

**B. TECH IN ARTIFICIAL INTELLIGENCE AND DATA SCIENCE****CURRICULUM FROM SEMESTERS I TO VIII**

Every course of B. Tech. Programme shall be placed in one of the nine categories as listed in table below.

| Sl. No | Category                                                    | Code | Credits    |
|--------|-------------------------------------------------------------|------|------------|
| 1      | Humanities and Social Sciences including Management courses | HMC  | 5          |
| 2      | Basic Science courses                                       | BSC  | 26         |
| 3      | Engineering Science Courses                                 | ESC  | 22         |
| 4      | Program Core Courses                                        | PCC  | 79         |
| 5      | Program Elective Courses                                    | PEC  | 15         |
| 6      | Open Elective Courses                                       | OEC  | 3          |
| 7      | Project work and Seminar                                    | PWS  | 10         |
| 8      | Mandatory Non-credit Courses (P/F) with grade               | MNC  | --         |
| 9      | Mandatory Student Activities (P/F)                          | MSA  | 2          |
|        | <b>Total Mandatory Credits</b>                              |      | <b>162</b> |
| 10     | Value Added Course (Optional)                               | VAC  | 20         |

No semester shall have more than five lecture-based courses and two laboratory and/or drawing/seminar/project courses in the curriculum. Semester-wise credit distribution shall be as below:

| Sem                  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | Total |
|----------------------|----|----|----|----|----|----|----|----|-------|
| Credits              | 17 | 21 | 22 | 22 | 23 | 23 | 15 | 17 | 160   |
| Activity Points      | 50 |    |    |    | 50 |    |    |    | ---   |
| Credits for Activity | 2  |    |    |    |    |    |    |    | 2     |
| G.Total              |    |    |    |    |    |    |    |    | 162   |

**Basic Science Courses:** Maths, Physics, Chemistry, Biology for Engineers, Life Science etc

**Engineering Science Courses:** Engineering Graphics, Programming in C, Basics of Electrical and Electronics Engineering, Basics of Civil and Mechanical Engineering, Engineering Mechanics, Thermodynamics, Design Engineering, Materials Engineering, Workshops etc.

**Humanities and Social Sciences including Management courses:** English, Humanities, Professional Ethics, Management, Finance & Accounting, Life Skills, Professional Communication, Economics etc

**Mandatory Non-credit Courses:** Environmental Science, Constitution of India/Essence of Indian Knowledge Tradition, Industrial Safety Engineering, Disaster Management etc.

### Course Code and Course Number

Each course is denoted by a unique code consisting of three alphabets followed by three numerals like **CSL 201**. The first two letter code refers to the department offering the course. CS stands for course in Computer Science & Engineering or allied department, course code MA refers to a course in Mathematics, course code ES refers to a course in Engineering Science etc. Third letter stands for the nature of the course as indicated in the following table.

| Code | Description                                                                                                                                                        |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| T    | Theory based courses (other than lecture hours, these courses can have tutorial and practical hours, e.g., L-T-P structures 3-0-0, 3-1-2, 3-0-2 etc.)              |
| L    | Laboratory based courses (where performance is evaluated primarily on the basis of practical or laboratory work with LTP structures like 0-0-3, 1-0-3, 0-1-3 etc.) |
| N    | Non-credit courses                                                                                                                                                 |
| D    | Project based courses (Major-, Mini- Projects)                                                                                                                     |
| Q    | Seminar courses                                                                                                                                                    |

Course Number is a three-digit number and the first digit refers to the Academic year in which the course is normally offered, i.e. 1, 2, 3, or 4 for the B. Tech. Programme of four-year duration. Of the other two digits, the last digit identifies whether the course is offered normally in the odd (odd number), even (non-zero even number) or in both the semesters (zero). The middle number could be any digit. CSL 201 is a laboratory course offered in Computer Science and Engineering or allied department for third semester, MAT 101 is a course in Mathematics offered in the first semester, EET 344 is a theory course in Electrical Engineering offered in the sixth semester, PHT 110 is a course in Physics offered both the first and second semesters, EST 102 is a course in Basic Engineering offered by one or many departments in the second semester. These course numbers are to be given in the curriculum and syllabi.

## Departments

Each course is offered by a Department and their two-letter course prefix is given in Table 2.

**Table 2: Departments and their codes**

| SL No | Department                                                                      | Course Prefix | SL No | Department                                | Course Prefix |
|-------|---------------------------------------------------------------------------------|---------------|-------|-------------------------------------------|---------------|
| 1     | Aeronautical Engineering                                                        | AO            | 23    | Electronics and Communication Engineering | EC            |
| 2     | Agriculture Engineering                                                         | AG            | 24    | Electronics and Computer Engineering      | ER            |
| 3     | Applied Electronics and Instrumentation                                         | AE            | 25    | Electrical and Computer Engineering       | EO            |
| 4     | Artificial Intelligence                                                         | AI            | 26    | Electrical and Electronics Engineering    | EE            |
| 5     | Artificial Intelligence and Data Science                                        | AD            | 27    | Food Technology                           | FT            |
| 6     | Artificial Engineering and Machine Learning                                     | AM            | 28    | Humanities                                | HU            |
| 7     | Automobile Engineering                                                          | AU            | 29    | Industrial Engineering                    | IE            |
| 8     | Biomedical Engineering                                                          | BM            | 30    | Information Technology                    | IT            |
| 9     | Biotechnology                                                                   | BT            | 31    | Instrumentation & Control                 | IC            |
| 10    | Chemical Engineering                                                            | CH            | 32    | Mandatory Courses                         | MC            |
| 11    | Chemistry                                                                       | CY            | 33    | Mathematics                               | MA            |
| 12    | Civil Engineering                                                               | CE            | 34    | Mechanical Engineering                    | ME            |
| 13    | Civil and Environmental Engineering                                             | CN            | 35    | Mechatronics                              | MR            |
| 14    | Computer Science and Business Systems                                           | CB            | 36    | Metallurgy                                | MT            |
| 15    | Computer Science and Design                                                     | CX            | 37    | Mechanical (Auto)                         | MU            |
| 16    | Computer Science and Engineering                                                | CS            | 38    | Mechanical (Prod)                         | MP            |
| 17    | Computer Science and Engineering (Artificial Intelligence)                      | CA            | 39    | Naval & Ship Building                     | SB            |
| 18    | Computer Science and Engineering (Artificial Intelligence and Machine Learning) | CM            | 40    | Physics                                   | PH            |
| 19    | Computer Science and Engineering (Data Science)                                 | CD            | 41    | Polymer Engineering                       | PO            |
| 20    | Computer Science and Engineering (Cyber Security)                               | CC            | 42    | Production Engineering                    | PE            |
| 21    | Cyber Physical Systems                                                          | CP            | 43    | Robotics and Automation                   | RA            |
| 22    | Electronics & Biomedical                                                        | EB            | 44    | Safety & Fire Engineering                 | FS            |

**SEMESTER I**

| SLOT         | COURSE NO. | COURSES                                        | L-T-P | HOURS        | CREDIT    |
|--------------|------------|------------------------------------------------|-------|--------------|-----------|
| A            | MAT 101    | LINEAR ALGEBRA AND CALCULUS                    | 3-1-0 | 4            | 4         |
| B<br>1/2     | PHT 100    | ENGINEERING PHYSICS A                          | 3-1-0 | 4            | 4         |
|              | CYT 100    | ENGINEERING CHEMISTRY                          | 3-1-0 | 4            | 4         |
| C<br>1/2     | EST 100    | ENGINEERING MECHANICS                          | 2-1-0 | 3            | 3         |
|              | EST 110    | ENGINEERING GRAPHICS                           | 2-0-2 | 4            | 3         |
| D<br>1/2     | EST 120    | BASICS OF CIVIL & MECHANICAL ENGINEERING       | 4-0-0 | 4            | 4         |
|              | EST 130    | BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING | 4-0-0 | 4            | 4         |
| E            | HUN 101    | LIFE SKILLS                                    | 2-0-2 | 4            | --        |
| S<br>1/2     | PHL 120    | ENGINEERING PHYSICS LAB                        | 0-0-2 | 2            | 1         |
|              | CYL 120    | ENGINEERING CHEMISTRY LAB                      | 0-0-2 | 2            | 1         |
| T<br>1/2     | ESL 120    | CIVIL & MECHANICAL WORKSHOP                    | 0-0-2 | 2            | 1         |
|              | ESL 130    | ELECTRICAL & ELECTRONICS WORKSHOP              | 0-0-2 | 2            | 1         |
| <b>TOTAL</b> |            |                                                |       | <b>23/24</b> | <b>17</b> |

**SEMESTER II**

| SLOT         | COURSE NO. | COURSES                                                       | L-T-P | HOURS        | CREDIT    |
|--------------|------------|---------------------------------------------------------------|-------|--------------|-----------|
| A            | MAT 102    | VECTOR CALCULUS ,<br>DIFFERENTIAL EQUATIONS<br>AND TRANSFORMS | 3-1-0 | 4            | 4         |
| B<br>1/2     | PHT 100    | ENGINEERING PHYSICS A                                         | 3-1-0 | 4            | 4         |
|              | CYT 100    | ENGINEERING CHEMISTRY                                         | 3-1-0 | 4            | 4         |
| C<br>1/2     | EST 100    | ENGINEERING MECHANICS                                         | 2-1-0 | 3            | 3         |
|              | EST 110    | ENGINEERING GRAPHICS                                          | 2-0-2 | 4            | 3         |
| D<br>1/2     | EST 120    | BASICS OF CIVIL &<br>MECHANICAL ENGINEERING                   | 4-0-0 | 4            | 4         |
|              | EST 130    | BASICS OF ELECTRICAL &<br>ELECTRONICS<br>ENGINEERING          | 4-0-0 | 4            | 4         |
| E            | HUN 102    | PROFESSIONAL<br>COMMUNICATION                                 | 2-0-2 | 4            | --        |
| F            | EST 102    | PROGRAMMING IN C                                              | 2-1-2 | 5            | 4         |
| S<br>1/2     | PHL 120    | ENGINEERING PHYSICS<br>LAB                                    | 0-0-2 | 2            | 1         |
|              | CYL 120    | ENGINEERING CHEMISTRY<br>LAB                                  | 0-0-2 | 2            | 1         |
| T<br>1/2     | ESL 120    | CIVIL & MECHANICAL<br>WORKSHOP                                | 0-0-2 | 2            | 1         |
|              | ESL 130    | ELECTRICAL &<br>ELECTRONICS WORKSHOP                          | 0-0-2 | 2            | 1         |
| <b>TOTAL</b> |            |                                                               |       | <b>28/29</b> | <b>21</b> |

**NOTE:**

1. Engineering Physics A and Engineering Chemistry shall be offered in both semesters. Institutions can advise students belonging to about 50% of the number of branches in the Institution to opt for Engineering Physics A in S1 and Engineering Chemistry in S2 & vice versa. Students opting for Engineering Physics A in a semester should attend Physics Lab in the same semester and students opting for Engineering Chemistry in one semester should attend Engineering Chemistry Lab in the same semester

2. Engineering Mechanics and Engineering Graphics shall be offered in both semesters. Institutions can advise students belonging to about 50% of the number of branches in the Institution to opt for Engineering Mechanics in S1 and Engineering Graphics in S2 & viceversa.
3. Basics of Civil & Mechanical Engineering and Basics of Electrical & Electronics Engineering shall be offered in both semesters. Basics of Civil & Mechanical Engineering contain equal weightage for Civil Engineering and Mechanical Engineering. Slot for the course is D with CIE marks of 25 each and ESE marks of 50 each. Students belonging to branches of AEI, EI, BME, ECE, EEE, ICE, CSE, CSE(Data Science), CSE(AI), CSE(AI & ML), AI & Data Science, AI, AI & ML, IT, RA can choose this course in S1.

Basics of Electrical & Electronics Engineering contain equal weightage for Electrical Engineering and Electronics Engineering. Slot for the course is D with CIE marks of 25 each and ESE marks of 50 each. Students belonging to AERO, AUTO, CE, FSE, IE, ME, MECHATRONICS, PE, METALLURGY, BT, BCE, CHEM, FT, POLY can choose this course in S1. Students having Basics of Civil & Mechanical Engineering in one semester should attend Civil & Mechanical Workshop in the same semester and students having Basics of Electrical & Electronics Engineering in a semester should attend Electrical & Electronics Workshop in the same semester.

#### 4. LIFESKILLS

Life skills are those competencies that provide the means for an individual to be resourceful and positive while taking on life's vicissitudes. Development of one's personality by being aware of the self, connecting with others, reflecting on the abstract and the concrete, leading and generating change, and staying rooted in time-tested values and principles is being aimed at. This course is designed to enhance the employability and maximize the potential of the students by introducing them to the principles that underlie personal and professional success, and help them acquire the skills needed to apply these principles in their lives and careers.

#### 5. PROFESSIONAL COMMUNICATION

Objective is to develop in the under-graduate students of engineering a level of competence in English required for independent and effective communication for their professional needs. Coverage: Listening, Barriers to listening, Steps to overcome them, Purposive listening practice, Use of technology in the professional world. Speaking, Fluency & accuracy in speech, Positive thinking, Improving self-expression, Tonal variations, Group discussion practice, Reading, Speed reading practice, Use of extensive readers, Analytical and critical reading practice, Writing Professional Correspondence, Formal and informal letters, Tone in formal writing, Introduction to reports. Study Skills, Use of dictionary, thesaurus etc., Importance of contents page, cover & back pages, Bibliography, Language Lab.

**SEMESTER III**

| SLOT                                                       | COURSE NO. | COURSES                                   | L-T-P | HOURS      | CREDIT       |
|------------------------------------------------------------|------------|-------------------------------------------|-------|------------|--------------|
| A                                                          | MAT 203    | DISCRETE MATHEMATICAL STRUCTURES          | 3-1-0 | 4          | 4            |
| B                                                          | CST 201    | DATA STRUCTURES                           | 3-1-0 | 4          | 4            |
| C                                                          | CST 203    | LOGIC SYSTEM DESIGN                       | 3-1-0 | 4          | 4            |
| D                                                          | CST 205    | OBJECT ORIENTED PROGRAMMING USING JAVA    | 3-1-0 | 4          | 4            |
| E<br>(1/2)                                                 | EST 200    | DESIGN & ENGINEERING                      | 2-0-0 | 2          | 2            |
|                                                            | HUT 200    | PROFESSIONAL ETHICS                       | 2-0-0 | 2          | 2            |
| F                                                          | MCN 201    | SUSTAINABLE ENGINEERING                   | 2-0-0 | 2          | --           |
| S                                                          | CSL 201    | DATA STRUCTURES LAB                       | 0-0-3 | 3          | 2            |
| T                                                          | CSL 203    | OBJECT ORIENTED PROGRAMMING LAB (IN JAVA) | 0-0-3 | 3          | 2            |
| R/M                                                        | VAC        | Remedial/Minor course                     | 3-1-0 | 4          | 4            |
| <b>TOTAL</b>                                               |            |                                           |       | <b>26*</b> | <b>22/26</b> |
| * Excluding Hours to be engaged for Remedial/Minor course. |            |                                           |       |            |              |

## SEMESTER IV

| SLOT                                                               | COURSE NO. | COURSES                                | L-T-P | HOURS      | CREDIT       |
|--------------------------------------------------------------------|------------|----------------------------------------|-------|------------|--------------|
| A                                                                  | MAT 256    | PROBABILITY AND STATISTICAL MODELING   | 3-1-0 | 4          | 4            |
| B                                                                  | CST 202    | COMPUTER ORGANISATION AND ARCHITECTURE | 3-1-0 | 4          | 4            |
| C                                                                  | CST 204    | DATABASE MANAGEMENT SYSTEMS            | 3-1-0 | 4          | 4            |
| D                                                                  | CST 206    | OPERATING SYSTEMS                      | 3-1-0 | 4          | 4            |
| E<br>(1/2)                                                         | EST 200    | DESIGN & ENGINEERING                   | 2-0-0 | 2          | 2            |
|                                                                    | HUT 200    | PROFESSIONAL ETHICS                    | 2-0-0 | 2          | 2            |
| F                                                                  | MCN 202    | CONSTITUTION OF INDIA                  | 2-0-0 | 2          | --           |
| S                                                                  | ADL 202    | PYTHON AND STATISTICAL MODELING LAB    | 0-0-3 | 3          | 2            |
| T                                                                  | CSL204     | OPERATING SYSTEMS LAB                  | 0-0-3 | 3          | 2            |
| R/M/<br>H                                                          | VAC        | Remedial/Minor/Honours course          | 3-1-0 | 4          | 4            |
| <b>TOTAL</b>                                                       |            |                                        |       | <b>26*</b> | <b>22/26</b> |
| * Excluding Hours to be engaged for Remedial/Minor/Honours course. |            |                                        |       |            |              |

## NOTE:

- Design & Engineering and Professional Ethics shall be offered in both S3 and S4. Institutions can advise students belonging to about 50% of the number of branches in the Institution to opt for Design & Engineering in S3 and Professional Ethics in S4 & vice versa.
- \*All Institutions should keep 4 hours exclusively for Remedial class/Minor course (Thursdays from 3 to 5 PM and Fridays from 2 to 4 PM). If a student does not opt for minor programme, he/she can be given remedial class.



**SEMESTER V**

| SLOT                                                               | COURSE NO. | COURSES                                 | L-T-P | HOURS      | CREDIT       |
|--------------------------------------------------------------------|------------|-----------------------------------------|-------|------------|--------------|
| A                                                                  | ADT 301    | FOUNDATIONS OF DATA SCIENCE             | 3-1-0 | 4          | 4            |
| B                                                                  | CST 303    | COMPUTER NETWORKS                       | 3-1-0 | 4          | 4            |
| C                                                                  | AMT 305    | INTRODUCTION TO MACHINE LEARNING        | 3-1-0 | 4          | 4            |
| D                                                                  | AIT 307    | INTRODUCTION TO ARTIFICIAL INTELLIGENCE | 3-1-0 | 4          | 4            |
| E                                                                  | CST 309    | MANAGEMENT OF SOFTWARE SYSTEMS          | 3-0-0 | 3          | 3            |
| F                                                                  | MCN 301    | DISASTER MANAGEMENT                     | 2-0-0 | 2          | --           |
| S                                                                  | ADL 331    | AI & DATA SCIENCE LAB                   | 0-0-3 | 3          | 2            |
| T                                                                  | CSL 333    | DATABASE MANAGEMENT SYSTEMS LAB         | 0-0-3 | 3          | 2            |
| R/M/H                                                              | VAC        | Remedial/Minor/Honours Course*          | 2-0-0 | 4          | 4            |
| <b>TOTAL</b>                                                       |            |                                         |       | <b>29*</b> | <b>23/27</b> |
| * Excluding Hours to be engaged for Remedial/Minor/Honours course. |            |                                         |       |            |              |

**NOTE:**

- \*All Institutions should keep 4 hours exclusively for Remedial class/Minor/ Honours course (Tuesdays from 3 to 5 PM and Wednesdays from 3 to 5 PM). If a student does not opt for minor/honours programme, he/she can be given remedial class.

## SEMESTER VI

| SLOT                                                               | COURSE NO. | COURSES                              | L-T-P | HOURS | CREDIT |
|--------------------------------------------------------------------|------------|--------------------------------------|-------|-------|--------|
| A                                                                  | ADT 302    | CONCEPTS IN BIG DATA ANALYTICS       | 3-1-0 | 4     | 4      |
| B                                                                  | AIT 304    | ROBOTICS AND INTELLIGENT SYSTEM      | 3-1-0 | 4     | 4      |
| C                                                                  | CST 306    | ALGORITHM ANALYSIS AND DESIGN        | 3-1-0 | 4     | 4      |
| D                                                                  | ADT ---    | PROGRAM ELECTIVE I                   | 2-1-0 | 3     | 3      |
| E                                                                  | HUT 300    | INDUSTRIAL ECONOMICS & FOREIGN TRADE | 3-0-0 | 3     | 3      |
| F                                                                  | ADT 308    | COMPREHENSIVE COURSE WORK            | 1-0-0 | 1     | 1      |
| S                                                                  | ADL 332    | BIGDATA ANALYTICS LAB                | 0-0-3 | 3     | 2      |
| T                                                                  | ADD 334    | MINIPROJECT                          | 0-0-3 | 3     | 2      |
| R/M/H                                                              | VAC        | Remedial/Minor/Honours course*       | 3-1-0 | 4     | 4      |
| TOTAL                                                              |            |                                      |       | 25*   | 23/27  |
| * Excluding Hours to be engaged for Remedial/Minor/Honours course. |            |                                      |       |       |        |

**Note:**

**Electives:** This curriculum envisages to offer a learner an opportunity to earn proficiency in one of the five trending areas in Computer Science/Artificial Intelligence and Data Science, namely Security in Computing, Computer Programming, Machine Learning Infrastructures, Computer Vision and Computational Linguistics. Three courses each from the above areas are included through Elective Courses in different Elective Buckets. For example, a learner who is interested in the *Computer Security* area may opt to take the elective courses - *Foundations in Security in Computing* from Elective-I in S6, *Security in Computing* from Elective-II in S7 and *Network Security Protocols* from Elective-III in S8. The Department may offer Elective Courses to enable students to utilize this opportunity, depending on the availability of faculty. The courses included from these areas under various Elective Buckets are shown in the table below.

| Different Specializations introduced through various Elective Buckets |                                  |                                                          |                                             |                                    |
|-----------------------------------------------------------------------|----------------------------------|----------------------------------------------------------|---------------------------------------------|------------------------------------|
| Bucket                                                                | Specialization                   | Semester                                                 |                                             |                                    |
|                                                                       |                                  | S6                                                       | S7                                          | S8                                 |
| 1                                                                     | Security in Computing            | FOUNDATIONS OF SECURITY IN COMPUTING (E-I)               | SECURITY IN COMPUTING (E-II)                | NETWORK SECURITY PROTOCOLS (E-III) |
| 2                                                                     | Computer Programming             | PROGRAMMING IN R (E-I)                                   | WEB PROGRAMMING (E-II)                      | PROGRAMMING PARADIGMS (E-III)      |
| 3                                                                     | Machine Learning Infrastructures | MACHINE LEARNING MODELS AND STORAGE MANAGEMENT (E-I)     | CLOUD COMPUTING (E-II)                      | GPU COMPUTING (E-III)              |
| 4                                                                     | Computer Vision                  | CONCEPTS IN COMPUTER GRAPHICS AND IMAGE PROCESSING (E-I) | INFORMATION EXTRACTION AND RETRIEVAL (E-II) | COMPUTER VISION (E-III)            |
| 5                                                                     | Computational Linguistics        | ARTIFICIAL NEURAL NETWORKS (E-I)                         | NATURAL LANGUAGE PROCESSING (E-II)          | COMPUTATIONAL LINGUISTICS (E-V)    |

## PROGRAM ELECTIVE I

| SLOT | COURSE NO. | COURSES                                               | L-T-P | HOURS | CREDIT |
|------|------------|-------------------------------------------------------|-------|-------|--------|
| D    | AIT 312    | i. RECOMMENDATION SYSTEM                              | 2-1-0 | 3     | 3      |
|      | AIT 322    | ii CONCEPTS IN COMPUTER GRAPHICS AND IMAGE PROCESSING | 2-1-0 |       |        |
|      | CST 332    | iii FOUNDATIONS OF SECURITY IN COMPUTING              | 2-1-0 |       |        |
|      | ADT 342    | iv DATA VISUALIZATION                                 | 2-1-0 |       |        |
|      | AIT 352    | v ARTIFICIAL NEURAL NETWORKS TECHNIQUES               | 2-1-0 |       |        |
|      | AIT 362    | vi PROGRAMMING IN R                                   | 2-1-0 |       |        |
|      | AMT 372    | vii MACHINE LEARNING MODELS AND STORAGE MANAGEMENT    | 2-1-0 |       |        |

**COURSES TO BE CONSIDERED FOR COMPREHENSIVE COURSE WORK**

|                                    |
|------------------------------------|
| i INTRODUCTION TO MACHINE LEARNING |
| ii DATA STRUCTURES                 |
| iii OPERATING SYSTEMS              |
| iv DATABASE MANAGEMENT SYSTEMS     |
| v FOUNDATIONS OF DATA SCIENCE      |

**NOTE:**

1. \*All Institutions should keep 4 hours exclusively for Remedial class/Minor/Honours course (Tuesdays from 3 to 5 PM and Wednesdays from 2 to 4 PM). If a student does not opt for a minor/honours programme, he/she can be given remedial class.
2. Comprehensive Course Work: The comprehensive course work in the sixth semester of study shall have a written test of 50 marks. The written examination will be of objective type similar to the GATE examination and will be conducted by the University. Syllabus for comprehensive examination shall be prepared by the respective BoS choosing the above listed 6 core courses studied from semesters 3 to 5. The pass minimum for this course is 25. The course should be mapped with a faculty and classes shall be arranged for practicing questions based on the core courses listed in the curriculum.
3. Mini project: It is introduced in the sixth semester with a specific objective to strengthen the understanding of student's fundamentals through effective application of theoretical concepts. Mini project can help to boost their skills and widen the horizon of their thinking. The ultimate aim of an engineering student is to resolve a problem by applying theoretical knowledge. Doing more projects increases problem-solving skills. Student Groups with 3 or 4 members should identify a topic of interest in consultation with Faculty/Advisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carry Out the design/fabrication or develop codes/programs to achieve the objectives. Demonstrate the novelty of the project through the results and outputs. The progress of the mini project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The product has to be

demonstrated for its full design specifications. Innovative design concepts, reliability considerations, aesthetics/ergonomic aspects taken care of in the project shall be given due weight. The internal evaluation will be made based on the product, the report and a viva-voce examination, conducted internally by a 3 member committee appointed by the Head of the Department comprising HoD or a senior faculty member, Mini Project coordinator for that program and project guide.

Total marks: 150 - CIE 75 marks and ESE 75

Marks Split up for CIE

|                |    |
|----------------|----|
| Attendance     | 10 |
| Project Guide  | 15 |
| Project Report | 10 |

Evaluation by the Committee (will be evaluating the level of completion and demonstration of functionality/specifications, presentation, oral examination, work knowledge and involvement) 40

## SEMESTER VII

| SLOT                                                               | COURSE NO. | COURSES                        | L-T-P | HOURS      | CREDIT       |
|--------------------------------------------------------------------|------------|--------------------------------|-------|------------|--------------|
| A                                                                  | AIT 401    | FOUNDATIONS OF DEEP LEARNING   | 2-1-0 | 3          | 3            |
| B                                                                  | ADT ---    | PROGRAM ELECTIVE II            | 2-1-0 | 3          | 3            |
| C                                                                  | CST ---    | OPEN ELECTIVE                  | 2-1-0 | 3          | 3            |
| D                                                                  | MCN401     | INDUSTRIAL SAFETY ENGINEERING  | 2-1-0 | 3          | ---          |
| S                                                                  | AIL 411    | DEEP LEARNING LAB              | 0-0-3 | 3          | 2            |
| T                                                                  | ADQ 413    | SEMINAR                        | 0-0-3 | 3          | 2            |
| U                                                                  | ADD 415    | PROJECT PHASE I                | 0-0-6 | 6          | 2            |
| R/M/H                                                              | VAC        | Remedial/Minor/Honours course* | 3-1-0 | 4          | 4            |
| <b>TOTAL</b>                                                       |            |                                |       | <b>24*</b> | <b>15/19</b> |
| * Excluding Hours to be engaged for Remedial/Minor/Honours course. |            |                                |       |            |              |

## PROGRAM ELECTIVE II

| SLOT | COURSE NO. | COURSES                                                     | L-T-P | HOURS | CREDIT |
|------|------------|-------------------------------------------------------------|-------|-------|--------|
| B    | AIT 413    | i. ADVANCED CONCEPTS OF MICROPROCESSOR AND MICRO CONTROLLER | 2-1-0 | 3     | 3      |
|      | CST 423    | ii CLOUD COMPUTING                                          | 2-1-0 |       |        |
|      | CST 433    | iii. SECURITY IN COMPUTING                                  | 2-1-0 |       |        |
|      | AIT 443    | iv. CONCEPTS IN COMPILER DESIGN                             | 2-1-0 |       |        |
|      | ADT 453    | v.INFORMATION EXTRACTION AND RETRIEVAL                      | 2-1-0 |       |        |
|      | CST 463    | vi. WEB PROGRAMMING                                         | 2-1-0 |       |        |
|      | CST 473    | vii NATURAL LANGUAGE PROCESSING                             | 2-1-0 |       |        |

## OPEN ELECTIVE

The open elective is offered in semester 7. Each program should specify the courses (maximum 5) they would like to offer as electives for other programs. The courses listed below are offered by the department of CSE (Data Science), CSE (Artificial Intelligence ) CSE(AI & Machine Learning) AI & Data Science), Artificial Intelligence, Artificial Intelligence & Machine Learning for students of other under graduate branches except for students of Computer Science & Engineering and Information Technology departments, offered in the colleges under APJAKTU.

| SLOT | COURSE NO. | COURSES                            | L-T-P | HOURS | CREDIT |
|------|------------|------------------------------------|-------|-------|--------|
| C    | CST 415    | i INTRODUCTION TO MOBILE COMPUTING | 2-1-0 | 3     | 3      |
|      | CST 425    | ii INTRODUCTION TO DEEP LEARNING   | 2-1-0 |       |        |
|      | CST 435    | iii COMPUTER GRAPHICS              | 2-1-0 |       |        |
|      | CST 445    | iv PYTHON FOR ENGINEERS            | 2-1-0 |       |        |
|      | CST 455    | v OBJECT ORIENTED CONCEPTS         | 2-1-0 |       |        |

**NOTE :**

1. \*All Institutions should keep 4 hours exclusively for Remedial class/Minor/Honours course (Mondays from 10 to 12 and Wednesdays from 10 to 12 Noon). If a student does not opt for minor/honours programme, he/she can be given remedial class.
2. Seminar: To encourage and motivate the students to read and collect recent and reliable information from their area of interest confined to the relevant discipline from technical publications including peer reviewed journals, conference, books, project reports etc., prepare a report based on a central theme and present it before a peer audience. Each student shall present the seminar for about 20 minutes duration on the selected topic. The report and the presentation shall be evaluated by a team of faculty members comprising Academic coordinator for that program, seminar coordinator and seminar guide based on style of presentation, technical content, adequacy of references, depth of knowledge and overall quality of the report.

Total marks: 100, only CIE, minimum required to pass 50

|               |    |
|---------------|----|
| Attendance    | 10 |
| Seminar Diary | 10 |
| Guide         | 20 |
| Report        | 20 |
| Presentation  | 40 |

3. Project Phase I: The course 'Project Work' is mainly intended to evoke the innovation and invention skills in a student. The course will provide an opportunity to synthesize and apply the knowledge and analytical skills learned, to be developed as a prototype or simulation. The project extends to 2 semesters and will be evaluated in the 7th and 8th semester separately, based on the achieved objectives. One third of the project credits shall be completed in 7th semester and two third in 8th semester. It is recommended that the projects may be finalized in the thrust areas of the respective engineering stream or as interdisciplinary projects. Importance should be given to address societal problems and developing indigenous technologies. The assignment to normally include:
  - Literature study/survey of published literature on the assigned topic
  - Formulation of objectives
  - Formulation of hypothesis/ design/ methodology
  - Formulation of work plan and task allocation.
  - Block level design documentation
  - Seeking project funds from various agencies
  - Preliminary Analysis/Modeling/Simulation/Experiment/ Design/Feasibility study
  - Preparation of Phase 1 report

Total marks: 100, only CIE, minimum required to pass 50

|                                                |    |
|------------------------------------------------|----|
| Guide                                          | 30 |
| Interim evaluation by the Evaluation committee | 20 |
| Final evaluation by the Evaluation committee   | 30 |
| Phase – I Report (By Evaluation committee)     | 20 |

The evaluation committee comprises HoD or a senior faculty member, Project coordinator and project supervisor.

**SEMESTER VIII**

| SLOT                                                               | COURSE NO. | COURSES                       | L-T-P  | HOURS      | CREDIT       |
|--------------------------------------------------------------------|------------|-------------------------------|--------|------------|--------------|
| A                                                                  | ADT 402    | BUSINESS ANALYTICS            | 2-1-0  | 3          | 3            |
| B                                                                  | ADT ---    | PROGRAM ELECTIVE III          | 2-1-0  | 3          | 3            |
| C                                                                  | ADT ---    | PROGRAM ELECTIVE IV           | 2-1-0  | 3          | 3            |
| D                                                                  | ADT ---    | PROGRAM ELECTIVE V            | 2-1-0  | 3          | 3            |
| T                                                                  | ADT 404    | COMPREHENSIVE COURSE VIVA     | 1-0-0  | 1          | 1            |
| U                                                                  | ADD 416    | PROJECT PHASE II              | 0-0-12 | 12         | 4            |
| R/M/H                                                              | VAC        | Remedial/Minor/Honours course | 3-1-0  | 4          | 4            |
| <b>TOTAL</b>                                                       |            |                               |        | <b>25*</b> | <b>17/21</b> |
| * Excluding Hours to be engaged for Remedial/Minor/Honours course. |            |                               |        |            |              |

**PROGRAM ELECTIVE III**

| SLOT | COURSE NO. | COURSES                             | L-T-P | HOURS | CREDIT |
|------|------------|-------------------------------------|-------|-------|--------|
| B    | AMT 414    | i. GPU COMPUTING                    | 2-1-0 | 3     | 3      |
|      | CST 424    | ii PROGRAMMING PARADIGMS            | 2-1-0 |       |        |
|      | CST 434    | iii NETWORK SECURITY PROTOCOLS      | 2-1-0 |       |        |
|      | CST 444    | iv SOFT COMPUTING                   | 2-1-0 |       |        |
|      | CST 454    | v FUZZY SET THEORY AND APPLICATIONS | 2-1-0 |       |        |
|      | CST 464    | vi EMBEDDED SYSTEMS                 | 2-1-0 |       |        |
|      | CST 474    | vii COMPUTER VISION                 | 2-1-0 |       |        |



## PROGRAM ELECTIVE IV

| SLOT | COURSE NO. | COURSES                                  | L-T-P | HOURS | CREDIT |
|------|------------|------------------------------------------|-------|-------|--------|
| C    | AMT 416    | i. HUMAN COMPUTER INTERACTION            | 2-1-0 | 3     | 3      |
|      | AIT 426    | ii MINING OF MASSIVE DATASETS            | 2-1-0 |       |        |
|      | CST 436    | iii PARALLEL COMPUTING                   | 2-1-0 |       |        |
|      | CST 446    | iv DATA COMPRESSION TECHNIQUES           | 2-1-0 |       |        |
|      | AIT 456    | v INTRODUCTION TO REINFORCEMENT LEARNING | 2-1-0 |       |        |
|      | CST 466    | vi DATA MINING                           | 2-1-0 |       |        |
|      | AIT 476    | vii BIO-INSPIRED OPTIMIZATION TECHNIQUES | 2-1-0 |       |        |

## PROGRAM ELECTIVE V

| SLOT | COURSE NO. | COURSES                        | L-T-P | HOURS | CREDIT |
|------|------------|--------------------------------|-------|-------|--------|
| D    | CST 418    | i HIGH PERFORMANCE COMPUTING   | 2-1-0 | 3     | 3      |
|      | CST 428    | ii BLOCK CHAIN TECHNOLOGIES    | 2-1-0 |       |        |
|      | CST 438    | iii IMAGE PROCESSING TECHNIQUE | 2-1-0 |       |        |
|      | CST 448    | iv INTERNET OF THINGS          | 2-1-0 |       |        |
|      | CST 458    | v SOFTWARE TESTING             | 2-1-0 |       |        |
|      | CST 468    | vi BIOINFORMATICS              | 2-1-0 |       |        |
|      | CST 478    | vii COMPUTATIONAL LINGUISTICS  | 2-1-0 |       |        |

## NOTE:

- \*All Institutions should keep 4 hours exclusively for Remedial class/Minor/Honours course (Mondays from 10 to 12 and Wednesdays from 10 to 12 PM). If a student does not opt for minor/honours programme, he/she can be given remedial class.

2. **Comprehensive Viva Voce:** The comprehensive viva voce in the eighth semester of study shall have a viva voce for 50 marks. The viva voce shall be conducted based on the core subjects studied from third to eighth semester. The viva voce will be conducted by the same three member committee assigned for final project phase II evaluation towards the end of the semesters. The pass minimum for this course is 25. The course should be mapped with a faculty and classes shall be arranged for practicing questions based on the core courses listed in the curriculum. The mark will be treated as internal and should be uploaded along with internal marks of other courses.
3. **Project Phase II:** The objective of Project Work Phase II & Dissertation is to enable the student to extend further the investigative study taken up in Project Phase I, either fully theoretical/practical or involving both theoretical and practical work, under the mentoring of a Project Guide from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment shall normally include:
  - In depth study of the topic assigned in the light of the Report prepared under Phase I;
  - Review and finalization of the Approach to the Problem relating to the assigned topic;
  - Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
  - Final development of product/process, testing, results, conclusions and future directions;
  - Preparing a paper for Conference presentation/Publication in Journals, if possible;
  - Preparing a Dissertation in the standard format for being evaluated by the Department;
  - Final Presentation before a Committee

Total marks: 150, only CIE, minimum required to pass 75

|                                                            |      |
|------------------------------------------------------------|------|
| Guide                                                      | : 30 |
| Interim evaluation, 2 times in the semester by a committee | : 50 |
| Quality of the report evaluated by the above committee     | : 30 |

(The evaluation committee comprises HoD or a senior faculty member, Project coordinator and project supervisor).

Final evaluation by the final evaluation committee : 40

(The final evaluation committee comprises Project coordinator, expert from Industry/research Institute and a senior faculty from a sister department. The same committee will conduct Comprehensive for 50 marks).

## MINOR

Minor is an additional credential a student may earn if she/he does 20 credits worth of additional learning in a discipline other than her/his major discipline of B. Tech degree. The objective is to permit a student to customize their Engineering degree to suit their specific interests. Upon completion of an Engineering Minor, a student will be better equipped to perform interdisciplinary research and will be better employable. Engineering Minors allow a student to gain interdisciplinary experience and exposure to concepts and perspectives that may not be a part of their major degree programs.

The academic units offering minors in their discipline will prescribe the set of courses and/or other activities like projects necessary for earning a minor in that discipline. A

specialist bucket of 3-6 courses is identified for each Minor. Each bucket may rest on one or more foundation courses. A bucket may have sequences within it, i.e., advanced courses may rest on basic courses in the bucket. She/he accumulates credits by registering for the required courses, and if the requirements for a particular minor are met within the time limit for the course, the minor will be awarded. This will be mentioned in the Degree Certificate as “Bachelor of Technology in xxx with Minor in yyy”. The fact will also be reflected in the consolidated grade card, along with the list of courses taken. If one specified course cannot be earned during the course of the programme, that minor will not be awarded. The individual course credits earned, however, will be reflected in the consolidated grade card.

(i) The curriculum/syllabus committee/BoS shall prepare syllabus for courses to be included in the curriculum from third to eight semesters for all branches. The minor courses shall be identified by M slot courses.

(ii) Registration is permitted for Minor at the beginning of third semester. Total credits required to award B. Tech with Minor is 182 (162 +20)

(iii) Out of the 20 Credits, 12 credits shall be earned by undergoing a minimum of three courses, of which one course shall be a mini project based on the chosen area. They can do mini project either in S7 or in S8. The remaining 8 credits could be acquired through 2 MOOCs recommended by the Board of Studies and approved by the Academic Council or 2 courses from the minor buckets listed here. The classes for Minor shall be conducted along with regular classes and no extra time shall be required for conducting the courses.

(iv) There won't be any supplementary examination for the courses chosen for Minor.

(v) On completion of the program, “Bachelor of Technology in xxx with Minor in yyy” will be awarded if the registrant earn 20 credits from the minor courses.

The registration for minor program will commence from semester 3 and all the academic units offering minors in their discipline should prescribe set of such courses. The courses shall be grouped into maximum of 5 buckets. The bucket of courses may have sequences within it, i.e., advanced courses may rest on basic courses in the bucket. Reshuffling of courses between various buckets will not be allowed. There is option to skip any two courses listed here and to opt for equivalent MOOC courses approved by the Academic Council. In any case, they should carry out a mini project based on the chosen area in S7 or S8. For example: For example: Students who have registered for **B.Tech Minor in Artificial Intelligence and Data Science** can opt to study the courses listed in minor baskets under Computer Science & Engineering Programme.

## HONOURS

### B.TECH ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Honours is an additional credential a student may earn if she/he opts for the extra 20 credits needed for this in her/his own discipline. Honours is not indicative of a class. The University is providing this option for academically extra brilliant students to acquire Honours. Honours is intended for a student to *gain expertise/get specialized* in an area inside his/her major B. Tech discipline and to enrich knowledge in emerging/advanced areas in the concerned branch of engineering. It is particularly suited for students aiming to pursue higher studies. Upon completion of Honours, a student will be better equipped to perform research in her/his branch of engineering. On successful accumulation of credits at the end of the programme, this will be mentioned in the Degree Certificate as “Bachelor of Technology in xxx, with Honours.” The fact will also be reflected in the consolidated grade card, along with the list of courses taken. If a student is not earning credits for any one of the specified course for getting Honours, she/he is not entitled to get Honours. The individual course credits earned, however, will be reflected in the consolidated grade card.

The courses shall be grouped into maximum of 3 buckets, each bucket representing a particular specialization in the branch. The students shall select only the courses from same bucket in all semesters. It means that the specialization is to be fixed by the student and cannot be changed subsequently. The internal evaluation, examination and grading shall be exactly as for other mandatory courses. The Honours courses shall be identified by H slot courses.

- (i) The curriculum/syllabus committee/BoS shall prepare syllabus for courses to be included in the curriculum from fourth to eight semesters for all branches. The Honours courses shall be identified by H slot courses.
- (ii) Registration is permitted for Honours at the beginning of fourth semester. Total credits required is 182 (162 +20).
- (iii) Out of the 20 Credits, 12 credits shall be earned by undergoing a minimum of three courses, of which one course shall be a mini project based on the chosen area. The remaining 8 credits could be acquired through 2 MOOCs recommended by the Board of studies and approved by the Academic Council or 2 courses from the same bucket as the above 3 courses. The classes for Honours shall be conducted along with regular classes and no extra time shall be required for conducting the courses. The students should earn a grade of ‘C’ or better for all courses under Honours.
- (iv) There won’t be any supplementary examination for the courses chosen for Honours.
- (v) On successful accumulation of credits at the end of the programme, “Bachelor of Technology in xxx, with Honours” will be awarded if overall CGPA is greater than or equal to 8.5, earned a grade of ‘C’ or better for all courses chosen for Honours and there is no history of ‘F’ Grade in the entire span of the B. Tech Course.
- (vi) The registration for Honours program will commence from semester 4 and the all academic units offering Honours in their discipline should prescribe set of such courses. The courses shall be grouped into maximum of 5 buckets, each bucket representing a particular specialization in the branch. The students shall select only the courses from same bucket in all semesters. It means that the

specialization is to be fixed by the student and cannot be changed subsequently. There is option to skip any two courses listed here if required, and to opt for equivalent MOOC courses approved by the Academic Council. In any case, they should carry out a mini project based on the chosen area in S8. For example: Students who have registered for **B.Tech in Artificial Intelligence and Data Science with Honours** can opt to study the courses listed in one of the buckets shown below:

| HONOURS BUCKETS                                                                         |                                        |                          |           |                |                                       |                                               |           |                |                                 |                                      |           |                |  |
|-----------------------------------------------------------------------------------------|----------------------------------------|--------------------------|-----------|----------------|---------------------------------------|-----------------------------------------------|-----------|----------------|---------------------------------|--------------------------------------|-----------|----------------|--|
| S<br>E<br>M<br>E<br>S<br>T<br>E<br>R                                                    | BUCKET-1                               |                          |           |                | BUCKET-2                              |                                               |           |                | BUCKET-3                        |                                      |           |                |  |
|                                                                                         | Specialization - Security in Computing |                          |           |                | Specialization –Computational Biology |                                               |           |                | Specialization –Computer Vision |                                      |           |                |  |
|                                                                                         | CO<br>URS<br>E<br>NO                   | COURSE NAME              | HO<br>URS | CR<br>ED<br>IT | CO<br>URS<br>E<br>NO                  | COURSE NAME                                   | HO<br>URS | CR<br>ED<br>IT | CO<br>URS<br>E<br>NO            | COURSE NAME                          | HO<br>URS | CR<br>ED<br>IT |  |
| S4                                                                                      | CST 292                                | NUMBER THEORY            | 4         | 4              | AIT 294                               | COMPUTATIONAL FUNDAMENTALS FOR BIOINFORMATICS | 4         | 4              | AIT 296                         | ADVANCED TOPICS IN COMPUTER GRAPHICS | 4         | 4              |  |
| S5                                                                                      | CST 393                                | CRYPTOGRAPHIC ALGORITHMS | 4         | 4              | AIT 395                               | COMPUTATIONAL BIOLOGY                         | 4         | 4              | AIT 397                         | ADVANCED CONCEPTS IN COMPUTER VISION | 4         | 4              |  |
| S6                                                                                      | CST 394                                | NETWORK SECURITY         | 4         | 4              | AIT 396                               | MACHINE LEARNING IN COMPUTATIONAL BIOLOGY     | 4         | 4              | AIT 398                         | IMAGE AND VIDEO PROCESSING           | 4         | 4              |  |
| S7                                                                                      | CST 495                                | CYBER FORENSICS          | 4         | 4              | AIT 497                               | COMPUTATIONAL HEALTH INFORMATICS              | 4         | 4              | AIT 499                         | SURVEILLANCE VIDEO ANALYTICS         | 4         | 4              |  |
| S8                                                                                      | ADD 496                                | MINI PROJECT             | 4         | 4              | ADD 496                               | MINI PROJECT                                  | 4         | 4              | ADD 496                         | MINI PROJECT                         | 4         | 4              |  |
| Note: Name of the specialization shall be mentioned in the Honours Degree to be awarded |                                        |                          |           |                |                                       |                                               |           |                |                                 |                                      |           |                |  |

## INDUCTION PROGRAM

There will be three weeks induction program for first semester students. It is a unique three-week immersion Foundation Programme designed specifically for the fresher's which includes a wide range of activities right from workshops, lectures and seminars to sports tournaments, social works and much more. The programme is designed to mould students into well-rounded individuals, aware and sensitized to local and global conditions and foster their creativity, inculcate values and ethics, and help students to discover their passion. Foundation Programme also serves as a platform for the fresher's to interact with their batch-mates and seniors and start working as a team with them. The program is structured around the following five themes:

The programme is designed keeping in mind the following objectives:

- **Values and Ethics:** Focus on fostering a strong sense of ethical judgment and moral fortitude.
- **Creativity:** Provide channels to exhibit and develop individual creativity by expressing themselves through art, craft, music, singing, media, dramatics, and other creative activities.
- **Leadership, Communication and Teamwork:** Develop a culture of teamwork and group communication.
- **Social Awareness:** Nurture a deeper understanding of the local and global world and our place in it as concerned citizens of the world.
- **Physical Activities & Sports:** Engage students in sports and physical activity to ensure healthy physical and mental growth.

