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Program Elective-4 — Complete Syllabus

BTEUP Diploma in Computer Science & Engineering • 6th Semester • Session 2026-27
Subject 6.1 (Program Elective-4) • Total 100 Marks • 4 Credits • L 4 • Choose ONE of
6.1.1 / 6.1.2

About this document: Program Elective-4 is a theory elective worth 4 credits and 100 marks. Students choose **ONE** of the two options below — 6.1.1 Fundamentals of Artificial Intelligence or 6.1.2 Data Science and Machine Learning — and are examined only in the option they choose. Both options are covered here, completely, in the official order.

Examination Scheme

Code	Paper	Type	L - P	Credits	Internal	External	Total
6.1	Program Elective-4 (choose ONE of 6.1.1 / 6.1.2)	Theory	4 - 0	4	Theory 40	Theory 60 (3 hrs)	100
Program Elective-4 Total				4	40	60	100

What This Subject Aims To Do

To let students specialise in one of two directions — artificial intelligence, or data science and machine learning — through a single 4-credit theory elective examined for 100 marks.

Option 6.1.1 — Fundamentals of Artificial Intelligence

Course Objectives: Identify problems where artificial intelligence techniques are applicable; apply selected basic AI techniques; judge applicability of more advanced techniques; participate in the design of systems that act intelligently and learn from experience.

Course Outcomes

- CO1: Understanding the basic concepts of Artificial Intelligence.
- CO2: Describing different AI searching algorithms.
- CO3: Applying various optimization techniques to real world problems.
- CO4: Capable of implementing autonomous planning under constraints in simulated or real environment.
- CO5: Applying different AI logics to solve various problems.

Unit-Wise Complete Topic List

Unit	Topic	Periods	Marks Share
1	Introduction	8	20%
2	Searching	8	20%
3	Finding Optimal Paths, Problem Decomposition and Game Playing	10	20%
4	Planning and Constraint Satisfaction	8	20%
5	Logic and Inferences	8	20%

Unit 1 — Introduction (8 Periods, 20%)

Topics: Overview and Historical Perspective, Turing test, Physical Symbol Systems and the scope of Symbolic AI, Agents.

Unit 2 — Searching (8 Periods, 20%)

Topics: Heuristic Search: Best First Search, Hill Climbing, Beam Search, Tabu Search. Randomized Search: Simulated Annealing, Genetic Algorithms, Ant Colony Optimization.

Unit 3 — Finding Optimal Paths, Problem Decomposition and Game Playing (10 Periods, 20%)

Topics: Finding Optimal Paths: Branch and Bound, A*, IDA*, Divide and Conquer approaches, Beam Stack Search. Problem Decomposition: Goal Trees, AO*, Rule Based Systems, Rete Net. Game Playing: Minimax Algorithm, Alpha-Beta Algorithm, SSS*.

Unit 4 — Planning and Constraint Satisfaction (8 Periods, 20%)

Topics: Domains, Forward and Backward Search, Goal Stack Planning, Plan Space Planning, Graphplan, Constraint Propagation.

Unit 5 — Logic and Inferences (8 Periods, 20%)

Topics: Propositional Logic, First Order Logic, Soundness and Completeness, Forward and Backward chaining.

Practical Work: No practicals listed in the official syllabus for this option.

Reference Books (as listed in the syllabus)

- Deepak Khemani. A First Course in Artificial Intelligence, McGraw Hill Education (India).
- <https://nptel.ac.in/courses/106106126/>
- Stefan Edelkamp and Stefan Schroedl. Heuristic Search, Morgan Kaufmann.
- Pamela McCorduck, Machines Who Think: A Personal Inquiry into the History and Prospects of Artificial Intelligence, A K Peters/CRC Press.
- Elaine Rich and Kevin Knight. Artificial Intelligence, Tata McGraw Hill.
- Stuart Russell and Peter Norvig. Artificial Intelligence: A Modern Approach, Prentice Hall.
- M.C. Trivedi, A classical approach to Artificial Intelligence, Khanna Publishing House.

Option 6.1.2 — Data Science and Machine Learning

Course Objectives: This course will introduce the concepts of data warehouse and data mining, which gives a complete description about the principles, used, architectures, applications, design and implementation of data mining and data warehousing concepts.

Course Outcomes

- CO 1: Understand the basics of Data Science.
- CO 2: Visualize and Analyze Data.
- CO 3: Understand concept of Exploratory Data Analysis.
- CO 4: Understand and develop Machine Learning Algorithms.
- CO 5: Implement Mining Process on Social Network Graph.

Unit-Wise Complete Topic List

Unit	Topic	Periods	Marks Share
1	Introduction of Data Science and Machine Learning	10	22%

2	Data Preprocessing, Analysis and Visualization	6	16%
3	Statistical Inference & Exploratory Data Analysis and the Data Science Process	10	22%
4	Machine Learning Algorithms	8	20%
5	Mining Social-Network Graphs, Data Science and Ethical Issues	8	20%

Unit 1 — Introduction of Data Science and Machine Learning (10 Periods, 22%)

Topics: Fundamentals of Artificial Intelligence, need and applications of Data Science, Data Mining, data preparation, Machine Learning, Types and Applications of Machine Learning.

Unit 2 — Data Preprocessing, Analysis and Visualization (6 Periods, 16%)

Topics: Data Pre-processing: Pre-processing Techniques — Mean Removal, Scaling, Normalization, Binarization, One Hot Encoding, Label encoding. Data Analyses: Loading and summarizing the dataset. Data Visualization: Univariate Plots, Multivariate Plots, Training Data, Test Data, Performance Measures.

Unit 3 — Statistical Inference & Exploratory Data Analysis and the Data Science Process (10 Periods, 22%)

Topics: Populations and samples, Types of Statistical modelling, Types of probability distributions, Parametric and Non-Parametric Methods, Distance Metrics. Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA, The Data Science Process.

Unit 4 — Machine Learning Algorithms (8 Periods, 20%)

Topics: Introduction to Supervised Learning Algorithms — Decision Tree, Linear Regression, k Nearest Neighbours (k-NN), SVM — and Introduction to Unsupervised Learning Algorithms — K-means Clustering, Mean Shift Algorithm, Dimensionality Reduction Techniques, Introduction to Neural Networks.

Unit 5 — Mining Social-Network Graphs, Data Science and Ethical Issues (8 Periods, 20%)

Topics: Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning of graphs, Neighbourhood properties in graphs, Discussions on privacy, security, ethics, A look back at Data Science, Next-generation data scientists.

Practical Work: No practicals listed in the official syllabus for this option.

Reference Books (as listed in the syllabus)

- Jiawei Han, Micheline Kamber, Jian Pei, Data Mining: Concepts and Techniques, Elsevier.
- Margaret H Dunham, Data Mining Introductory and Advanced Topics, Pearson Education.
- Amitesh Sinha, Data Warehousing, Thomson Learning, India.
- Xingdong Wu, Vipin Kumar, the Top Ten Algorithms in Data Mining, CRC Press, UK.

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Source: BTEUP 3rd Year curriculum (folder2627), approved in C.D.C. meeting held on 16.07.2026. Topic lists follow the official syllabus; short explanations are the author's own plain-English summaries, not syllabus text.

Please confirm with your own polytechnic for any local changes.

