| Course Type | Course Code | Name of Course | L | T | P | Credit |
|---|---|---|---|---|---|---|
| DC | NMSC 521 | Statistical Methods and Applications | 3 | 0 | 0 | 3 |

## Course Objective

This course is expected to provide the student with the fundamentals of probability, stochastic processes and data analysis methods that are relevant to industrial engineering and management problems.

## Learning Outcomes

To understand the basic concepts of probability theory, probability distribution, estimation theory, statistical methods, stochastic processes and their application to a business or an industrial engineering problem. Moreover, students are supposed to learn some application software like R, Python, MS Excel, SYSTAT, SPSS for data analysis.

| Unit No. | Topics to be Covered | Lecture Hours | Learning Outcome |
|---|---|---|---|
| 1 | Introduction to probability; Discrete and Continuous Random variables; expectation; variance; moment generation function; random vectors; probability distributions; joint and marginal distributions; Law of large numbers; | 5 | Learn about probability theory, important theorems, conditional probability and their applications. Understand the concept of univariate and multivariate probability distribution. |
| 2 | Introduction to Statistical Methods; Concept of moments and its measures; Theoretical distributions: Binomial, Poisson, Uniform, Normal, Log-normal, Exponential, Weibul; | 9 | Understand the concept of measures of characterizing a distribution and get familiar with some theoretical probability distributions |
| 3 | Statistical Estimation: Sampling distributions; Point and Interval estimates; Characteristics of estimators; Methods of Estimation; Testing hypotheses of mean and proportion: one/two-sample tests; z-test, t-test, chi-square test, F-test; Analysis of Variance (ANOVA). Case Studies related to Statistical Thinking for Process improvement and industrial engineering problem-solving. | 10 | To get familiar with statistical estimation and their application. |
| 4 | Regression Analysis: Simple regression and correlation; Multiple and Partial correlation; Making inferences about population parameters; Residuals, Standard error of the estimate; Multiple Linear Regression Models; Polynomial Regression; Indicator Variables; Logistic Regression; Case Studies related to fitting of regression models for process data, optimization, process control and prediction. | 9 | Understand the concept of fitting regression models using a data set and their application. |
| 5 | Introduction to Stochastic Process: Introduction and its classification; Poisson process; Renewal processes; Availability analysis; Discrete-parameter Markov Chains, State classification and limiting distributions; Continuous-parameter Markov Chains, Chapman-Kolmogorov equation, Birth-Death process; | 9 | Understand the concept of stochastic processes and their application in solving industrial engineering problems. |

| | Applications related to design and analysis of industrial problems, capacity planning, inventory control, waiting lines, and service systems. | | |
|---|---|---|---|
| | **TOTAL** | **42** | |

**Text Books:**
1. *Introduction to Probability Models*, 12th Edition, 2019, Sheldon M. Ross Academic Press, Elsevier. ISBN: 9780128143469.
2. *Applied Statistics and Probability for Engineers*, 7th edition, 2018, D. C. Montgomery and G. C. Runger, John Wiley & Sons. ISBN: 978-1-119-40036-3.

**Reference Books:**
1. *Statistics for Management*, 8th edition, 2017, Richard I. Levin, Masood Husain Siddiqui, Sanjay Rastogi and David S. Rubin, Pearson Education Publication. ISBN 9789332581180.
2. *An Introduction to Probability Theory and Its Applications*, Volume 1, 3rd Edition, 1991, William Feller, John Wiley & Sons. ISBN: 978-0-471-25708-0.