



DATA SCIENCE FOR ENGINEERS

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PRE-REQUISITES : 10 hrs of pre-course material will be provided, learners need to practise this to be ready to take the course.

INTENDED AUDIENCE : Any interested learner

INDUSTRY SUPPORT : HONEYWELL, ABB, FORD, GYAN DATA PVT. LTD

COURSE OUTLINE :

Learning Objectives :

- Introduce R as a programming language
- Introduce the mathematical foundations required for data science
- Introduce the first level data science algorithms
- Introduce a data analytics problem solving framework
- Introduce a practical capstone case study

Learning Outcomes:

- Describe a flow process for data science problems (Remembering)
- Classify data science problems into standard typology (Comprehension)
- Develop R codes for data science solutions (Application)
- Correlate results to the solution approach followed (Analysis)
- Assess the solution approach (Evaluation)
- Construct use cases to validate approach and identify modifications required (Creating)

ABOUT INSTRUCTOR :

Prior to joining IIT Madras as a professor, **Prof.Rengaswamy** was a professor of Chemical Engineering and Co-Director of the Process Control and Optimization Consortium at Texas Tech University, Lubbock, USA. He was also a professor and associate professor at Clarkson University, USA and an assistant professor at IIT Bombay. His major research interests are in the areas of fault detection and diagnosis and development of data science algorithms for manufacturing industries.

Prof.Shankar Narasimhan is currently a professor in the department of Chemical Engineering at IIT Madras. His major research interests are in the areas of data mining, process design and optimization, fault detection and diagnosis and fault tolerant control. He has co-authored several important papers and a book titled Data Reconciliation and Gross Error Detection: An Intelligent Use of Process Data which has received critical appreciation in India and abroad.

COURSE PLAN :

Week 1: Course philosophy and introduction to R

Week 2: Linear algebra for data science

1. Algebraic view - vectors, matrices, product of matrix & vector, rank, null space, solution of over-determined set of equations and pseudo-inverse)

2. Geometric view - vectors, distance, projections, eigenvalue decomposition

Week 3: Statistics (descriptive statistics, notion of probability, distributions, mean, variance, covariance, covariance matrix, understanding univariate and multivariate normal distributions, introduction to hypothesis testing, confidence interval for estimates)

Week 4: Optimization

Week 5: 1. Optimization

2. Typology of data science problems and a solution framework

Week 6: 1. Simple linear regression and verifying assumptions used in linear regression

2. Multivariate linear regression, model assessment, assessing importance of different variables, subset selection

Week 7: Classification using logistic regression

Week 8: Classification using kNN and k-means clustering