

# **SRI KRISHNA ARTS AND SCIENCE COLLEGE**

An Autonomous College Affiliated to Bharathiar University  
Coimbatore - 641008, Tamil Nadu, India.

## **LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**

**M. Sc. Bioinformatics  
(I to IV Semester)**

**for 2024 - 25 admitted Students**

**DEPARTMENT OF BIOSCIENCE**



**SRI KRISHNA ARTS AND SCIENCE COLLEGE**  
**COIMBATORE – 641008**  
**DEPARTMENT OF BIOINFORMATICS**  
**(2024 - 2025)**

<b>I. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)</b>	
Post Graduates from the M.Sc. Bioinformatics Programme are expected to achieve the following PEOs	
<b>PEO 1</b>	Graduates will acquire knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics.
<b>PEO 2</b>	Graduates with an ability to use software effectively to extract information from large databases and to use this information in computer modelling.
<b>PEO 3</b>	Graduates will have problem-solving skills, including the ability to develop new algorithms and analysis methods.
<b>PEO 4</b>	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.
<b>PEO 5</b>	To enrich the global thinktanks with right mixes of innovative ability, existing policies at generating and safeguarding the product of their intellect, equipped with entrepreneurship abilities.

<b>II. PROGRAMME LEARNING OUTCOMES (PLOs)</b>	
The Post Graduates of M.Sc. Bioinformatics programme will be able to:	
<b>PLO1</b>	<b>Knowledge:(Cognitive)</b> By understanding the broad principles of science and technology and apply them in varied contexts
<b>PLO2</b>	<b>Critical Thinking Skills:(Cognitive)</b> Contribute to the advancement of science, through formulating clear study goals or hypotheses and designing research to meet the goals
<b>PLO3</b>	<b>Practical Skills:(Psychomotor)</b> 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
<b>PLO4</b>	<b>Teamwork Skills:(Affective)</b> Demonstrate capability to locate, evaluate, manage, and use information/data and research to develop and guide their own knowledge, learning and practice
<b>PLO5</b>	<b>Communication Skills:(Affective)</b> Will be able to use of computers to collect, analyse and interpret biological information at the molecular and proteome level
<b>PLO6</b>	<b>Digital Skills:(Affective)</b> Demonstrate the ability to use state-of-the-art digital tools and software to mine the data, procure, analyse and present the biological data
<b>PLO7</b>	<b>Numeracy Skills:(Cognitive)</b> Establish the literacy and numeracy skills necessary to understand and interpret information/data and communicate according to the context
<b>PLO8</b>	<b>Leadership Skills:(Affective)</b> Function effectively as a leader and as well as team member in diverse/multidisciplinary environments
<b>PLO9</b>	<b>Lifelong Learning Skills:(Affective)</b>

	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
<b>PLO10</b>	<b>Entrepreneurial Skills:(Affective)</b> To inculcate the scientific temperament in the students and outside the scientific community to be a researcher, academician or entrepreneur
<b>PLO11</b>	<b>Ethics &amp; Professional Skills:(Affective)</b> Model ethical professional behavior, including transparency and honesty in analysis and reporting of results, ethical reasoning during study design, and engaging respectfully with others

**III. PROGRAMME LEARNING OUTCOMES VS GRADUATE ATTRIBUTES  
VSTAXONOMY OF VERBS**

PLO	Graduate Attributes										Blooms		
	Knowledge	Critical Thinking	Practical Skills	Team work	Communication skills	Digital skills	Numeracy	Leadership skills	Lifelong learning	Entrepreneurial skills	Ethics & Professionalism	Cognitive	Psychomotor
1	√										√		
2		√									√		
3			√									√	
4				√									√
5					√								√
6						√							√
7							√				√		
8								√					√
9									√				√
10										√			√
11											√		√

**IV. PROGRAMME LEARNING OUTCOMES VS PROGRAMME EDUCATIONAL OBJECTIVES**

	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5
PLO 1	√				
PLO 2		√			
PLO 3	√				
PLO 4			√		
PLO 5				√	
PLO 6	√				
PLO 7		√			
PLO 8			√		
PLO 9				√	
PLO 10					√
PLO 11					√

V. ADDITIONAL PROGRAMME OUTCOMES (APOs)	
<b>APO 1</b>	Graduates will be introduced to the concepts of Bioinformatics and its significance in biological data analysis.
<b>APO 2</b>	Graduates will gain knowledge about various biological databases that provide information about nucleic acids and protein.
<b>APO 3</b>	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.
<b>APO 4</b>	Graduates will be exposed to computational methods, tools and algorithms employed for Biological Data Interpretation
<b>APO 5</b>	Graduates will be provided with hands on training on various computational tools and techniques employed in biological sequence analysis
<b>APO 6</b>	Graduates will be developing professional skills and values in bioinformatics domain
<b>APO 7</b>	Graduates will be developing entrepreneurial skills in various domains of bioinformatics
<b>APO 8</b>	Graduates will be developing professional ethics in societal aspects for people welfare

VI. PROGRAMME SPECIFIC OUTCOMES (PSO's)	
<b>PSO 1</b>	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.
<b>PSO 2</b>	Graduates will be able to analyse about various approaches used in the simulation of metabolic pathways Explain about gene regulatory networks
<b>PSO 3</b>	Graduates will be able to find about the various methods and tools used for the study of genetic diversity and phylogenetic analysis

### VII. Mapping of PEOs with PSOs

	PSO 1	PSO 2	PSO 3
<b>PEO 1</b>	√		
<b>PEO 2</b>	√		
<b>PEO 3</b>		√	
<b>PEO 4</b>		√	
<b>PEO 5</b>			√

## VIII. Curriculum Structure for M.Sc. Bioinformatics

### Course Components, Credits & Marks Distribution

Group	Basic Structure: Distribution of Courses	Number of Courses	Total Marks	Total Credits
1	DSC – Discipline Specific Courses	21	1950	79
2	DSE – Discipline Specific Electives	2	100	4
3	GEC – Generic Elective Courses	2	200	7
4	Drive Through Courses (DTCs) – (SWAYAM-NPTEL, Coursera, any courses certified by statutory bodies, etc.)	Any number	-	Additional Credits
<b>Total</b>		<b>25</b>	<b>2250</b>	<b>90</b>

#### Group 1. Discipline Specific Courses (DSCs)(19 Courses)

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. It includes major project.

S. No.	Course Code	Course Title	Semester	Contact Hours	Marks	Credits
1	24BIP01	Fundamentals of Biological Sciences	I	4	100	4
2	24BIP02	Computational Biology	I	4	100	4
3	24BIP03	Computer Programming in C	I	4	100	4
4	24BIP04	Genomics and Proteomics	I	4	100	4
5	24BIP05	Immunoinformatics	I	4	100	4
6	24BIP06	Lab in Biological Techniques	I	5	100	4
7	24BIP07	Lab in C Programming	I	5	100	4
8	24BIP08	Biomolecular Structure and Interaction	II	4	100	5
9	24BIP09	Python for Bioinformatics	II	4	100	4
10	24BIP10	Lab in Python	II	4	100	3
11	24BIP11	Lab in Biological Data Analytics	II	5	100	4
12	24BIP12	Algorithms in Bioinformatics	II	5	100	5
13	24BIP15	Sequencing Technologies and NGS	III	4	100	4

14	24BIP16	Machine Learning in Bioinformatics	III	5	100	4
15	24BIP17	Molecular Modelling	III	4	100	4
16	24BIP18	Lab in Computer Aided Drug Design	III	4	100	4
17	24BIP19	Pharmacogenetic Analysis	III	5	100	4
18	24BIP22	Internship Training	III	-	Completed	-
19	24BIP23	Research Methodology for Life Science	IV	5	50	2
20	24BIP24	Bioethics, Biosafety and IPR	IV	5	50	2
21	24BIP25	Project Work and Viva Voce	IV	20	150	6
<b>Total</b>					<b>1950</b>	<b>79</b>

### Project Work

During the fourth semester each student should undertake a project work and submit the report. A guide will be allotted to each student by the Department. A student can select any research 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.

#### **Internal Evaluation:**

Reviews (2)	– 60 Marks
Report	– 20 Marks
Attendance	– 20 Marks
Total	– 100 Marks will be converted to 75 (Internal) Marks

**End Semester Viva-Voce** will be conducted for 75 Marks.

(Dissertation - 50 Marks & Viva-voce - 25 Marks)

### Group 2. Discipline Specific Elective (DSEs) (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 one course from two courses each in the list of following DSEs.

S. No.	Course Code	Course Title	Ownership Department	Contact Hours	Marks	Credits
1	24BIP13	<b>DSE I : Genetic Modifications and Metabolomic interactions</b> rDNA Technology	Bioinformatics	4	50	2
	24BIP14	Metabolomics	Bioinformatics			
2	24BIP20	<b>DSE II: Computational and Drug Analysis</b> Applied Bioinformatics	Bioinformatics	4	50	2
	24BIP21	Drug Discovery	Bioinformatics			
<b>Total</b>					<b>100</b>	<b>4</b>

**Group 3. Generic Elective Courses (GECs)(2Courses)**

Generic Elective Courses are interdisciplinary in nature. They are additional courses based on expertise, specialization, requirements, scope, and need of the department.

Sl. No.	Course Code	Course Title	Semester	Ownership Department	Contact Hours	Marks	Credits
1	24GEP02	<b>GEC - I:</b> Research Methodology for Bioscience	2	Mathematics	4	100	3
	24GEP03	Quantitative Aptitude					
2	24GEP27	<b>GEC - II:</b> Introduction to Database and Data Mining	3	Software Systems	4	100	4
	24GEP28	Data Analytics Using R			4	100	4
<b>Total</b>						<b>200</b>	<b>7</b>

**Group 4.****i) Drive-Through Courses (DTCs) I & II– 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 4/3/2 credits per course will be given on submission of certificate.

1. Coursera
2. NPTEL

**ii) Drive-Through Course (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/E	Ins. Hrs/ Week	ESE Dur. Hrs	CIA Marks	ES Marks	Total Marks	Credits	SD/ EM/ EN	L/ R/ N/ G
24BIP01	<b>DSC I:</b> Fundamentals of Biological Sciences	T	4	3	25	75	100	4	EM	N
24BIP02	<b>DSC II:</b> Computational Biology	T	4	3	25	75	100	4	EM	G
24BIP03	<b>DSC III:</b> Computer Programming in C	T	4	3	25	75	100	4	SD	N
24BIP04	<b>DSC IV:</b> Genomics and Proteomics	T	4	3	25	75	100	4	EM	G
24BIP05	<b>DSC V:</b> Immunoinformatics	T	4	3	25	75	100	4	SD	N
24BIP06	<b>DSC Practical I:</b> Lab in Biological Techniques	P	5	5	40	60	100	4	SD	N
24BIP07	<b>DSC Practical II:</b> Lab in C Programming	P	5	3	40	60	100	4	SD	N
Drive Through Course : NPTEL / Coursera							Additional Credits			
<b>Total</b>			<b>30</b>				<b>700</b>	<b>28</b>		
Semester II										
Course Code	Course Title	T/P/E	Ins. Hrs/ Week	ESE Dur. Hrs	CIA Marks	ES Marks	Total Marks	Credits	SD/ EM/ EN	L/ R/ N/ G
24BIP08	<b>DSC VI:</b> Biomolecular Structure and Interaction	T	4	3	25	75	100	5	SD	N
24BIP09	<b>DSC VII:</b> Python for Bioinformatics	T	4	3	25	75	100	4	SD	G
24BIP10	<b>DSC Practical III:</b> Lab in Python	P	4	3	40	60	100	3	SD	G
24BIP11	<b>DSC Practical IV:</b> Lab in Biological Data Analytics	P	5	3	40	60	100	4	SD	N
24BIP12	<b>DSC VIII</b> Algorithm in Bioinformatics	T	5	3	25	75	100	5	EM	G
24BIP13 24BIP14	<b>DSE I: Genetic Modifications and Metabolomic interactions</b> rDNA Technology Metabolomics	T	4	3	10	40	50	2	SD	N
24GEP02	<b>GEC - I:</b> Research Methodology for Bioscience	T	4	3	25	75	100	3	SD	G
24GEP03	Quantitative Aptitude								EM	G
Drive Through Course II: NPTEL / Coursera							Additional Credits			
<b>Total</b>			<b>30</b>				<b>650</b>	<b>26</b>		



Semester III										
Course Code	Course Title	T/P/E	Ins. Hrs/ Week	ESE Dur. Hrs	CIA Marks	ES Marks	Total Marks	Credits	SD/ EM/ EN	L/ R/ N/ G
24BIP15	<b>DSC IX:</b> Sequencing Technologies and NGS	T	4	3	25	75	100	4	EM	G
24BIP16	<b>DSC X:</b> Machine Learning in Bioinformatics	T	5	3	25	75	100	4	SD	G
24BIP17	<b>DSC XI:</b> Molecular Modelling	T	4	3	25	75	100	4	EN	G
24BIP18	<b>DSC Practical V:</b> Lab in Computer Aided Drug Design	P	4	3	40	60	100	4	EN	G
24BIP19	<b>DSC XII:</b> Pharmacogenetic Analysis	T	5	3	25	75	100	4	SD	G
24BIP20 24BIP21	<b>DSE II:</b> Computational and Drug Analysis Applied Bioinformatics Drug Discovery	T	4	3	10	40	50	2	EM SD	N
24GEP27	<b>GEC - II:</b> Introduction to Database and Data Mining	T	4	3	25	75	100	4	SD	G
24GEP28	Data Analytics Using R									
24BIP22	<b>DSC – XIII:</b> Internship Training	P	-	-	Completed			-	SD	N
<b>Total</b>			<b>30</b>				<b>650</b>	<b>26</b>		
Semester IV										
Course Code	Course Title	T/P/E	Ins. Hrs/ Week	ESE Dur. Hrs	CIA Marks	ES Marks	Total Marks	Credits	SD/ EM/ EN	L/ R/ N/ G
24BIP23	<b>DSC - XIV:</b> Research Methodology for Life Science	T	5	3	10	40	50	2	SD	N
24BIP24	<b>DSC - XV:</b> Bioethics, Biosafety and IPR	T	5	3	10	40	50	2	EN	G
24BIP25	<b>DSC - XVI:</b> Project Work and Viva Voce	P	20	3	75	75	150	6	EM	N
<b>Total</b>			<b>30</b>				<b>250</b>	<b>10</b>		
							<b>2250</b>	<b>90</b>		
<b>Drive - Through Course (DTC):</b> Courses offered in SWAYAM - NPTEL, Coursera			Additional 4 Credits per Course will be given on submission of Certificate				During Semester I to Semester IV			

**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 of Marks and Credits**

Semester	Total Marks	Total Credits
I	700	28
II	650	26
III	650	26
IV	250	10
<b>Total</b>	<b>2250</b>	<b>90</b>

**OFFERED BY**

List of Courses Offered by **Mathematics** Department

Semester	Course Code	Course Name	Programme	T/P/E	Ins. hrs	CIA	ES	Total Marks	Credit	SD/EM/EN	L/R/N/G
II	24GEP02	<b>GEC - I:</b> Research Methodology for Bioscience	M.Sc BI & M.Sc BT	T	4	25	75	100	3	SD	G
	24GEP03	Quantitative Aptitude								EM	

List of Courses Offered by **Software System** Department

Semester	Course Code	Course Name	Programme	T/P/E	Ins. hrs	CIA	ES	Total Marks	Credit	SD/EM/EN	L/R/N/G
III	24GEP27	<b>GEC - II:</b> Introduction to Database and Data Mining	M.Sc BI	T	4	25	75	100	4	SD	G
	24GEP28	Data Analytics Using R									

**OFFERED TO**

List of Courses Offered to **Biotechnology** Department

Semester	Course Code	Course Name	Programme	T/P/E	Ins. hrs	CIA	ES	Total Marks	Credit	SD/EM/EN	L/R/N/G
III	24GEP29	<b>GEC - II:</b> Bioinformatics	M.Sc BT	T	3	10	40	50	2	SD	G
	24GEP30	Lab in Bioinformatics		P	2	20	30	50	2		
	24GEP31	Molecular Sequencing		T	3	10	40	50	2	SD	G
	24GEP32	Lab in Molecular Sequencing		P	2	20	30	50	2		