B. Tech. (Data Science Artificial Intelligence) Curriculum

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1 Introduction

This document describes the curriculum for the proposed undergraduate **B.Tech. (Bachelor of Technology)** program in DSAI (Data Science and Artificial Intelligence). The document details the overall program structure, total credits with a semester-wise break-up of the credits and a break-up of the credits with reference to the various groups of core and elective courses.

Overall B. Tech. Programme Structure (minimum 154 credits)

Semester 1 (15 weeks)	**22 credits** ● 6 core courses
Semester 2 (15 weeks)	**20 credits** ● 5 core courses
Semester 3 (15 weeks)	**24 credits** ● 6 core courses
Semester 4 (15 weeks)	**20 credits** ● 5 core courses
Semester 5 (15 weeks)	**20 credits** ● 5 core courses
Semester 6 (15 weeks)	**16 credits** ● 4 electives
Semester 7 (15 weeks)	**16 credits** ● 4 electives
Semester 8 (15 weeks)	**16 credits** ● Project/Internship/Thesis

The course credits earned over 8 semesters are grouped into the following categories:

- Humanities and Social Sciences (HSS)
- Mathematics and Basic Sciences (MBS)
- Systems (Sys)
- Eng. Core (EC)
- DSAI Core
- General Electives
- Bachelor's Thesis/Project/Internship

The break-up of credits under each category is in the table below. The courses under each category are in the tables that follow.

Data Science Artificial Intelligence (DSAI)	
Heads	**Credits**
Humanities and Social Sciences (HSS)	16
Mathematics and Basic Sciences	20
Systems (Sys)	12
Eng. Core (EC)	18
DSAI Core	40
General Electives	32
Internship/Bachelor's Thesis/Project	16
Total	154

1.1 Humanities and Social Sciences (HSS)

The courses under this category are listed in the following table

Course Name	Credits	L:T:P:C
Economics	4	3:1:0:4
English	2	2:0:0:2
Technical Communication	2	2:0:0:2
AI Ethics	4	3:1:0:4
Data and Society	4	3:1:0:4

Table 1 : HSS

1.2 Mathematics and Basic Sciences (MathBS)

The following table lists the courses under this category.

Course Name	Credits	L:T:P:C
Math 3 (Statistics for DS)	4	3:1:0:4
Math 4 (Probability for DS)	4	3:1:0:4
Math 1 (Multivariate Diff. Calculus & Optimization)	4	3:1:0:4
Physics - 1	4	3:1:0:4
Math 2 (Linear Algebra)	4	3:1:0:4

Table 2 : Mathematics and Basic Sciences

1.3 Systems

The following table contains the courses under the systems category.

Course Name	Credits	L:T:P:C
Computing Infrastructure	4	3:1:0:4
Database Systems	4	3:1:0:4
Signals and Systems	4	3:1:0:4

Table 3 : Systems

1.4 Eng. Core

The following table contains the courses under the category of core courses exclusive to DSAI.

Eng. Core Course Name	Credits	L:T:P:C
C and Python	4	2:0:4:4
Data Structures and Algorithms	4	3:1:0:4
Data Structures Lab	2	0:2:0:2
Discrete Math	4	3:1:0:4
Design and Analysis of Algorithms	4	3:1:0:4

Table 4 : Eng. Core

1.5 DSAI Core

The following table contains the courses under the category of core courses exclusive to DSAI.

DSAI Core Course Name	Credits	L:T:P:C
Statistical Learning	4	3:1:0:4
Foundations of AI	4	3:1:0:4
Neural Networks and Deep Learning	4	3:1:0:4
MLOps	4	3:1:0:4
Computational Learning Theory	4	3:1:0:4
Advanced Deep Learning	4	3:1:0:4
Big data Systems	4	3:1:0:4
Data Modeling	4	3:1:0:4
Reinforcement Learning	4	3:1:0:4
Data Visualization	4	3:1:0:4

Table 5 : DSAI Core

1.6 Electives and Branch Electives

Apart from the courses specified in the previous sections, DSAI students need to take **at least** 8 elective courses, each carrying 4 credits. The students can plan their electives starting from the 6th semester to the 7th semester. The elective courses can be spanned across various departments.

1.7 Project and Reading Electives

A project elective (PE) is a special type of 4-credit elective, where a student registers for a semester-long project under the supervision of a faculty member and is graded based on the project delivered. Similarly, a reading elective (RE) is a special type of 4-credit elective, where a student registers under a faculty member for some advanced-level research topic. Typically the student will be provided some research material to read and present (for example, a set of research papers or some chapters from a research monogram) and the student is graded based on how well the student has understood and presented the material.

Note: PEs and REs are **optional**. A **maximum** of 1 PE and 1 RE can be taken by a student throughout their entire programme.

2 Bachelor's Project / Thesis/ Internship

A student can do either a 16-credit B.Tech project or a 20-credit thesis under the supervision of a faculty member at IIITB during their 8th semester. Alternatively, students also have an option to do a 16-credit internship during their 8th semester.

3 Other General Courses

Apart from the above courses, the students also need to compulsorily pass other general courses as specified in the following table

Course Name	Credits	L:T:P:C
Physical Education 1	0	0:4:0:0
Physical Education 2	0	0:4:0:0

4 Optional B.Tech. (Hons) with Specialization and Minor

DSAI students are encouraged to specialize in one of the following listed domains.

- DSAI Algorithms
- DSAI in Data Domains (e.g., NLP, Vision)

DSAI Algos	**DSAI in data domains**
Approximation Algorithms	NLP
Multiagent Systems	Visual Recognition
Bayesian Methods & PGM	Adv. Data Visualization
Neurosymbolic AI	Generative AI for Vision
Few shot learning	Recommendation Systems
Self-supervised learning	Geo Information Systems
Network Science	Generative AI for NLP
	3D Vision
	Statistical Techniques for Spatio-Temporal Data analysis

Note that this list is not permanent and may be changed every year, depending upon the availability of the courses.

To get a specialization, a student must earn an additional 20 credits in that specific domain by doing **additional** elective courses offered in that domain. Note that a **maximum** of 1 PE and 1 RE can be counted for getting a specialization. Students completing a DSAI specialization with a CGPA above or equal to 3.5 out of 4.0 will be graduating with a B.Tech. (DSAI) Honours with specialization in the respective domains.

Alternatively, a DSAI student can earn a minor in a non-DSAI area by completing an **additional** 20 credits in the area chosen. The minor could be in one of the following listed areas:

- VLSI (VLSI Systems).
- SY (Software Systems)

- DT (Digital Society).

The above lists of areas for specialization and minor are subject to change and refinements from time to time. Also, note that students can complete B.Tech. (DSAI) programme **without** the requirement of earning a specialization or minor with extra credits.

Note that a **maximum** of 1 PE and 1 RE can be counted for getting a minor.

5 Course Sequencing for BTech (DSAI)

The course sequencing for the DSAI branch is given in the following table.

Course Name	Credits	Course Category	Level
SEMESTER 1	**22**		
Math-3	4	Mathematics and Basic Sciences	Level 1
Math-4	4	Mathematics and Basic Sciences	Level 1
Computing Infrastructure	4	Systems	Level 1
C and Python	4	Eng. Core	Level 1
Economics	4	Humanities and Social Sciences	Level 1
English	2	Humanities and Social Sciences	Level 1
SEMESTER 2	**20**		
Math – 1	4	Mathematics and Basic Sciences	Level 1
Statistical Learning	4	Data Science Artificial Intelligence Core	Level 1
Data Structures and Algorithms	4	Eng. Core	Level 1
Data Structures Lab	2	Eng. Core	Level 1
Math-2	4	Mathematics and Basic Sciences	Level 1
Technical Communication	2	Humanities and Social Sciences	Level 1
SEMESTER 3	**24**		
Foundations of AI	4	Data Science Artificial Intelligence Core	Level 1
Neural Networks and Deep Learning	4	Data Science Artificial Intelligence Core	Level 1
Database systems	4	Systems	Level 1
Physics-1	4	Mathematics and Basic Sciences	Level 1
Signals and Systems	4	Systems	Level 1
Discrete Math	4	Eng. Core	Level 1
SEMESTER 4	**20**		
Design and Analysis of Algorithms	4	Eng. Core	Level 1
Data and Society	4	Humanities and Social Sciences	Level 1
Data Modeling	4	Data Science Artificial Intelligence Core	Level 1
Reinforcement Learning	4	Data Science Artificial Intelligence Core	Level 1
Data Visualization	4	Data Science Artificial Intelligence Core	Level 1

Course Name	Credits	Course Category	Level
SEMESTER 5	**20**		
Computational Learning Theory	4	Data Science Artificial Intelligence Core	Level 1
Advanced Deep Learning	4	Data Science Artificial Intelligence Core	Level 1
AI Ethics	4	Humanities and Social Sciences	Level 1
Big data Systems	4	Data Science Artificial Intelligence Core	Level 1
MLOps	4	Data Science Artificial Intelligence Core	Level 1
SEMESTER 6	**16**		
Elective – 1	4	Elective	Level 2
Elective – 2	4	Elective	Level 2
Elective – 3	4	Elective	Level 2
Elective – 4	4	Elective	Level 2
SEMESTER 7	**16**		
Elective – 5	4	Elective	Level 2 / Level 3
Elective – 6	4	Elective	Level 2 / Level 3
Elective – 7	4	Elective	Level 2 / Level 3
Elective – 8	4	Elective	Level 2 / Level 3
SEMESTER 8	**16**		
B.Tech. Project / Thesis / Internship	16	Project/Thesis/Internship	Bachelor's Project/Thesis/Internshi

Table 10: Course Sequencing for B.Tech (DSAI)