# AI-ML Semester 1: Detailed Topics & Verified Online Resources (with Practice)

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This document organizes each subject into core topics. Every topic lists at least three carefully chosen links from reputable sources (MDN, MIT OCW, Khan Academy, Stanford, Berkeley, Python.org, NumPy, pandas, NPTEL, etc.). All links are clickable.

## IWT (Internet & Web Technology)

### HTML Foundations

- MDN: HTML — element reference & guide
- freeCodeCamp: Responsive Web Design (HTML/CSS)
- MDN: Getting started with the Web

### CSS Essentials

- web.dev: Learn CSS
- MDN: CSS — Cascading Style Sheets
- freeCodeCamp: Responsive Web Design Certification

### JavaScript Basics

- MDN: JavaScript Guide
- Eloquent JavaScript (online book)
- freeCodeCamp: JavaScript Algorithms and Data Structures

### Web Accessibility

- W3C WAI: Accessibility Tutorials
- WebAIM: Introduction to Web Accessibility
- MDN: Accessibility - Learn Web Development

### Publishing & Deployment

- GitHub Docs: Quickstart for GitHub Pages
- MDN: Publishing your website
- Netlify Docs: Start pathways

### Practice

- Frontend Mentor (real-world HTML/CSS challenges)
- CSSBattle

- JavaScript 30 (30 JS projects)

# Python Programming

## Syntax & Control Flow

- Python.org: Official Tutorial
- Automate the Boring Stuff with Python (free online)
- CS50 Python (Harvard/edX)

## Core Data Structures

- Python.org: Data Structures (lists, dicts, sets)
- Real Python: Lists & Dictionaries
- Programiz: Python Data Structures

## Functions, OOP & Modules

- Python.org: Defining Functions & Modules
- Real Python: OOP in Python
- Python.org: Classes

## Files & Exceptions

- Python.org: Input and Output
- Python.org: Errors and Exceptions
- Real Python: Reading and Writing Files

## Libraries for AI/ML Prep

- NumPy: Getting Started
- pandas: Getting started tutorials
- Matplotlib: Pyplot tutorial

## Practice

- LeetCode Python practice (Easy tag)
- HackerRank Python track
- Exercism Python track

# Linear Algebra

## Vectors, Matrices & Operations

- Khan Academy: Linear Algebra course
- MIT 18.06 OCW: Linear Algebra
- 3Blue1Brown: Essence of Linear Algebra (playlist)

## Systems of Equations & Row Reduction

- Khan Academy: Solving systems by elimination/row echelon form
- MIT 18.06: Row Reduction & Echelon Forms (Lecture/notes)
- Paul's Online Math Notes: Gaussian Elimination

## Linear Transformations & Geometry

- 3Blue1Brown: Linear Transformations
- MIT 18.06: Linear Transformations (notes/lectures)
- Khan Academy: Linear Transformations

## Eigenvalues, Eigenvectors & Diagonalization

- Khan Academy: Eigenvalues and Eigenvectors
- MIT 18.06: Eigenvalues & Eigenvectors (lectures)
- 3Blue1Brown: Eigenvectors and Eigenvalues (video)

## Orthogonality, Projections & SVD

- MIT 18.06: Orthogonality & Projections
- Khan Academy: Orthogonal Projections
- MIT 18.06: Singular Value Decomposition (SVD)

## Practice

- Brilliant.org Linear Algebra practice
- Khan Academy: Practice exercises
- MIT OCW: Problem sets (18.06)

# DECA (Digital Electronic Circuits & Architecture)

## Boolean Algebra & Logic Gates

- NPTEL: Digital Electronic Circuits (IIT Kharagpur)
- All About Circuits: Digital Logic textbook
- Nand2Tetris: Course overview

## Combinational Logic (Adders, Multiplexers, etc.)

- All About Circuits: Combinational Logic
- NPTEL: Digital Circuits module (Combinational)
- MIT OCW: Digital Systems - Combinational Logic

## Sequential Logic (Flip-Flops, Registers, Counters)

- NPTEL: Flip-Flops & Sequential Circuits
- TutorialsPoint: Flip-Flops
- All About Circuits: Sequential Circuits

## Finite State Machines (FSMs)

- NPTEL: Sequential Circuit Design / FSMs
- GeeksforGeeks: Finite State Machines
- CMU 18-549: FSM Lecture Notes

## Computer Organization & Architecture Basics

- NPTEL: Computer Organization and Architecture
- Nand2Tetris Part II (Architecture/OS stack)
- Gate Vidyalay: Computer Organization Notes

## Practice

- HDLBits (Digital logic practice problems)
- Logisim Evolution (digital circuit simulator)
- Nand2Tetris projects

# Intro to AI

## Search & Problem Solving

- Berkeley CS188: Search (Project 1)
- AIMA 4e: Chapters 3–4 (Search)
- MIT OCW: Artificial Intelligence (search lectures)

## Constraint Satisfaction Problems

- AIMA 4e: Chapter 6 (CSPs)
- Berkeley CS188: CSP materials
- Stanford CS221: Course materials (CSPs)

## Adversarial Search & Games

- AIMA 4e: Chapter 5 (Adversarial Search)
- Berkeley CS188: Multi-agent search
- UC Berkeley CS188 Pacman Projects

## Probabilistic Reasoning & Graphical Models

- Stanford CS228 Notes
- AIMA 4e: Chapters 12–14 (Probability & Bayes Nets)
- Stanford CS221: Graphical models modules

## Reinforcement Learning (Intro)

- Sutton & Barto: Reinforcement Learning (2e) free PDF
- Berkeley CS188: RL lectures/projects
- CMU/Stanford hosted PDF (alt link)

## Practice

- CS188 Pacman Projects
- Kaggle: Intro to Machine Learning (practice datasets)
- AIMA Exercises (by chapter)

# FCS (Foundations of Computer Science)

## Number Systems & Binary Arithmetic

- Khan Academy: Binary & data
- Brilliant: Binary numbers
- GeeksforGeeks: Number Systems in Computer Science

## Algorithms & Complexity Basics

- MIT OCW 6.006: Algorithms (videos)
- Khan Academy: Algorithms
- Harvard CS50x: Algorithmic thinking

## Data Structures (Arrays, Stacks, Queues, Trees)

- UCSD/Coursera: Data Structures (public syllabus)
- GeeksforGeeks: Data Structures
- VisuAlgo: Data structure visualizations

## Operating Systems & Computer Architecture (Basics)

- Georgia Tech OMSCS CS6200 (overview)
- Udacity Intro to OS (free course archive)
- NPTEL COA course

## Version Control (Git/GitHub)

- Pro Git (official online book)
- GitHub Pages Quickstart (for hosting docs/projects)
- GitHub Learning Lab (Intro to GitHub)

## Practice

- HackerRank: CS domains
- LeetCode Explore: Data Structures
- Codeforces (competitive programming)