) book chapter.

VIII. Semester-wise Scheme

Semester I										
Course Code	Course Title	T/P	Ins. Hrs/ week	Examination				Credits	SD/ EM/ EN	L/R/ N/G
				Dur. Hrs	CIA	ES	Total Marks			
22BIP01	DSC I: Fundamentals of Biological Sciences	T	4	3	50	50	100	4	EM	N
22BIP02	DSC II: Biological Data Analytics	T	4	3	50	50	100	4	EN	G
22BIP03	DSC III: Computer Programming in C	T	4	3	50	50	100	4	SD	N
22BIP04	DSC IV: Sequencing Technologies	T	4	3	50	50	100	4	SD	G
22BIP05	DSC V: Perl Programming	T	4	3	50	50	100	4	SD	N
22BIP06	DSC Practical I: Lab in Biological Techniques	P	5	5	50	50	100	4	SD	N
22BIP07	DSC Practical II: Lab in C Programming	P	5	3	50	50	100	4	SD	N
DTC I - Additional Credit Courses (NPTEL/ Coursera)										
Total			30				700	28		
Semester II										
Course Code	Course Title	T/P	Ins. Hrs/ week	Examination				Credits	SD/ EM/ EN	L/R/ N/G
				Dur. Hrs	CIA	ES	Total Marks			
22BIP08	DSC VI: Biomolecular Structure and Interaction	T	5	3	50	50	100	5	SD	N

22BIP09	DSC VII: Web Designing	T	4	3	50	50	100	4	SD	G
22BIP10	DSC Practical III: Lab in Web Designing.	P	3	3	50	50	100	3	SD	G
22BIP11	DSC Practical IV: Lab in Biological Data Analytics	P	5	3	50	50	100	4	SD	N
22BIP12	DSC VIII: Machine Learning in Bioinformatics	T	5	3	50	50	100	4	EM	G
22BIP13 22BIP14	DSE I: Genetic Modifications and Metabolomic interactions A. rDNA Technology B. Metabolomics									
		T	4	3	50	50	100	4	SD SD	N N
22GEP02	GEC-I: Biological Statistics and Research Methodology	T	4	3	50	50	100	3	SD	N
22GEP05	Quantitative Aptitude								SD	N
DTC II - Additional Credit Courses (NPTEL/ Coursera)										
Total				30				700	27	
Semester III										
Course Code	Course Title	T/ P	Ins. Hrs/ week	Examination				Credits	SD/ EM/ EN	L/R/ N/G
				Dur. Hrs	CIA	ES	Total Marks			
22BIP15	DSC VIII: Genomics and Proteomics	T	4	3	50	50	100	4	EM	G
22BIP16	DSC X: Algorithms in Bioinformatics	T	5	3	50	50	100	4	SD	G
22BIP17	DSC XI: Molecular Modelling and Drug Designing	T	4	3	50	50	100	4	EN	G
22BIP18	DSC Practical V: Lab in Computer Aided Drug Design	P	4	3	50	50	100	4	EN	G
22BIP19	DSC XII: Applied Bioinformatics	T	5	3	50	50	100	5	SD	G
22BIP20 22BIP21	DSE II: Structural Biology and Drug analysis A. Biophysics and Crystallography B. Pharmacogenetic Analysis	T	4	3	50	50	100	4	EM SD	N N
22BIP22	DSC XIII: Internship Training	P	-	-	-	-	Completed		SD	N
22GEP07	GEC-II: Data Mining	T	4	3	50	50	100	4	SD	G
22GEP38	Data Analytics Using R								SD	G
Total				30				700	29	
Semester IV										
Course Code	Course Title	T/ P	Ins. Hrs/ week	Examination				Credits	SD/ EM/ EN	L/R/ N/G
				Dur. Hrs	CIA	ES	Total Marks			
22BIP23	DSC XIV: Project Work and Viva Voce	P	25	-	75	75	150	6	EM	G
DTC III – Paper Publications / Book Publications										
Total				3				150	6	
Total							2250	90		

Drive-Through Course (DTC): Courses offered in SWAYAM - NPTEL, Coursera OR Any courses certified by statutory bodies.	Additional 4 Credits per Course will be given on submission of Certificate	During Semester I to Semester IV
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The Courses focus on the following needs	
SD	Skill Development
EM	Employability
EN	Entrepreneurship
L	Local
R	Regional
N	National
G	Global

Semester-wise Distribution

Semester	Total Marks	Total Credits
I	700	28
II	700	27
III	700	29
IV	150	6
Total	2250	90

List of Courses Offered to Biotechnology

SEM	Course Code	Course Title	T/P	Programme	Ins. Hrs/ week	Examination				Credits
						Dur. Hrs	CIA	ES	Total Marks	
III	22BTU12/22MBU12	Bioinformatics	T	B.Sc. BT	3	3	50	50	100	3
III	22GEP27	Bioinformatics	T	M.Sc. BT	3	3	25	25	50	2
III	22GEP28	Lab in Bioinformatics	P	M.Sc. BT	2	3	25	25	50	2

List of Courses Offered to Microbiology

SEM	Course Code	Course Title	T/P	Programme	Ins. Hrs/ week	Examination				Credits
						Dur. Hrs	CIA	ES	Total Marks	
III	22MBU12/22BTU12	Bioinformatics	T	B.Sc. MB	3	3	50	50	100	3

List of Courses Offered by Mathematics

SEM	Course Code	Course Title	T/P	Ins. Hrs/ week	Examination				Credits
					Dur. Hrs	CIA	ES	Total Marks	
II	22GEP02	Biological Statistics and Research Methodology	T	4	3	50	50	100	3
II	22GEP05	Quantitative Aptitude	T	4	3	50	50	100	3

List of Courses Offered by Computer Technology

SEM	Course Code	Course Title	T/P	Ins. Hrs/ week	Examination				Credits
					Dur. Hrs	CIA	ES	Total Marks	
I	22BIP03	Computer Programming in C	T	4	3	50	50	100	4
	22BIP07	Lab in C Programming	P	5	3	50	50	100	4
II	22BIP09	Web Designing	T	4	3	50	50	100	4
	22BIP10	Lab in Web Designing	P	3	3	50	50	100	3

List of Courses Offered by Computer Science

SEM	Course Code	Course Title	T/P	Ins. Hrs/ week	Examination				Credits
					Dur. Hrs	CIA	ES	Total Marks	
III	22GEP07	Data Mining	T	4	3	50	50	100	4