

## IC152 Computing and Data Science

Credits : 3-0-2-4

Prerequisite: Institute core/consent of faculty member

Students intended for: B.Tech

Elective or Core: Institute Core

Semester: Odd

**Course objective:** The first course in computing is a core course to all engineering disciplines as the use of computers in every engineering discipline requires mastering efficient computing for problem solving. Computers are used for mathematical analysis, data analysis, numerical problem solving, communications, and for many specialized applications.

Many engineering applications being are becoming largely data driven. Inexpensive sensors can be found in engines, mobile phones, home appliances and more elaborate ones in various measuring equipment like seismographs or medical equipment. Large corporations collect large amounts of user data from various online frameworks (like social media, emails etc.). Many businesses offer customized services to their customers based on data analysis. In this regard, an exposure to the science of data analysis would permit students to appreciate this paradigm.

This course is the first on a three-course series on computation, data science, statistics and introductory machine learning.

### Course Content:

- Introduction: History, basic structure of a computer, network of computers [3 lec] • Program = Algorithms + Data, programs as a sequence of instructions Levels of programming: high-level language, medium-level language, machine language, interpreted and compiled languages [2 lec]
- Memory: variables, types, scalar, composite types, arrays/lists, expressions [3 lec]
- Functions: scope of variables, code reuse, call frame and call stack, arguments, return values [3 lec]
- Control flow: decisions, iterations [3 lec]
- Data structures and objects: lists, dictionaries, NumPy arrays, strings [8 lec]
- File I/O, command line arguments [3 lec]
- Data visualisation: plotting functions, making use of colour, geographical data [4 lec]
- Program development: Testing, test cases, debugging, program efficiency [3 lec]
- Case studies: Modeling using statistics, curve fitting, interpolation, histograms, classification, correlation: [6 lec]
- Quizzes, review etc: [3 lec]

### Text books

1. Python Programming for the Absolute Beginner, Michael Dawson, Third Edition Course Technology PTR (Chapter 1-7)
2. The Python Workbook: A Brief Introduction with Exercises and Solutions, 2014 Edition
3. Python Data Science Handbook, Jake Vanderplas (Chapters 1-4)
4. How to solve it by computer, R. G. Dromey, Pearson, 1982
5. V. A. Spraul, Think Like a Programmer: An Introduction to Creative Problem Solving, No Starch Press, 2012 (Soft-copy available from the Library website)

### References

1. How to Think Like a Computer Scientist: Learning with Python, Allen Downey, Jeffrey Elkner, Chris Meyers, Green Tea Press (Chapter 1-9, Chapter 11)
2. Python for probability, statistics and machine learning, Jose Unpingco, Springer.

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