INTERNATIONAL INSTITUTE OF INFORMATION TECHNOLOGY

HYDERABAD

Undergraduate Curriculum Handbook
2018 – Version 2

I. Undergraduate Programmes – an overview

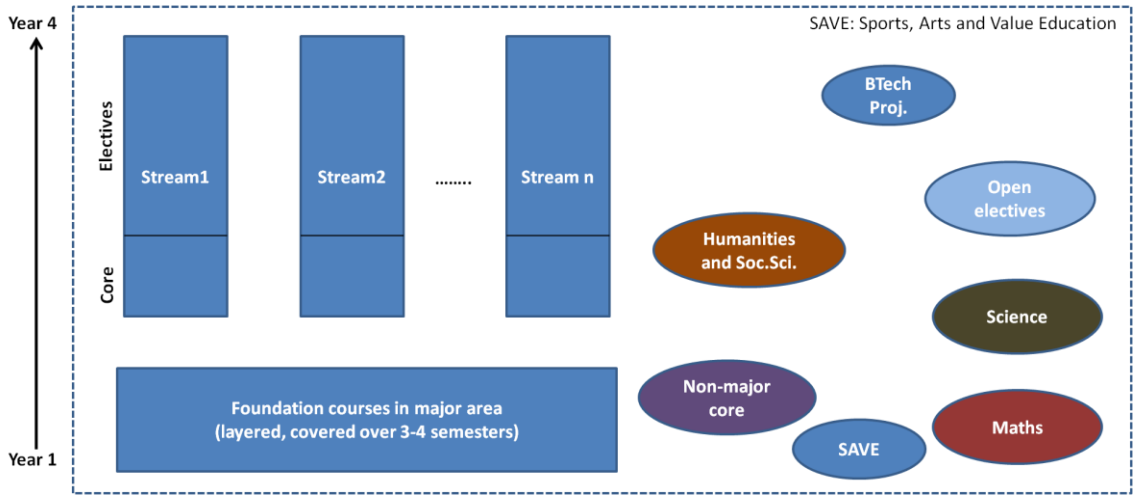
1.0. Introduction

There are two types of programmes offered at the undergraduate level: *single* degree and *dual* degree. The single degree programmes require completing a minimum of 161 credits while the dual degree programmes require completing 177 credits and *defending a research thesis*.

In addition to structured courses offered within the Institute, students can opt to learn in few other modes, with approval from academic office. These include *Independent study* and *Semester project* under Institute faculty supervision; courses offered outside of the Institute under platforms such as SWAYAM/MOOC/NPTEL or University of Hyderabad.

The rest of this document is structured as follows. *Sections II* and *III* give an overview of the single and dual degree programmes, including the credit requirements. *Sections IV* and *V* provide a detailed description of these programmes.

The curriculum design that spans all our undergraduate programmes is as shown below. The first two years lays foundations for the discipline while the next two years allows students flexibility to pursue subjects of interests in different streams. Every programme has a good mixture of courses from the core discipline (or major area) and from other areas to impart a balanced education.



The curriculum for a dual degree programme prepares students to do research in a graded manner, with four research projects starting from year 3 culminating in a *research thesis* in the final (fifth) year.

2.0. Single degree programmes

Students in this programme can earn a *Bachelor of Technology (BTech)* degree in one the following disciplines upon completing a minimum of the number of credits indicated:

- Computer Science and Engineering (CSE) - minimum credit requirement is 161.
- Electronics and Communication Engineering degrees (ECE) – minimum credit requirement is 161.

2.1. BTech (in CSE or ECE) programmes

These have a common curricular structure which is described below.

- 73 credits for CSE and 73 credits for ECE in the respective core programmes
- 12 credits in Sports, Arts and Value Education
    - 4 credits from each of the three subjects
- 16 credits each in Maths and Science
- 20 Credits in Humanities and Social Science
    - 2 courses (2 credits each) in Ethics
- 4 credits of BTech Project
- 20 credits from any discipline/area (open electives) at 400 level or above

Earning of credits via independent study, project and sources outside of the Institute is restricted to the open electives category. While a student can earn any number of credits in this manner, only 8 such credits can be counted towards the graduation requirement.

2.2. BTech (Honours) degree:

Students with a strong academic record can choose to earn a *BTech degree with Honours*. Under this option, a student can gain an in-depth knowledge in a stream by choosing appropriate set of electives and doing 4 projects. The student has to choose this option at the end of the 2nd year (4th semester). Students are attached to a research centre and assigned a faculty to provide advice on the electives to be completed, assign and supervise projects.

A BTech (Honours) degree requires a **minimum of 165 credits** of which 8 credits are to be earned as four, 2-credit honours projects between the 5th and 8th semesters.

3.0. Dual degree programmes:

Students in this programme can earn two degrees, namely, *BTech* and a *Master of Science* (MS) degree. The MS degree requires completing 24 thesis credits and 2 seminar credits. Currently offered programmes and the minimum number of credits required are as follows:

- *BTech in Computer Science and Engineering and MS in Computer Science and Engineering by Research* (CSD) – minimum credit requirement is 177.
- *BTech in Electronics and Communication Engineering and MS in Electronics and Communication Engineering by Research* (ECD) - minimum credit requirement is 177.
- *Bachelor of Technology in Computer Science and MS in Computational Linguistics by Research* (CLD) - minimum credit requirement is 177.
- *Bachelor of Technology in Computer Science and MS in Computational Natural Sciences by Research* (CND) - minimum credit requirement is 177.
- *Bachelor of Technology in Computer Science and MS in Computing and Human Sciences by Research (CHD) – minimum credit requirement is 177*

3.1. CSD and ECD programmes

These two have a common curricular structure as described below.

- 85 credits for CSE and 85 credits for ECE in the respective core programmes
- 12 credits in Sports, Arts and Value Education
    - 4 credits from each of the three subjects
- 16 credits each in Maths and Science
- 20 Credits in Humanities and Social Science
    - 2 courses (2 credits each) in Ethics
- 8 credits of Honors Project
- 20 credits from any discipline/area
- 2 seminar credits
- 1 unit (0 credits) of technical writing
- 1 unit(0 credits) of research proposal
- 24 credits of Research thesis

3.2. CND programme

This is broadly structured as follows.

- 61 credits in Computer Science
- 12 credits in Sports, Arts and Value Education
    - 4 credits from each of the three subjects
- 60 credits in Computational Natural Science
- 16 credits in Maths
- 12 credits in Humanities and Social Science
- 8 credits from any discipline
- 8 credits in honours project
- 2 seminar credits
- 1 unit (0 credits) of technical writing
- 1 unit (0 credits) of research proposal
- 24 credits of Research thesis

3.3. CLD programme

This is broadly structured as follows.

- 59 credits in Computer Science
- 12 credits in Sports, Arts and Value Education
    - 4 credits from each of the three subjects
- 46 credits in Computational Linguistics
- 16 credits each in Maths
- 8 credits in Science
- 16 credits in Humanities & Social Science
- 12 credits from any discipline
- 8 credits in honours project
- 2 seminar credits
- 1 unit (0 credits) of technical writing
- 1 unit (0 credits) of research proposal
- 24 credits of Research thesis

3.4. CHD programme

This is broadly structured as follows.

- 61 credits in Computer Science
- 12 credits in Sports, Arts and Value Education
    - 4 credits from each of the three subjects
- 60 credits in Human Sciences
- 16 credits each in Maths
- 8 credits in Science
- 12 credits from any discipline
- 8 credits in honours project
- 2 seminar credits
- 1 unit (0 credits) of technical writing
- 1 unit (0 credits) of research proposal
- 24 credits of Research thesis

II. Computer Science and Engineering (CSE)

The curriculum for CSE is prepared keeping in mind the pace of change in computing as a discipline. Computing now is affecting many domains including the natural sciences, materials and humanities in a big way. It is therefore imperative that the curriculum offers a student the scope to acquire fundamental knowledge quickly and the ability to specialize in some particular subject domain.

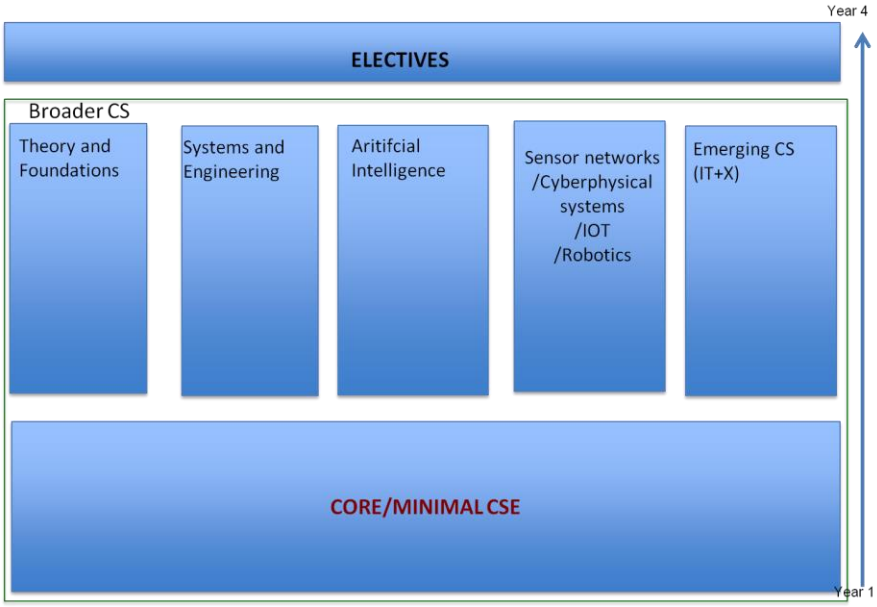
IIIT Hyderabad strives to impart education that does not simply train students get their first employment but rather trains students to be thought-leaders in their respective domains. Doing so requires a curriculum with flexibility that allows individual students to focus on their strengths and interests and customize it within some constraints. At the same time, the curriculum needs to have a minimal core/foundation that helps students in making informed choices going forward.

The curriculum has a set of 52 credits in Computer Science in the first four semesters. The courses in the first four semesters cover programming, data structures, algorithms, circuits, computer systems, operating systems, computer networks, database systems, and software engineering. These equip the students with the basics of the discipline, prepare them for problem-solving, and include lots of hands-on projects. By the end of these courses, students will be able to create systems that are requirement and process driven, version-controlled, talk over the network, prepare SQL queries, and are usable. Indeed, IIIT Hyderabad has a history of using several such systems.

To create a good synergy between CS and ECE, within these credits, we also recommend hands-on courses in EECS. Through these courses, students will be able to build simple systems that can bring together several aspects of EECE such as sensors, converters, decision making/feedback, communication, and the like. The remaining 6 credits in the minimal CS is driven by two credit courses that prepare them for depth in a broad area. These courses therefore serve to introduce the required body of knowledge across 8 courses (of 2 credits each).

The curriculum across semesters 5 through 8 is largely elective driven. Students are encouraged to do five courses (20 credits) in Computer Science apart from other open choice credits, science courses, and courses in humanities. The five courses in Computer Science can be from one subject area such as AI or be spread across several areas depending on the interests of the individual student. These courses can be also from other applied domains such as computational science or building science. We consider that every student will do at least one course from the Theory bouquet and at least one course from the Systems bouquet. It is therefore considered that 18 courses adding up to 72 credits plus a 4 credit B. Tech. Project is the minimal CS requirement. This layer of 76 credits is appropriate for students wanting to specialize in domains outside of CS. Most CSE students will be encouraged to do additional CSE credits.

The structure of the CSE programme is shown below.



Requirements for a BTech degree in CSE:

A. Maths requirement (16 credits): 4 core courses mandatory for all students.

Core Maths courses

Course Name	Semester	Credits
Discrete Structures	Semester 1	4
Real Analysis	Semester 1	4
Linear algebra	Semester 2	4
Probability and Statistics	Semester 3	4
Total Credits		**16**

B. Science requirement (16 credits): 2 core + 2 elective courses

Core Science courses

Course Name	Semester	Credits
Science 1	Semester 3	4
Science 2	Semester 4	4
Total Credits		**8**

C. Humanities and Social Sciences (HSS) requirement (20 credits): 2 core + 2 elective courses

Core HSS Science courses

Course Name	Semester	Credits
Intro to Human Sciences	Semester 4	4
Ethics-1	Semester 7	2
Ethics-2	Semester 8	2
Total Credits		**8**

D. Institute core requirement (12 credits): 4 credits each in Sports, Arts and Value education

Course Name	Semester	Credits
Sports	Semesters 1 through 4	4
Arts	Semesters 1 and 2	4
Value education	Semesters 1 and 4	4
Total Credits		12

E. Programme core requirement: These are to be completed in the first 4 semesters. The list of programme core courses is as below.

Core courses in the CSE Programme: (53 credits)

Monsoon	Course title	Credits	Spring	Course title	Credits
Sem 1	Computer Programming	5	**Sem 2**	Introduction to IoT	3
	Digital Systems and Microcontrollers	5		Introduction to Software Systems	2
				Data Structures and Algorithms	5
				Computer Systems Organization	4
	Sub-total	10		Sub-total	14
Total					**24**
Sem 3	Data and Applications	2	**Sem 4**	Design and Analysis of Software Systems	4
	Automata Theory	2			
	Operating Systems and Networks	4		Machine, Data and Learning	4
	Embedded Systems Workshop	3			
	Sub-total	11		Sub-total	8
Total					**19**

6. Programme Breadth Elective Courses: These are to be completed in the semesters 4 or 6 or 8. Each student does three Breadth Elective Courses each of two credits. These courses are also categorized into two classes: Theory/Foundations and Systems/Applications. The indicative list of courses in each category is given below.

Theory/Foundation:

1. Program Verification
2. Introduction to Information Security
3. Introduction to Quantum Information and Computation

Systems/Applications

1. Software Programming for Performance
2. Digital Signal Analysis
3. Data Visualization
4. Introduction to Brain and Cognition

7. Other programme requirements: 40 credits in electives + 4 credits of BTech project.

After the foundations built via core courses in the first two semesters, CSE curriculum permits a student the flexibility to pursue their interests via electives in the last two years. Of the 40 credits in electives, a minimum of 20 credits has to be earned in the core CSE programme *bouquet core courses* while the rest (20 credits) can be earned via courses from across disciplines including those from CSE.

CSE bouquet core courses are organized into *five streams*, with each stream consisting of introductory as well as advanced level courses. Courses in this category are usually offered at least once every year.

The five categories and indicative courses in each category are listed below.

1. *Theory/Foundations*: Advanced Algorithms, Optimization Methods, Programming Languages, Modern Information Security
2. *Systems*: Advanced Computer Networks, Advanced Database Systems, Distributed Systems, Compilers, Software Engineering
3. *AI*: Information Retrieval, Data Warehousing and Data mining, Computer Vision, Machine Learning, Advanced NLP
4. *EECS*: Sensor Networks, Robotics, Cyber-physical Systems, Internet-of-Things
5. *Emerging CS/IT for X*: Select Courses from Computational Natural Science, Building Science, etc. will be included in this stream.

BTech (Honours) requirement **:**

- 4 honours projects in Sem 5 through 8
- At least three bouquet electives from ONE bouquet, as per the concurrence of the honors advisor, that closely matches the chosen honours stream.

BTech project (4 credits) : This is to be done as 2-credit projects each in Semesters 6 and 7, preferably on the same topic.

Requirements for BTech in CSE and MS in CSE by research (CSD):

CSD requirement is similar to the CSE requirement with the following additional requirements.

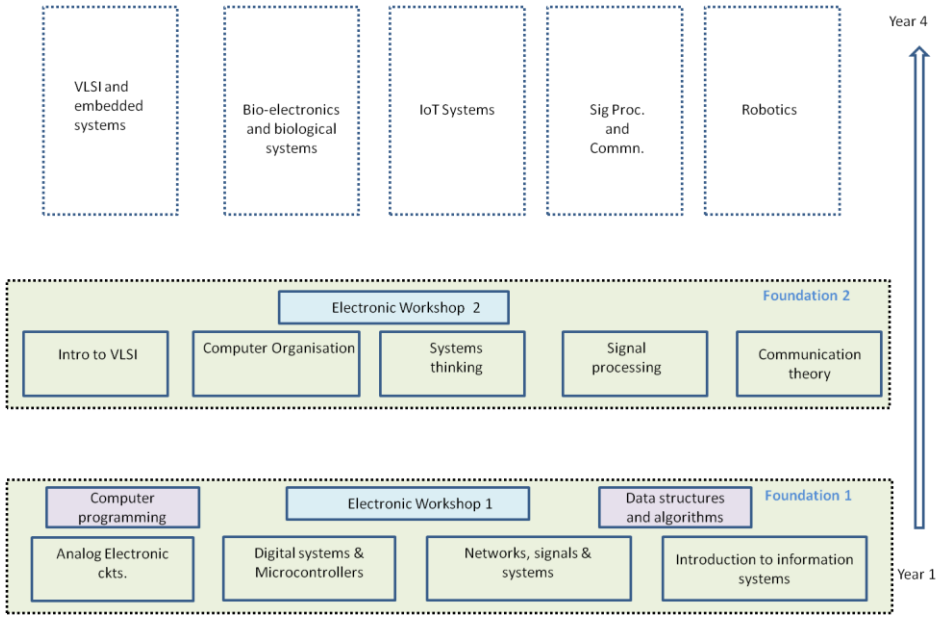
- 4 additional (honours) project credits
- 12 credits of electives
- **2 seminar credits** in the 8th and 9th semesters.
- **1 unit (0 credits)** of **technical writing** in the summer at the end of the 3rd year. This is to be registered in the 7th Semester.
- **1 unit (0 credits)** of **research proposal** by the end of 4th year. Register in 8th semester.
- Must register for **24 Research thesis credits** in the 9th and 10th semesters (at least 12 credits in a semester).

III. Electronics and Communication Engineering (ECE)

ECE is an old engineering discipline and is an integral part of modern field of Information Technology. Advances in hardware and embedded computing have become key enablers for communication over land, sea and space; robotics and quantum computing. From medical devices to Internet of Things (IoT) to distributed computing and storage, today's information systems straddle scale and space in a hitherto unseen manner. Recently, development of high performance processors with novel architectures has been harnessed for deep learning leading to a resurgence of Artificial Intelligence. Overall, the boundary between disciplines CSE and ECE is increasingly fluid. The robust theoretical framework ECE offers to understand systems is also finding place in modeling of complex biological systems.

The ECE curriculum has been designed keeping these in mind. In addition to the core discipline it has components from a range of domains such as maths, science, required for analysis and modeling; as well as humanities and social sciences, to help understand and navigate the world where technology is playing an increasing role.

A schematic of the broad structure of the ECE curriculum is given below. The curriculum has two levels of core courses serving to build the foundations of the ECE discipline. These cover basics in hardware (electronics to vlsi) and communication (networks to systems thinking). This is also supported by foundations in computing (programming to computer organization). The foundations are followed by a set of stream-based electives that permits students to build deeper knowledge in specific streams. The streams span established and emerging areas and are designed to cater to interests in theory/analysis or applications/design.



Requirements for a BTech degree in ECE:

A. Maths requirement (16 credits): 3 core + 1 elective courses

Core Maths courses

Real Analysis	Semester 1
Linear algebra	Semester 2
Probability and random processes	Semester 3

B. Science requirement (16 credits): 2 core + 2 elective courses

Core Science courses

Science 1 - scientific method, the micro and the macro principles of Natural phenomena	Semester 3
Science 2 - electromagnetism, applications of classical and quantum mechanics	Semester 6

C. Humanities and Social Sciences (HSS) requirement (20 credits): 2 core + 3 elective courses

Core HSS Science courses

Intro to Human Sciences (4 credits)	Semester 4
Ethics -1 (2 credits)	Semester 7
Ethics-2 (2 credits)	Semester 8

D. Institute core requirement (12 credits): 4 credits each in Sports, Arts and Value education

Sports (4 credits)	Semesters 1 through 4
Arts (4 credits)	Semesters 1 and 2
Value education (4 credits)	Semesters1 and 4

E. Programme core requirement: These are to be completed in the first 4 semesters. The list of programme core courses is as below.

Core courses in the ECE Programme: (53 credits)

Monsoon	Course title	Credits	Spring	Course title	Credits
Sem 1	Networks, Signals and Systems	4	**Sem 2**	Analog Electronic Circuits	5
	Digital Systems and Microcontrollers	5		Data structures and algorithms	5
	Computer Programming	5		Information & Communication	4
	Electronic workshop 1	2			
	Sub total	**16**		Sub total	**14**

Monsoon	Course title	Credits	Spring	Course title	Credits
Sem 3	VLSI Design	4	**Sem 4**	Introduction to Processor Architecture	2
	Signal processing	5		Electronic workshop 2	4
	Systems thinking	4		Communication theory	4
	Sub total	**13**		Sub total	**10**

F. Other programme requirements: 40 credits in electives + 4 credits of BTech project.

After the foundations built via core courses in the first two semesters, ECE curriculum permits a student the flexibility to pursue their interests via electives in the last two years. Of the 40 credits in electives, a minimum of 20 credits has to be earned in the core ECE programme while the rest (20 credits) can be earned via courses from across disciplines.

ECE electives are organized into 5 *streams*, with each stream consisting of introductory as well as advanced level courses. The offerings at the advanced level can change from time to time.

1. VLSI and embedded systems
2. Signal processing and communications
3. Robotics
4. Bio-electronics and biological systems
5. IoT systems

The following is the requirement for different type of students.

BTech Regular:

By the time of graduation should have completed at-least one star elective in VLSI stream and one star elective in SPC Stream. The star electives are given at the end

BTech Honors:

By the time of graduation four stream electives from their research stream needs to be completed. This can be from Foundation Electives/Star Electives/Stream Electives. Open Elective slots can be used for doing these electives

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BTech Dual Degree:

By the end of the 8th semester 6 stream electives from their research stream needs to be completed. This can be from Foundation Electives/Star Electives/Stream Electives. Open Elective slots can be used for doing these electives.

* Any change needs the approval of the advisor and the programme coordinator

BTech project (4 credits) : This is to be done as 2-credit projects each in Semesters 6 and 7, preferably on the same topic.

Requirements for BTech in ECE and MS in ECE by Research (ECD):

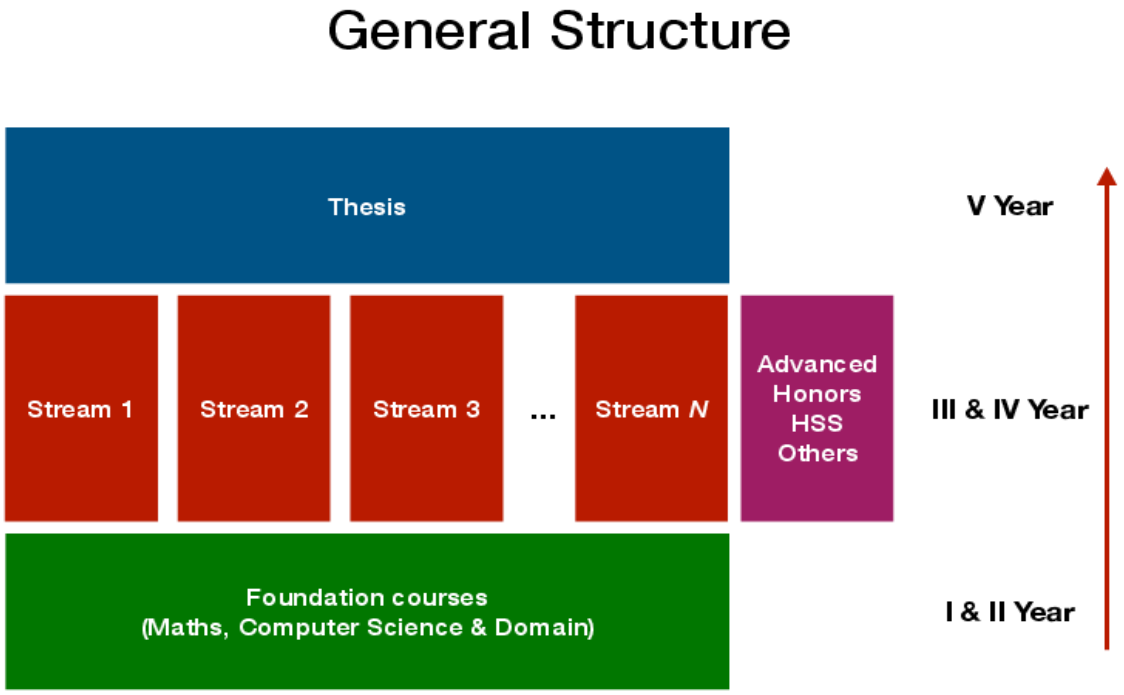
ECD requirements are the same as ECE curriculum with the following additional requirements;

- 4 additional (honours) project credits
- 8 credits of stream electives
- **2 seminar credits** in the 8th and 9th semesters.
- **1 unit (0 credits)** of **technical writing** in the summer at the end of the 3rd year. This is to be registered in the 7th Semester.
- **1 unit (0 credits)** of **research proposal** by the end of 4th year. Register in 8th semester.
- Must register for **24 Research thesis credits** in the 9th and 10th semesters (at least 12 credits in a semester).

IV. Dual degree programme in Computational Natural Sciences (CND)

This dual degree program is designed to impart the young minds high-quality education both in computer science and in emerging areas in computational natural sciences and eventually to 'Computational Thinking' empowered research in natural sciences; primary goals are:

a. Providing state of the art skills pertaining to application of computers and computational sciences;
b. Enabling young students to carry out research activities in several new and emerging multidisciplinary areas in sciences across the boundaries of the traditional scientific disciplines, e.g., interface of biology and nano materials, fluid dynamics, material science, networks (biological, social, epidemiology, etc.,), statistical mechanics, quantum mechanics/chemistry, structure function relationships of biological molecules, drug design, etc.; Special courses are designed to offer a multidisciplinary view in this broad research area. Students receive a basic training in all disciplines, and choose a specialization within one of these disciplines;
c. Providing an environment with coming together of computer and computational scientists with domain specialists, both theoretical as well as experimental



With these goals in mind, the programme has the following structure:

- Core/foundational topics in math, and science domain, in addition to computer sciences are
- covered in the beginning four/five semesters
- Advanced courses in specific streams of interest (from the fifth year) and honors projects will lay the ground for research work
- Streams that are planned for this dual degree programme currently are:
    - Computational biology and Systems biology
    - Multi-scale modeling
    - Nanosciences
    - Quantum Physics
    - Computational Chemistry
- Thesis work on the selected problem start at the end of 8th semester.

The specific academic requirements for the program are as follows:

Requirement Type	Course Name	Semester	Credits
Math CORE	Discrete Structures	I	4
	Real Analysis	I	4
	Linear Algebra	II	4
	Probability and Random Processes	III	4
Science Domain CORE	Computing in Sciences – I	I	2
	Computing in Sciences- II	II	2
	Classical Mechanics	II	2
	Electrodynamics	II	2
	General and Structural Chemistry	II	4
	Introduction to Biology (I)	III	4
	Science Lab I	III	2
	Quantum Mechanics	III	4
	Statistical Mechanics	IV	2
	Thermodynamics	IV	2
	Biomolecular Structures	IV	2
	Science Lab II	IV	2
	Organic Chemistry	IV	2
	Spectroscopy	V	2
	Chemical Kinetics and Reaction Dynamics	V	2
	Bioinformatics	V	2

	Systems Biology	V	2
	CCNSB Seminars	V, VI, VII, VII	0
Requirement Type	**Course Name**	**Semester**	**Credits**
Computer Sciences CORE	Computer Programming	I	5
	Digital Systems and Microcontrollers	I	5
	Data Structures and Algorithms	II	5
	Introduction to Software Systems	II	4
	Algorithm Analysis and Design	III	4
	Automata Theory	III	2
	Data and Applications	III	2
	Design and Analysis of Software Systems	IV	4
	Computer systems Organization	IV	4
	Machine, Data and Learning	IV	4
	Operating Systems and Networks	V	4
Humanities CORE	Introduction to Human Sciences	VI	4
Others, CORE	Sports, Arts, Value Education	I, II, III, IV	8

The remainder of the courses are electives and Honors projects:

1. Humanities electives: 2 courses (8 credits)
2. Computer Science electives: 4 courses (16 credits)
3. Science Domain electives: 5 courses (20 credits) . Additional restriction is that THREE of the FIVE have to be in a PARTICULAR stream and remaining two can be in ANY of the other streams so as to enable student to prepare by taking advanced level courses in the thesis problem, while giving the choice to explore other streams.
4. Other electives: 2 to 8 credits
5. **1 unit (0 credits)** of **technical writing** in the summer at the end of the 3rd year. This is to be registered in the 7th Semester.
6. **1 unit (0 credits)** of **research proposal** by the end of 4th year. Register in 8th semester.
7. Must register for **24 Research thesis credits** in the 9th and 10th semesters (at least 12 credits in a semester).

Honors projects – 4 courses (8 credits). Project courses enable students to gain practice in working on problems related to or leading directly to thesis work. These projects start after foundational courses in first four semesters, i.e. V, VI, VII and VIII semesters.

V. Dual degree programme in Computational Linguistics (CLD)

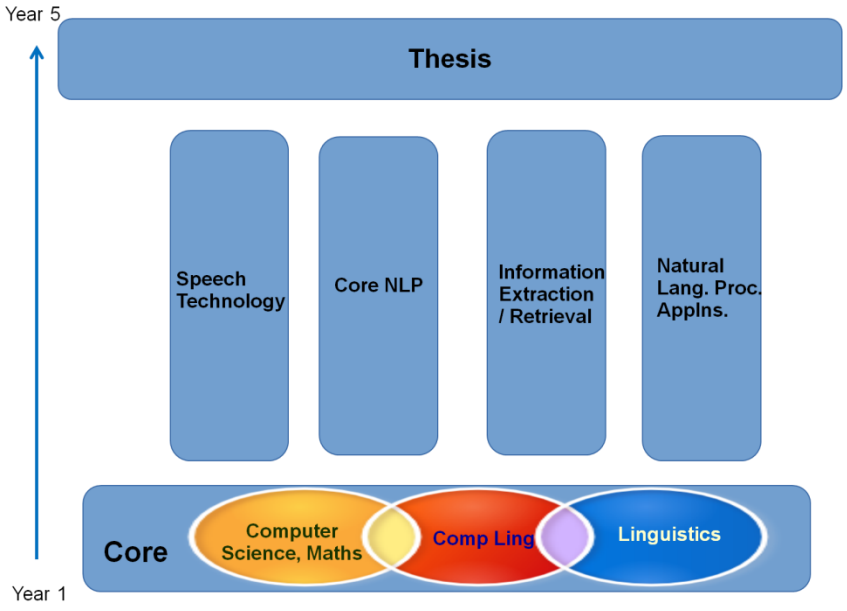
Computational linguistics is a transdisciplinary field of study. It deals with computational modeling of natural language understanding and generation using rule based or statistical methods. The graduates of this programme will work towards developing man - man and man-machine communication systems which include natural language understanding and natural language generation. They can also contribute to the field of linguistics by studying linguistic problems using computational methods. Since the field is inter-disciplinary in nature, an ability to synthesise knowledge from the fields of Computer Science and Linguistics is required. The curriculum for CLD has to equip the students with fundamentals from the following areas:

a) **Linguistics**: phonetics/Phonology, morphology, syntax, semantics, discourse, pragmatics, the relation between language and society etc.

b) **Computer Science:** programming languages, data structures, algorithm analysis, automata theory, AI, software design etc

c) **Maths** : Discreet maths, Probability and statistics, calculus, differential equations and matrices,
linear regression, real analysis, abstract algebra etc.

Therefore, the CLD curriculum has a balanced mixture of courses from different fields (Computer Science, Maths, Linguistics, Humanties, Science etc). The total credit requirement is 201 of which 24 are to be from a research thesis. The broad structure of the programme is as shown below.



Details of the requirements for the CLD programme are described next.

1. Maths requirement (16 credits): 3 core + 1 elective

Maths courses

Discrete Structures	Semester 1
Linear algebra	Semester 2
Probability and Statistics	Semester 3
Maths Elective	Semester 8

2. Science requirement (8 credits): 2 core

Core Science courses

Science 1 - scientific method, the micro and the macro principles of Natural phenomena	Semester 5
Science 2 - electromagnetism, applications of classical and quantum mechanics	Semester 6

3. Humanities and Social Sciences (HSS) requirement (16 credits): 2 core + 2 elective courses

Core HSS Science courses

Intro to Human Sciences (4 credits)	Semester 4
Ethics -1 (2 credits)	Semester 7
Ethics-2 (2 credits)	Semester 8

4. Institute core requirement (12 credits): 4 credits each in Sports, Arts and Value education

Sports (4 credits)	Semesters 1 through 4
Arts (4 credits)	Semesters 1 and 2
Value education (4 credits)	Semesters1 and 4

5. Programme core requirement: These are to be completed in the first 5 semesters. The list of programme core courses is as below.

Core courses in the CLD Programme:

Monsoon	Course title	Credits	Spring	Course title	Credits
Sem 1	Introduction to Liguistics-1	4	**Sem 2**	Introduction to Linguistics-2	4
	Digital Systems and Microcontrollers	5		Data structures and algorithms	5
	Computer Programming	5		Computational Linguistics-1	4
				Introduction to Software Systems	2
				Computer Systems Organization	4

Monsoon	Course title	Credits	Spring	Course title	Credits
Sem 3	Language and Society	4	**Sem 4**	Language Typology and Universals	4
	Computational Linguistics-2	4		Introduction to Natural Language Processing	4
				Digital Signal Analysis	2
	Algorithm Analysis and Design	4		Machine, Data and Learning	4
	Data and Applications	2		Design and Analysis of Software Systems	4
	Automata Theory	2		Introduction to Human Sciences	4
Sem 5	Advance NLP	4			
	Operating Systems and Networks	4			

6. Other programme requirements: credits in electives 48 + 8 credits of Honours projects.

Once the foundation is built via core courses in the first four semesters, the CLD curriculum allows a student the flexibility to pursue choose her/his stream of research and do courses to build the depth in the stream in the last two years. The electives in different streams provide that opportunity. Of the 48 credits in electives, a minimum of 14 credits have to be earned in the domain area, 16 in Computer Science and the rest (18 credits) can be earned via courses from across disciplines.

CLD electives are organized into 4 streams (Figure-1 above), with each stream consisting of introductory as well as advanced level courses. The offerings at the advanced level can change from time to time. Every student is expected to do 3 electives in the chosen stream and the fourth from any other stream. Any change needs the approval of the advisor and the programme coordinator.

Hons projects (8 credits): This is to be done as 2-credit projects each in Semesters 6 and 7, 8 and 9 preferably on the same topic.

2 seminar credits in the 8th and 9th semesters.

1 unit (0 credits) of **technical writing** in the summer at the end of the 3rd year. This is to be registered in the 7th Semester.

1 unit (0 credits) of **research proposal** by the end of 4th year. Register in 8th semester.

Thesis (24 credits): This is to be done in the fifth year.

VI. Dual degree programme in Computing and Human Sciences (CHD)

Computers and its various incarnations are transforming our world in ways that are unprecedented, and even unintended. Comparable historical parallels are, perhaps, the emergence of the printing press and, some centuries later, the spread of hydrocarbon fuels like coal and oil; but perhaps computers are changing the world at a much faster rate. The academic competencies required to comprehend such fundamental transformations will not be found either within standard science and technology departments, nor within those of the humanities and social sciences. Both of these focus on one side of this complex phenomenon.

Academic advances in the human sciences in the 21st century will depend on an ability to work with computers. Similarly, computer science will be impactful when it understands the society it works in. This programme is for intellectual pioneers who are keen to take on this inter-disciplinary challenge of understanding computers and society in a holistic manner.

Students will be expected to engage in research which pushes our knowledge in either or both directions within computer and human sciences. Students will participate in innovative and pioneering research projects where computer science tools and methods are used to ask questions in the social sciences; or which use social science methods to understand computer science. They will graduate with an ability to identify new research areas, use radically new academic methods, and ask questions which cannot be accommodated within the currently available academic formats.

Goals of curriculum design

- Build a pioneering teaching cum research curriculum which enriches both Computer as well as the Human sciences.
- Provide a platform for innovative, new research paradigms to emerge
- Encourage cross-disciplinary thinking and problem solving

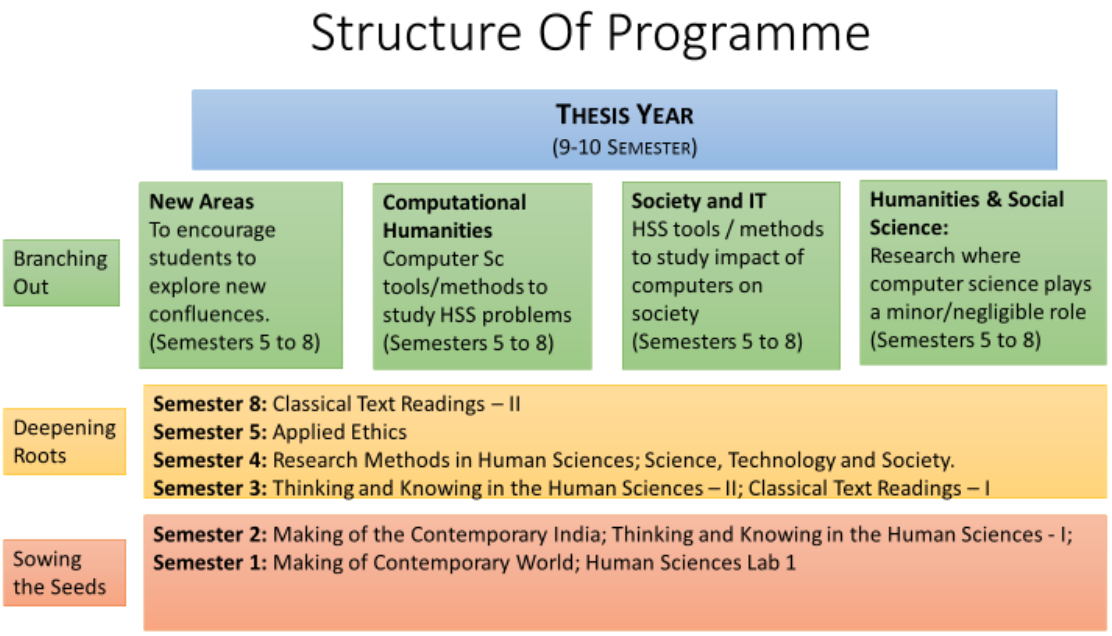
Key Objectives

- Build competencies for Industry
- Build capabilities for further research in both Human and Computer Sciences
- Help students find confluence of Computer and Human Sciences.

Design Philosophy of the Curriculum

- Year One: Sow the Seeds
- Year Two: Strengthen Roots
- Year Three & Four: Deepen Roots, Branch Out

The CHD curriculum has a balanced mixture of courses from different fields (Computer Science, Maths, Humanities, Science etc). The total credit requirement is 201 of which 24 are to be from a research thesis. The broad structure of the programme is as shown below.



1. Maths requirement (16 credits): 3 core +1 elective

Maths courses

Discrete Structures	Semester 1
Linear algebra	Semester 2
Probability and Statistics	Semester 3
Maths Elective	Semester 7

2. Science requirement (8 credits): 2 core

Core Science courses

Science 1 - scientific method, the micro and the macro principles of Natural phenomena	Semester 5
Science 2 - electromagnetism, applications of classical and quantum mechanics	Semester 6

3. Institute core requirement (12 credits): 4 credits each in Sports, Arts and Value education

Sports (4 credits)	Semesters 1 through 4
Arts (4 credits)	Semesters 1 and 2
Value education (4 credits)	Semesters1 and 4

4. Programme core requirement: These are to be completed in the first 5 semesters. The list of programme core courses is as below.

Monsoon	Course title	Credits	Spring	Course title	Credits
Sem 1	Making of the Contemporary World	4	Sem 2	Making of Contemporary India	4
	Digital Systems and Microcontrollers	5		Data structures and algorithms	5
	Computer Programming	5		Thinking and Knowing in the Human Sciences - I	4
				Introduction to Software Systems	2
	Human Sciences Lab-1	2			
Monsoon	**Course title**	**Credits**	**Spring**	**Course title**	**Credits**
Sem 3	Thinking & Knowing in the Human Sciences - II	4	Sem 4	Research Methods in Human Sciences	4
	Classical Text Readings-I	4		Science Technology Society	4
	Data and Applications	2		Design and Analysis of Software Systems	2
	Algorithm Analysis and Design	4		Machine, Data and Learning	4
	Automata Theory	2		Computer Systems Organization	4
Sem 5	Applied Ethics	4			
	Operating Systems and Networks	4			

5. Other programme requirements: credits in electives 54 + 8 credits of Honours projects.

Hons projects (8 credits): This is to be done as 2-credit projects each in Semesters 6 and 7, 8 and 9 preferably on the same topic.

2 seminar credits in the 8th and 9th semesters.

1 unit (0 credits) of **technical writing** in the summer at the end of the 3rd year. This is to be registered in the 7th Semester.

1 unit (0 credits) of **research proposal** by the end of 4th year. Register in 8th semester.

Thesis (24 credits): This is to be done in the fifth year.