# Bachelor of Science in Artificial Intelligence Program

# For Fall 2022 and onwards

## Department of Creative Technology

## Faculty of Computing and Artificial Intelligence

## Air University, Islamabad

**For Fall 2022 and onwards**

# Contents

# PROGRAMME GENERAL INFORMATION

| | |
|---|---|
| **Academic year** | 2022/23 |
| **Awarding body** | Air University |
| **Teaching institute and location** | Air University, Islamabad Campus |
| **Language of study** | English |
| **Final award** | BS |
| **Program title** | Artificial Intelligence |
| **Duration of study** | 4 years (maximum time upto 6 years) |
| **Total number of semesters** | 8 |
| **Number of weeks per semester** | 12 - 18 (16 for teaching and 2 for examinations) |
| **Total number of credit hours** | 130 |
| **Total number of courses** | 42 |
| **Credit hours per semester** | 15-18 |

## *Distribution of Courses*

Following is the distribution of courses:

| S# | Category | Credit Hours | HEC Rec. |
|---|---|---|---|
| 1 | Computing Core | 39 | 39 |
| 2 | Domain Core (AI) | 18 | 18 |
| 3 | Domain Electives (AI) | 12 | 12 |
| 4 | Domain Supporting (AI) | 18 | 18 |
| 5 | Mathematical & Science Foundation | 12 | 12 |
| 6 | University Elective Courses | 12 | 12 |
| 7 | General Education Courses | 19 | 19 |
| | **Total Credit Hours** | 130 | 130 |

## Computing Core Courses

| Course Title | Credit hours |
|---|---|
| Programming Fundamentals | (3-1-4) |
| Discrete Structures | (3-0-3) |
| Object Oriented Programming | (3-1-4) |
| Data Structures & Algorithms | (3-1-4) |
| Operating Systems | (3-1-4) |
| Database Systems | (3-1-4) |
| Software Engineering | (3-0-3) |
| Information Security | (3-0-3) |
| Computer Networks | (3-1-4) |
| Senior Year Design Project | (0-6-6) |
| **Total** | **39 (26-13)** |

## Artificial Intelligence Core Courses

| | Course Title | Credit hours |
|---|---|---|
| 1 | Programming for Artificial Intelligence | (2-1-3) |
| 2 | Machine Learning | (2-1-3) |
| 3 | Knowledge Representation & Reasoning | (3-0-3) |
| 4 | Artificial Neural Networks | (2-1-3) |
| 5 | Natural Language Processing | (3-0-3) |
| 6 | Computer Vision | (2-1-3) |
| | **Total** | **18 (14-4)** |

## Artificial Intelligence Supporting Courses

| Course Title | Credit hours |
|---|---|
| Digital Logic and Design | (3-1-4) |
| Artificial Intelligence | (3-1-4) |
| Design and Analysis of Algorithms | (3-0-3) |
| Parallel and Distributed Computing | (2-1-3) |
| Computer Organization and Assembly Language | (3-1-4) |
| **Total** | **18 (14-4)** |

## Mathematics and Science Foundation Courses

| Course Title | Credit hours |
|---|---|
| Calculus & Analytical Geometry | 3-0-3 |
| Linear Algebra | 3-0-3 |
| Differential Equation | 3-0-3 |
| Probability & Statistics | 3-0-3 |
| **Total** | **12 (12-0)** |

## General Education Electives

| Course Title | Credit hours |
|---|---|
| English Composition & Comprehension | 3-0-3 |
| Technical & Business Writing | 3-0-3 |
| Communication & Presentation Skills | 3-0-3 |
| Intro to Info. & Comm. Technologies | 2-1-3 |
| Islamic Studies and Ethics | 2-0-2 |
| Pakistan Studies and Global Perspective | 2-0-2 |
| Professional Practices and Ethics in Artificial Intelligence | 3-0-3 |
| **Total** | **19 (18-1)** |

## University Elective Courses

(Not limited to the list below, the university may add more courses)

| Course Code | Course Title | Credit hours |
|---|---|---|
| AF141 | Principles of Accounting | 3-0-3 |
| BA758 | Operation Research | 3-0-3 |
| BA354 | Human Resource Management | 3-0-3 |
| BA151 | Principles of Management | 3-0-3 |
| BA253 | Total Quality Management | 3-0-3 |
| BA252 | Organizational Behavior | 3-0-3 |
| HU400 | Introduction to Philosophy and Iqbaliyat | 3-0-3 |
| HU117 | Social Psychology and Human Behavior | 3-0-3 |
| EN131 | Introduction to English Linguistics | 3-0-3 |
| FL XXX | Foreign Language | 2-0-2 |
| BA XXX | Entrepreneurship & Technology Commercialization | 3-0-3 |
| HU414 | Social Services | 1-0-1 |
| | **Total (Any four courses +** Social Services**)** | **12** |

BS-Artificial Intelligence Scheme of Studies

## *Semester-Wise Study Plan*

### Semester – I

| Code | Course Title | Non-Medical Credit Hours | Medical Credit hours | Pre-requisite |
|---|---|---|---|---|
| CS180 | Introduction to Information and Communication Technologies | 2-0-2 | 2-0-2 | |
| CS180L | Introduction to Information and Communication Technologies Lab | 0-1-1 | 0-1-1 | |
| CS111 | Programming Fundamentals | 3-0-3 | 3-0-3 | |
| CS111L | Programming Fundamentals Lab | 0-1-1 | 0-1-1 | |
| EL100 | Reading and Writing Skills | 3-0-3 | 3-0-3 | |
| HU124 | Islamic Studies and Ethics | 2-0-2 | 2-0-2 | |
| MA113 | Pre-Calculus | N/A | 2-0-2 | |
| MA114 | Foundational Mathematics | N/A | 4-0-4 | |
| **Total** | | **10-2-12** | **16-2-18** | |

### Semester – II

| Code | Course Title | Credit Hours | Pre-requisite |
|---|---|---|---|
| EL200 | Communication and Presentation Skills | 3-0-3 | EL100 |
| MA110 | Calculus and Analytical Geometry | 3-0-3 | |
| CS112 | Object Oriented Programming | 3-0-3 | CS111, CS111L |
| CS112L | Object Oriented Programming Lab | 0-1-1 | CS111 |
| MA216 | Discrete Structures | 3-0-3 | |
| EE223 | Digital Logic and Design | 3-0-3 | |
| EE223L | Digital Logic and Design Lab | 0-1-1 | |
| **Total** | | **15-2-17** | |

### Semester – III

| Code | Course Title | Credit Hours | Pre-requisite |
|---|---|---|---|
| CS214 | Data Structures and Algorithms | 3-0-3 | CS112, CS112L |
| CS214L | Data Structures and Algorithms Lab | 0-1-1 | CS112 |
| MA106 | Differential Equations | 3-0-3 | MA110 |
| MA301 | Probability and Statistics | 3-0-3 | |
| AI130 | Programming for Artificial Intelligence | 2-0-2 | |
| AI130L | Programming for Artificial Intelligence Lab | 0-1-1 | |

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| CS223 | Computer Organization and Assembly Language | 3-0-3 | EE223, EE223L |
|---|---|---|---|
| CS223L | Computer Organization and Assembly Language Lab | 0-1-1 | EE223 |
| **Total** | | **14-3-17** | |

## Semester – IV

| Code | Course Title | Credit hours | Pre-requisite |
|---|---|---|---|
| CS332 | Design and Analysis of Algorithms | 3-0-3 | CS214/CS214L |
| CS230 | Database Systems | 3-0-3 | CS214, CS214L |
| CS230L | Database Systems Lab | 0-1-1 | CS214 |
| AI231 | Artificial Intelligence | 3-0-3 | AI130, AI130L |
| AI231L | Artificial Intelligence Lab | 0-1-1 | AI130 |
| CS360 | Computer Networks | 3-0-3 | |
| CS360L | Computer Networks Lab | 0-1-1 | |
| MA201 | Linear Algebra | 3-0-3 | MA110 |
| **Total** | | **15-3-18** | |

## Semester – V

| Code | Course Title | Credit Hours | Pre-requisite |
|---|---|---|---|
| AIXXX | AI-Elective-I | 3-0-3 | |
| SE100 | Software Engineering | 3-0-3 | |
| AI301 | Knowledge Representation and Reasoning | 3-0-3 | AI231\AI231L |
| AIXXX | AI-Electives-II | 3-0-3 | |
| AI332 | Machine Learning | 2-0-2 | |
| AI332L | Machine Learning Lab | 0-1-1 | |
| HU/BAXXX | University Elective -I | 3-0-3 | |
| **Total** | | **17-1-18** | |

## Semester – VI

| Code | Course Title | Credit Hours | Pre-requisite |
|---|---|---|---|
| CS225 | Operating Systems | 3-0-3 | CS214, CS214L |
| CS225L | Operating Systems Lab | 0-1-1 | CS214 |
| AIXXX | AI-Electives-III | 3-0-3 | |
| AI320 | Natural Language Processing | 3-0-3 | AI332/AI332L |
| AI303 | Computer Vision | 2-0-2 | |
| AI303L | Computer Vision Lab | 0-1-1 | |

| EL400 | Technical & Business Writing | 3-0-3 | EL200 |
| AI497 | FYP-I | 0-1-1 | List A |
| **Total** | | **14-3-17** | |

## Semester – VII

| Code | Course Title | Credit hours | Pre-requisite |
|------|--------------|--------------|---------------|
| AI498 | FYP-II | 0-2-2 | AI497 |
| CS426 | Parallel and Distributed Computing | 2-0-2 | CS225, CS225L |
| CS426L | Parallel and Distributed Computing Lab | 0-1-1 | CS225L |
| AIXXX | AI-Electives-IV | 3-0-3 | |
| AI433 | Artificial Neural Networks | 2-0-2 | AI332, AI332L |
| AI433L | Artificial Neural Networks Lab | 0-1-1 | AI332L |
| CS415 | Information Security | 3-0-3 | |
| HU/BAXXX | University Elective-II | 3-0-3 | |
| **Total** | | **13-4-17** | |

## Semester – VIII

| Code | Course Title | Credit hours | Pre-requisite |
|------|--------------|--------------|---------------|
| HU414 | Social Service | 1-0-1 | |
| AI440 | Professional Practices and Ethics in Artificial Intelligence | 3-0-3 | |
| HU125 | Pakistan Studies and Global Perspective | 2-0-2 | |
| AI499 | FYP – III | 0-3-3 | AI498 |
| HU/BAXXX | University Elective -III (Foreign Language) | 2-0-2 | |
| HU/BAXXX | University Elective – IV | 3-0-3 | |
| **Total** | | **11-3-14** | |

**Total Credit Hours: 130**

## Artificial Intelligence Elective Courses

**Note:** More courses may be added to this list of elective courses by the department.

| Code | Course Title | Credit hours |
|---|---|---|
| AI300 | Probability Methods in Artificial Intelligence | 3-0-3 |
| AI302 | Digital Image Processing | 3-0-3 |
| AI304 | Speech Processing | 3-0-3 |
| AI310 | AI Project Design and Development | 3-0-3 |
| AI311 | Microcontroller and Embedded Systems | 3-0-3 |
| AI312 | Automation and Robotics | 3-0-3 |
| AI313 | Internet of Things | 3-0-3 |
| AI314 | Ubiquitous Computing | 3-0-3 |
| AI315 | Artificial Intelligence in Automation | 3-0-3 |
| AI321 | Semantic Technologies | 3-0-3 |
| AI322 | Computational Linguistics | 3-0-3 |
| AI323 | Information Retrieval | 3-0-3 |
| AI341 | Artificial Intelligence for Games | 3-0-3 |
| AI342 | Biometrics-Enabled Intelligence | 3-0-3 |
| AI405 | Cognitive Artificial Intelligence | 3-0-3 |
| AI406 | Brain-Computer Interface | 3-0-3 |
| AI407 | Bio-inspired Computing | 3-0-3 |
| AI408 | Computational Biology | 3-0-3 |
| AI409 | Evolutionary Computing | 3-0-3 |
| AI415 | Intelligent Systems | 3-0-3 |
| AI416 | Agent-based Modeling | 3-0-3 |
| AI417 | Swarm Intelligence | 3-0-3 |
| AI424 | Linked Data Engineering | 3-0-3 |
| AI434 | Deep Learning | 3-0-3 |
| AI435 | Reinforcement Learning | 3-0-3 |
| AI442 | Edge Computing | 3-0-3 |
| AI443 | Virtual and Augmented Reality | 3-0-3 |
| CS333 | Theory of Automata | 3-0-3 |
| CS437 | Data Warehousing and Data Mining | 3-0-3 |
| MA421 | Numerical Analysis | 3-0-3 |
| MT446 | Digital Signal Processing | 3-0-3 |
| MA105 | Multi-Variable Calculus | 3-0-3 |

# List A

| Code | Course Title | Credit Hours | Prerequisite |
|---|---|---|---|
| CS214 | Data Structures & Algorithms | (3-0-3) | CS112, CS112L |
| CS214L | Data Structures & Algorithms Lab | (0-1-1) | CS112 |
| AI130 | Programming for Artificial Intelligence | 2-0-2 | |
| AI130L | Programming for Artificial Intelligence Lab | 0-1-1 | |

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| AI231 | Artificial Intelligence | 3-0-3 | AI130, AI130L |
|-------|-------------------------|-------|----------------|
| AI231L | Artificial Intelligence Lab | 0-1-1 | AI130 |
| AI301 | Knowledge Representation and Reasoning | 3-0-3 | AI231\AI231L |