



## **Regulations for B.Tech. in Computer Science and Biosciences (CSB) Program**

### **1. Preamble**

With the advent of high-throughput techniques, biological sciences are grappling with a paradigm shift towards data-intensive explorations and challenges for management and analysis of massive data. Apart from fundamental contributions to basic science, data-driven analysis in biology has the potential to conquer challenges such as modeling and control of complex diseases, management and diagnosis of pathologies, personalized medicine, and drug and vaccine design, among others. Making progress on these frontiers requires insight into biological processes, algorithms, machine learning techniques, mathematical modeling, apart from numerical and programming skills.

Thus, interdisciplinary education that imparts knowledge of foundations of biology and computer science as well as training in modeling and analysis of biomedical data is the key to create personnel who can provide solutions to problems on the interface of computation and biology. Knowledge of different aspects of modern biology and computational sciences will facilitate addressing relevant problems in biology and medicine. Towards this aim, an undergraduate program that seamlessly integrates foundations of computer science, biology and mathematics along with training to ask data-driven questions in biology and medicine is an important step in this direction.

### **Program Objectives**

The program aims to develop capabilities in Computer Sciences as well as in Biosciences. At the end of the program, a student will have:

1. Understanding of foundations, capabilities and limits of computing.
2. Ability to design and implement efficient software solutions particularly for biological applications using suitable algorithms, data structures, and other computing techniques.
3. Understanding of foundations of biological sciences and biological data.
4. Ability to compile, manage and analyze data to address problems in biological and medical sciences.
5. Ability to build and apply mathematical modeling techniques to biological problems.

In addition, the graduate of this program will also have the following general skills that are common with other B. Tech. programs:

1. Ability to function effectively in teams to accomplish a common goal.
2. An understanding of professional and ethical responsibility.
3. Ability to communicate effectively with a wide range of audiences.

4. Ability to self-learn and engage in life-long learning.
5. Ability to undertake research tasks and projects.
6. Ability to take an idea and develop into a business plan for an entrepreneurial venture.
7. Understanding of the impact of solutions in an economic, societal, and environment context.

This document specifies the specific regulations for the B.Tech. (CSB) program – the general regulations for the B.Tech. program are given in a separate document. These regulations are in addition to the regulations of the B.Tech. program.

### 3. Program Structure

The B.Tech. program at IIIT-D follows a philosophy of having a small set of core-courses, allowing students significant flexibility in designing their curriculum and specialization.

- A. Majority of core courses are completed in the first four semesters. The structure for first few semesters is as follows:

For students of 2019 batch and onwards

Semester 1	Semester 2	Semester 3	Semester 4	Semester 5
Introduction to Programming	Data Structures and Algorithms	Operating Systems	Algorithm Design (B)	Elective
Prototyping Interactive Systems	Computer Organization	Advanced Programming	Fundamentals of Database Management Systems	Elective
Maths I – (Linear Algebra)	Maths II -(Probability & Statistics)	Maths III - (Multi Variate Calculus)	Basic Electronics (offered for 1 <sup>st</sup> year students for ECE and CS)	Biophysics or Structural Biology
Digital Electronics	Foundations of Biology	Cell Biology & Biochemistry*	Practical Bioinformatics <sup>#</sup>	Algorithms in computational Biology
Communication Skills	SSH	Genetics and Molecular Biology*	Introduction to Quantitative Biology	Technical Communication + Environmental Studies

For students of 2018 batch

Semester 1	Semester 2	Semester 3	Semester 4	Semester 5
Introduction to Programming	Data Structures and Algorithms	Computer Architecture and Operating Systems	Algorithm Design (B)	Elective

Systems Management	Introduction to Engineering Design	Advanced Programming	Fundamentals of Database Management Systems	Elective
Maths I – (Linear Algebra)	Maths II -(Probability & Statistics)	Maths III - (Multi Variate Calculus)	Basic Electronics (offered for 1 <sup>st</sup> year students for ECE and CS)	Biophysics or Structural Biology
Digital Electronics	Foundations of Biology	Cell Biology & Biochemistry*	Practical Bioinformatics <sup>#</sup>	Algorithms in computational Biology
Communication Skills	SSH	Genetics and Molecular Biology*	Introduction to Quantitative Biology	Technical Communication + Environmental Studies

\* Wet lab is required for these courses # Dry lab is required for this course

#### B. List of Technical and Non-technical courses of first year

Semester	Technical Courses	Non-Technical Courses
<b>Semester 1</b>	Introduction to Programming Digital Circuits Math I Prototyping Interactive Systems	Communication Skills
<b>Semester 2</b>	Data Structures and Algorithms Foundations of Biology Probability and Statistics Computer Organization	SSH Elective

C. Rest of the program consists mostly of elective courses. An elective course is one which is not compulsory, and a student may have choices from which to select the courses he/she wants to do.

#### Computer Science Electives

CSE courses that are regularly offered. These will likely to include courses like Computer Vision, Image Analysis, Data Mining, Machine Learning, Pattern Recognition, Statistical Computation etc.

#### Biological Science Electives

- Network Biology
- Systems Biology
- Biostatistics
- Machine Learning for Biomedical applications
- Computer Aided Drug Discovery
- Big Data Mining in Healthcare

- Biomedical Image Analysis
- Introduction to Computational Neuroscience

*Note: This is a new program and the structure and details of the program and courses will evolve with time, so the list of courses and course contents will change with time.*

- D. List of courses, and further information about the courses is available on the website: <https://www.iiitd.ac.in/academics/courses>

#### **4. Requirements for Graduation**

For a B.Tech. (CSB) degree, a student must satisfy all the following requirements:

1. Earn a total of 156 (inclusive of 2 credits each of SG/CW credits) credits (equivalent to 39 full courses – 21 courses in the first two years and 18 courses in the last two years).
2. Successfully complete all the core courses and special electives (if specified).
3. Complete at least 12 credits of Social Science and Humanities (SSH) Courses.
4. Do 2 credits of Community Work and Self Growth each. These are pass/fail credits, which are required to be completed, and will count for fulfilling the credit requirements.
5. A student may take Online Courses. No more than 8 of these credits can count towards satisfying the credit requirements of the degree.
6. In the last four semesters, a student must complete at least 32 credits of CSE/Bio courses, which should include at least 12 credits of CSE and 12 credits of BIOcourses. B.Tech. Project /Independent Project/Independent Study/Undergraduate Research will not count towards this requirement. UGC may approve some other relevant courses (e.g., Maths/ECE etc.) to be counted as CSE/BiOcourses for this purpose. Online courses of the respective discipline (i.e. online courses with CSE/BIO course code), if done in last four semesters will count towards this requirement.
7. A B.Tech. Project (BTP) is optional. A student opting for BTP, may take a total of 8 to 12 credits of BTP, spread over 2 semesters, with no more than 8 credits in a semester. A student not completing BTP credits will have to forgo the partial BTP credits earned earlier and it will not be counted towards the credit requirement of 156 credits.
8. A student may take “Independent Project” or “Independent Study” or “Undergraduate Research” courses for 1, 2, or 4 credits in a semester. No more than 8 of these credits can count towards satisfying the credit requirements of the degree. Only students with satisfactory CGPA (at least 7.5) or with a strong interest in some area with CGPA of at least 7 (the faculty advisor to determine this) can take these courses.

9. A student can take maximum 2, 2xx level courses in 3rd and 4th year.

## 5. Honors Program

The B.Tech. (CSB) program has the Honors option, requirements for which are same as specified in the regulations for the B.Tech. program. Namely;

1. The student must earn an additional 12 discipline credits (i.e. must complete at least 168 credits).
2. The student's program must include a B.Tech. Project.
3. At graduation time, the student must have a CGPA of 8.0 or more.

- **July 2018 Release – Version 1**

- **July 2019 release**

- (i) Counting of SG, CW credits in total credits. Applicable from 2018 batch onwards.
- (ii) Total credits requirement for graduation and credit requirement for Honors students. Applicable from 2018 batch onwards.
- (iii) Courses for Honors students. Applicable from 2018 batch onwards.
- (iv) Discontinuation of BTP to IP conversion. Applicable from AY2019-20.
- (v) Technical Courses
- (vi) 2xx level courses

- **August 2019 release**

- (i) Program structure Pnt 3(A).
- (ii) List of technical and non-technical courses in the first year, pnt 2(B). For students of 2018 batch

Semester	Technical Courses	Non-Technical Courses
<b>Semester 1</b>	Introduction to Programming Digital Circuits Math I System Management	Communication Skills
<b>Semester 2</b>	Data Structures and Algorithms Foundations of Biology Probability and Statistics Introduction to Engineering Design	SSH Elective