Regulations for the B.Tech. in Computer Science and Artificial Intelligence(CSAI) Program

1. Preamble

Artificial Intelligence (AI) has become an integral part of technology in our daily lives, driving to office, searching for a restaurant, getting news updates, and recommendations on social media are all using AI. With increase in usage, there is a significant requirement of researchers who can understand AI and build AI technologies. This program will provide students an opportunity to learn both foundational and experimental components of AI and Machine Learning. A student completing this program will be able to undertake industry careers involving innovation and problem solving using Artificial Intelligence (AI) and Machine Learning (ML) technologies and research careers in AI, ML, and, in general, Computer Science areas. Along with courses that provide specialization in AI, students will also have option to explore applied domains such as computer vision, natural language processing, robotics, and autonomous systems as well as other interdisciplinary areas such as neuroscience, edge computing, and Internet of Things.

Overall objectives of the B.Tech. (CSAI) program are to help develop the following attributes in students:

1. Understanding of foundational topics in Computer Science, Artificial Intelligence, and Machine Learning.
2. Understanding of theoretical foundations and limits of artificial intelligence and machine learning.
3. Ability to design and implement algorithms and data structures for efficiently solving new problems.
4. Ability to model and analyze a variety of problems using appropriate mathematical/computational and AI concepts.
5. Ability of apply and develop AI and ML algorithms to transform large amount of data into intelligent decisions and/or behavior.
6. An understanding of the impact of AI and SML based solutions in an economic, societal, and environment context.

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

7. Ability to function effectively in teams to accomplish a common goal.

8. An understanding of professional and ethical responsibility.

9. Ability to communicate effectively with a wide range of audience.

10. Ability to self learn and engage in life-long learning.

11. Ability to undertake small research tasks and projects.

12. Ability to take an idea and develop into a business plan for an entrepreneurial venture (if desired).

This document specifies the specific regulations for the B.Tech. (CSAI) 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.

2. Program Structure

1. The Foundation program provides the basic knowledge about Computer Science and Artificial Intelligence (CSAI) through a set of core courses, which are compulsory for all students.

2. The set of core courses are shown in the table below (courses mentioned in [ ] are electives and actual courses for these slots are as defined from semester to semester.)

SEM 1	SEM 2	SEM 3	SEM 4	SEM 5	Sem 6		
Introduction to Programming	Data Structures and Algorithms	Advanced Programming	[Fundamentals of Database Management Systems/Computer Organization/Ethics in AI]*	Machine Learning			
Digital Circuits	Introduction of Intelligent Systems	Operating Systems	[Maths IV/Graph Theory/Statistical Inference/Introduction to Mathematical Logic/Theory of Computation]#	[Computer Architecture/ Computer Networks/ Compilers]*	Ethics in Artificial Intelligence		
Maths I- (Linear Algebra)	Maths II- (Probability & Statistics)	Discrete Mathematics	Algorithm Design and Analysis	Artificial Intelligence	[2 AI Core Courses]		
Prototyping Interactive Systems	[Computer Organization/Fundamentals of Database Management Systems]*	Maths III	Statistical Machine Learning	[4 AI Application Electives]			
Communication Skills	[SSH]	Signals & Systems	Optimization	Technical Communication + Environmental Sciences			

3. List of technical and non-technical courses in the first year

Semester	Technical Courses	Non-Technical Courses
Semester 1	Introduction to Programming Digital Circuits Maths I Prototyping Interactive Systems	Communication Skills
Semester 2	Data Structures and Algorithms Introduction to Intelligent Systems Probability and Statistics Computer Organization/Fundamentals of Database Management Systems	SSH Elective

The Advanced Part of the program

1. The rest of the program consists mostly of *elective and selected AI compulsory 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. A list of Elective Courses is available as Appendix.

2. Some of the electives may be chosen from various domains like (more can be added later):

- Neuroscience or Cognition
- AI in Heathcare
- Hardware related AI, Edge Computing and AI
- Parallel or Distributed AI for large scale applications
- Human Centered AI
- IoT and AI

3. Besides electives for specialized areas, electives from domain areas (e.g. health, life sciences, finance, economics, E-Governance, sciences, etc.) may also be offered.

4. There will also be a set of Social Sciences and Humanities (SSH) courses offered.

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

3. Requirements for Graduation

For a B.Tech. (CSAI) 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.

3. Do at least 12 credits of Social Science and Humanities (SSH) Courses including a mandatory SSH course, Ethics in AI. Refer Appendix I for list of 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. Earn 8 credits of additional CS core courses (from the courses marked as * in the above table other than Ethics in AI course, which is a SSH course) and 4 credits of Maths Elective Courses (from the courses marked as # in the above table). Refer Appendix I for list of courses.

6. Earn 8 credits of additional AI core courses from list of courses and 16 credits of AI application electives available at Appendix I.

7. A student may take Online Courses. No more than 8 of these credits can count towards satisfying the credit requirements of the degree.

8. 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 minimum 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.

9. 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 (the faculty advisor to determine this) and CGPA of at least 7.0 can take these courses.

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

4. Honors Program

The B.Tech. (CSAI) 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

Appendix I: Tentative list of Electives

A. Additional CS Core Courses: Select 2 out of following courses (*2X4 = 8 credits*) **-** should be done in first 4-semesters

- Computer Architecture
- Computer Organization
- Fundamentals of Database Management Systems
- Computer Networks
- Compilers

B. Additional AI Core Courses: Select 2 out of the following courses (*2 X 4 = 8 credits*)

- Deep Learning
- Advanced Machine Learning
- Reinforcement Learning
- Data Mining
- Big Data Analytics
- Data Science
- Probabilistic Graphical Models
- Human-AI Interaction

C. AI Applications Courses: Select 4 out of the following courses (*4 X 4 = 16 credits*)

- Computer Vision
- Natural Language Processing
- Information Retrieval
- Robotics
- Multi-agent Systems
- Collaborative Filtering/Recommender Systems
- Speech Recognition and Understanding
- Semantic Web/Knowledge Graphs
- Additional Applications Related Courses

D. MTH Elective Courses: Select 1 out of the following: (*1 X 4 = 4 credits*)

- Maths IV

- Scientific Computing

- Graph Theory

- Statistical Inference

- Theory of Computation

- Introduction to Mathematical Logic

E. SSH Courses (3 *X 4 = 12 credits*)**: (**i) Ethical, Social, and Legal (ESL) Aspects in AI, and 2 other SSH courses with recommendation for (a) Game Theory, (b) Critical Thinking.

Change History

November 2019: Version 1