Annexure I

NOIDA INTERNATIONAL UNIVERSITY



**School of Engineering & Technology**

**SCHEME OF EVALUATION**

**For**

**BACHELOR OF TECHNOLOGY in Computer Science & Engineering**

**[B. Tech. (CSE)]**

**With Minor Specialization in Artificial Intelligence & Machine Learning**

**(Four Year Honours Under Graduate Degree Program)**

**W.e.f. Academic Session 2022-2023 onwards**

**Program Curriculum**

**FOR B. Tech. (CSE-AI&ML)**

**(Effective from Academic Session 2022-2023)**

B. Tech. in Computer Science and Engineering (Artificial Learning and Machine Learning) is undoubtedly one of the most sought-after specializations of Engineering. B. Tech. (CSE-AI&ML) is a Four-Year Undergraduate program with strong focus on students’ learning in the modern fields of Artificial Intelligence and Machine Learning which are the harbinger of Digital Transformation worldwide. Artificial Intelligence (AI) refers to the deployment of machines to enable them to perform tasks with intelligence similar to humans and Machine Learning (ML) gives computers the ability to learn without being explicitly programmed. Machine learning is a subfield of artificial intelligence (AI). The goal of machine learning generally is to understand the structure of data and fit that data into models that can be understood and utilized by people. Machine learning allow for computers to train on data inputs and use statistical analysis in order to output values that fall within a specific range. Machine learning facilitates computers in building models from sample data in order to automate decision-making processes based on data inputs.

**Program Educational Objectives (POs)**

The Department of Computer Science & Engineering has developed and maintained a well-defined set of Program Educational Objectives and desired Program Outcomes. Educational objectives of the program cater to the requirements of the stakeholders such as students, parents, employers, alumni, faculty etc. The Program Educational Objectives are as follows:

After few years of Graduation, the Graduates of **B. Tech. (CSE-Artificial Intelligence & Machine Learning)** will be able to:

* **PEO1:**  Demonstrate technical skills, competency in AI & ML and exhibit team management capability with proper communication in a job environment.
* **PEO2:** Support the growth of economy of our country by starting enterprise with a lifelong learning attitude
* **PEO3:**  Carry out research in the advanced areas of AI & ML and address the basic needs of the society.

**Program Outcomes (POs)**

***On successful completion of B. Tech. (CSE-AI&ML) Engineering Graduates will be able to:***

* **PO**1. **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
* **PO**2. **Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
* **PO**3. **Design/Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
* **PO**4. **Conduct Investigations of Complex Problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
* **PO**5. **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
* **PO**6. **The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
* **PO**7. **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
* **PO**8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
* **PO**9. **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
* **PO**10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
* **PO**11. **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
* **PO**12**. Life-Long Learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**Program Specific Outcomes (PSOs)**

On successful completion of the program, the graduates of B. Tech CSE (**Artificial Intelligence & Machine Learning**) program will be able to:

* **PSO1:** Understand, Analyse and Demonstrate the knowledge of human cognition, Artificial Intelligence, Machine Learning and data engineering for designing intelligent systems.
* **PSO2:** Develop andApply computational knowledge and project development skills to provide innovative solutions.
* **PSO3:** Use tools and techniques to solve problems in AI & ML.

**Credit System-**Credit requirement for award of B.Tech:

* + Every semester shall offer a minimum of **12 credits** and a maximum of 27 **credits**.
	+ Credits for the Project or Thesis can vary from 10 to 15.
	+ The total number of credits for the B. tech Degree Course could vary from a **minimum of 158** credits to a

**Maximum of 180** credits.

* + All courses of study put together would engage the students for a **minimum of 26 periods** or hours of study a week and a **maximum of 30 periods** or hours a week.

While calculating credits the following guidelines shall be adopted, namely: -

* + 1 Hr. Lecture (L) per week 1 credit
	+ 1 Hr. Tutorial (T) per week 1 credit
	+ 1 Hr. Practical (P) per week 0.5
	+ 2 Hours Practical(Lab)/week 1 credit

**Credit distribution in each semester** (158 credits to 8 semesters)

|  |  |
| --- | --- |
| **Semester** | Total Credits |
| 1st | 20.5 |
| 2nd | 17.5 |
| 3rd | 26 |
| 4th | 25 |
| 5th | 27 |
| 6th | 25 |
| 7th | 22 |
| 8th | 16 |
| Total | **179** |

**Course coding system**

Every course coded as follows:

BSC : Basic Science Courses

ESC : Engineering Science Course MC : Mandatory Courses

HSMC : Humanities and Social Sciences including Management

PCC : Program core courses PEC : Program Elective courses OEC : Open Elective courses

## Bachelor of Technology-CSE [AI & ML]

### First Semester

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **COURSE** | **Contact Hours/Week** | **Credit** | **Evaluation Scheme** |  |
| **Code** | **Course Title** | **L** | **T** | **P** | **CA** | **TA** | **Int. Total** | **Ext.** | **Total** |  |
| BSC 103 | Mathematics –I |  3 | 1 | 0 | 4 | 20 | 20 | 40 | 60 | 100 |  |
| BSC102 | Chemistry-I |  3 | 1 | 0 | 4 | 20 | 20 | 40 | 60 | 100 |  |
| HSMC 101 | English |  2 | 0 | 0 | 2 | 20 | 20 | 40 | 60 | 100 |  |
| ESC103 | Programming for Problem Solving  |  3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |  |
| ESC102 | Engineering Graphics & Design |  1 | 0 | 0 | 1 | 20 | 20 | 40 | 60 | 100 |  |
|  | Induction Program | - | - | - |  |  |  |  |  |  |  |
| **PRACTICALS** |  |
|  BSC 102P | Chemistry-I Lab | 0 | 0 | 3 | 1.5 | 20 | 20 | 40 | 60 | 100 |  |
| ESC103P | Programming forProblem Solving Lab | 0 | 0 | 4 | 2 | 20 | 20 | 40 | 60 | 100 |  |
| ESC102P | Engineering graphics & Design Lab | 0 | 0 | 4 | 2 | 20 | 20 | 40 | 60 | 100 |  |
| HSMC101P | English Lab | 0 | 0 | 2 | 1 | 20 | 20 | 40 | 60 | 100 |  |
| **Total** | **0** | **0** | **13** | **20.5** |  |  |  |  |  |
| **SECOND SEMESTER** |  |
| BSC101 |  Physics | 3 | 1 | 0 | 4 | 20 | 20 | 40 | 60 | 100 |  |
| BSC 104 |  Mathematics –II | 3 | 1 | 0 | 4 | 20 | 20 | 40 | 60 | 100 |  |
| ESC104 | Workshop/Manufacturing Practices | 1 | 0 | 0 | 1 | 20 | 20 | 40 | 60 | 100 |  |
| ESC101 | Basic Electrical Engineering | 3 | 1 | 0 | 4 | 20 | 20 | 40 | 60 | 100 |  |
| AECC01 | Environmental Studies | 2 | 0 | 0 | 0 | 20 | 20 | 40 | 60 | 100 |  |
| **PRACTICALS** |  |
| BSC101P | Physics Lab | 0 | 0 | 3 | 1.5 | 20 | 20 | 40 | 60 | 100 |
| ESC102P | Workshop/Manufacturing Practices | 0 | 0 | 4 | 2 | 20 | 20 | 40 | 60 | 100 |
| ESC101P | Basic Electrical EngineeringLab | 0 | 0 | 2 | 1 | 20 | 20 | 40 | 60 | 100 |
| **Total** | **12** | **3** | **9** | **17.5** |  |  |  |  |  |

### THIRD SEMESTER

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **COURSE** | **Contact Hours/Week** | **Credit** | **Evaluation Scheme** |  |
| **Code** | **Course Title** | **L** | **T** | **P** | **CA** | **TA** | **Int. Total** | **Ext.** | **Total** |  |
| BSC301 | Discrete Mathematics | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |  |
| ESC301 | Analog Electronic Circuits | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |  |
| ESC302 | Digital Electronics | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |  |
| PCC-CS301 | Data Structure & Algorithms | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |  |
| PCC-CS302 | IT Workshop | 1 | 0 | 0 | 1 | 20 | 20 | 40 | 60 | 100 |  |
| HSMC301 | Humanities –I (Human psychology) | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |  |
| AIML01 | Introduction to Python | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |  |
| **PRACTICALS** |  |
| ESC301P | Analog Electronic Circuits Lab | 0 | 0 | 4 | 2 | 20 | 20 | 40 | 60 | 100 |  |
| ESC302P | Digital Electronics Lab | 0 | 0 | 4 | 2 | 20 | 20 | 40 | 60 | 100 |  |
| PCC- CS301P | Data Structure & Algorithms Lab | 0 | 0 | 2 | 1 | 20 | 20 | 40 | 60 | 100 |  |
| PCC-CS302 P | IT Workshop (MATLAB) Lab | 0 | 0 | 2 | 1 | 20 | 20 | 40 | 60 | 100 |  |
| AIML01P | Introduction to Python Lab | 0 | 0 | 2 | 1 | 20 | 20 | 40 | 60 | 100 |  |
| **Total** | **19** | **0** | **14** | **26** |  |  |  |  |  |
| **FOURTH SEMESTER** |  |
| PCC-CS401 | Computer Based Numerical & Statistical Techniques | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |  |
| PCC-CS402 | Computer Organization & Architecture | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |  |
| PCC-CS403 | Operating Systems | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |  |
| PCC-CS404 | Design &Analysis of Algorithms | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |  |
| HSMC-401 | Humanities –II (Human Values) | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |  |
| BSC-401 | Biology | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |  |
| AIML02 | Introduction to Artificial Intelligence and Machine Learning  | 4 | 0 | 0 | 4 | 20 | 20 | 40 | 60 | 100 |  |
| PRACTICALS |  |
| PCC- CS402P | Computer Organization & Architecture Lab | 0 | 0 | 2 | 1 | 20 | 20 | 40 | 60 | 100 |
| PCC- CS403P | Operating Systems Lab | 0 | 0 | 2 | 1 | 20 | 20 | 40 | 60 | 100 |
| PCC- CS404P | Design &Analysis of Algorithms Lab | 0 | 0 | 2 | 1 | 20 | 20 | 40 | 60 | 100 |
| **Total** | **22** | **0** | **06** | **25** |  |  |  |  |  |

**FIFTH SEMESTER**

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | **Contact Hours/Week** | **Credit** | **Evaluation Schemes** |
| **Code** | **Course Title** | **L** | **T** | **P** | **CA** | **TA** | **Int. Total** | **Ext.** | **Total** |
| ESC-501 | Signal &Systems | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |
| PCC-CS501 | Database Management Systems | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |
| PCC-CS502 | Formal Language & Automata Theory | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |
| PCC-CS503 | Object Oriented Programming | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |
|  | Elective I | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |
| HSMC501 | Management I(OB/F&A\*) | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |
|  AIML03 | Advanced AI and ML Techniques | 3 |  0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |
| **PRACTICALS** |
| PCC-CS501P | Database Management Systems Lab | 0 | 0 | 2 | 1 | 20 | 20 | 40 | 60 | 100 |
| PCC-CS503P | Object Oriented Programming Lab | 0 | 0 | 2 | 1 | 20 | 20 | 40 | 60 | 100 |
| AIML03 | Advanced AI and ML Techniques Lab | 0 | 0 | 2 | 1 | 20 | 20 | 40 | 60 | 100 |
| PROJ-CS50 | Industrial Seminar\*\* | 0 | 0 | 6 | 3 | 20 | 20 | 40 | 60 | 100 |
| **Total** | **21** | **0** | **12** | **27** |  |  |  |  |  |
| **SIXTH SEMESTER** |
| PCC-CS601 | Compiler Design | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |
| PCC-CS602 | Computer Networks | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |
|  | Elective II | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |
|  | Elective III | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |
| OEC001 | Soft Skills & interpersonal Communication | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |
| MC601 | Constitution of India/Essence of Indian traditional knowledge | 0 | 0 | 0 | 0 | 20 | 20 | 40 | 60 | 100 |
| AIML04 | Web Applications Using MLT | 4 | 0 | 0 | 4 | 20 | 20 | 40 | 60 | 100 |
| **PRACTICALS** |
| PCC-CS601P | Compiler Design | 0 | 0 | 2 | 1 | 20 | 20 | 40 | 60 | 100 |
| PCC-CS602P | Computer Networks | 0 | 0 | 2 | 1 | 20 | 20 | 40 | 60 | 100 |
| AIML04P | Web Applications Using MLT Lab | 0 | 0 | 2 | 1 | 20 | 20 | 40 | 60 | 100 |
| PROJ-CS60 | Project –I\*\* | 0 | 0 | 6 | 3 | 20 | 20 | 40 | 60 | 100 |
|  | **Total** | **19** | **0** | **12** | **25** |  |  |  |  |  |

**SEVENTH SEMESTER**

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | **Contact Hours/Week** | **Credit** | **Evaluation Schemes** |
| **Code** | **Course Title** | **L** | **T** | **P** | **CA** | **TA** | **Int. Total** | **Ext.** | **Total** |
|  | Elective IV | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |
|  | Elective V | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |
|  | Elective VI | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |
| OEC002 | HRD & OB \* | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |
| AIML05 | Deep Learning and Neural Network | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |
| AIML06 | IOT with Machine Learning  | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |
| PRACTICALS |
| AIML06P | IOT with Machine Learning Lab | 0 | 0 | 2 | 1 | 20 | 20 | 20 | 60 | 100 |
| PROJ-CS70 | Project-II\*\* | 0 | 0 | 6 | 3 | 20 | 20 | 40 | 60 | 100 |
| **Total** | **18** | **0** | **8** | **22** |  |  |  |  |  |

**EIGHTH SEMESTER**

|  |  |  |  |
| --- | --- | --- | --- |
| **COURSE** | **Contact Hours/Week** | **Credit** | **% of Total Marks** |
| **Code** | **Course Title** | **L** | **T** | **P** | **CA** | **TA** | **Int. Total** | **Ext.** | **Total** |
| OEC003 | Cyber Law & Ethics | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |
| AIML07 | Artificial Intelligence and Machine Learning in Health care and Agriculture | 3 | 0 | 0 | 3 | 20 | 20 | 20 | 60 | 100 |
| AIML08 | Complex Analysis , Probability and Statistical Methods | 3 | 0 | 0 | 3 | 20 | 20 | 20 | 60 | 100 |
| OEC004 | History of Science & engineering/Introduction to Philosophical Thoughts/MetroSystems and Engineering | 3 | 0 | 0 | 3 | 20 | 20 | 40 | 60 | 100 |
| PRACTICALS |
| PROJ-CS80 | Project III\*\* | 0 | 0 | 8 | 4 | 100 | 100 | 200 | 300 | 500 |
| **Total** | **12** | **0** | **8** | **16** |  |  |  |  |  |

**LIST OF ELECTIVES**

|  |
| --- |
| **Thread 1:** Theory & Algorithms |
| **Elective(s)** | **Subject Code** | **Subject Name** |
| Elective I | PEC-CS-T 501 | Graph Theory |
| Elective II | PEC-CS-T 601 | Advanced Algorithms |
| Elective III | PEC-CS-T 602 | Parallel & Distributed Algorithms |
| Elective IV | PEC-CS-T 701 | Computational Complexity |
| Elective V | PEC-CS-T 702 | Computational Complexity |
| Elective VI | PEC-CS-T 703 | Queuing Theory & Modeling |
| **Additional Subject (can replace with any elective from the same thread): Theory Of Computation** |

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| **Thread 2:** Systems |
| **Elective(s)** | **Subject Code** | **Subject Name** |
| Elective I | PEC-CS-S 501 | Advanced Computer Architecture |
| Elective II | PEC-CS-S 601 | Software Engineering |
| Elective III | PEC-CS-S 602 | Distributed Systems |
| Elective IV | PEC-CS-S 701 | Embedded Systems |
| Elective V | PEC-CS-S 702 | Advanced Operating Systems |
| Elective VI | PEC-CS-S 703 | Low Power Circuit & Systems |
| **Additional Subject (can replace with any elective from the same thread): Fault Tolerant Computing** |
| **Thread 3:**Data Science & Machine Intelligence |
| **Elective(s)** | **Subject Code** | **Subject Name** |
| Elective I | PEC-CS-D 501 | Artificial Intelligence |
| Elective II | PEC-CS-D 601 | Machine Learning |
| Elective III | PEC-CS-D 602 | \*\*Data Mining |
| Elective IV | PEC-CS-D 701 | Soft Computing |
| Elective V | PEC-CS-D 702 | Speech and Natural Language Processing |
| Elective VI | PEC-CS-D 703 | \*\*Data Analytics |
| **Thread 4:** Applications |
| **Elective(s)** | **Subject Code** | **Subject Name** |
| Elective I | PEC-CS-A 501 | Image Processing |
| Elective II | PEC-CS-A 601 | Digital Signal Processing |
| Elective III | PEC-CS-A 602 | \*\*Cloud Computing |
| Elective IV | PEC-CS-A 701 | Human Computer Interaction |
| Elective V | PEC-CS-A 702 | Electronic Design Automation |
| Elective VI | PEC-CS-A 703 | Computer Graphics |