**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani**
**Pilani Campus**
**AUGS/ AGSR Division**

# SECOND SEMESTER 2020-2021
# COURSE HANDOUT (Part II)

**Date: March 01, 2021**

In addition to Part I (General Handout for all courses appended to the time table), the portion below provides specific details regarding the course.

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| **Course Number** | **:** | **MATH F113** |
| **Course Title** | **:** | **Probability & Statistics** |
| **Instructor-In-Charge** | **:** | **RAKHEE** |
| **Instructors** | **:** | **P.H. Keskar(L1), Rakhee(L1), Chandra Shekhar(L2), Rajiv Kumar(L2), Rajesh Kumar(L3), Sumanta Pasari(L3).** |
| **Tutorial Instructors** | **:** | **Anirudh Singh Rana, Divyum Sharma, Gaurav Dwivedi, Jitender Kumar, Sourav Kumar Sasmal, Santhosh Kumar Pamula.** |

## 1. Course Description:

Probability and statistics form an exciting sub-area of mathematical science. They have relevance in almost all disciplines concerned with data and uncertainty. While probability theory deals with many real life problems, which either inherently involve the chance phenomena or describe the behavior of a system, statistical analysis is built up on the concepts of probability theory. Interpretation of a process in many engineering aspects often depends on the ideas of probability and statistics coupled with computational aspects. In this fundamental course, the aim is to build up skills in understanding the concepts of random variable, probability distribution, statistical inference, regression and correlation among several other related topics.

## 2. Scope and Objective of the Course:

The primary objective of this course is to familiarize students with the fundamental concepts and techniques of probability theory and statistical analysis.

## 3. Text Book:

Devore, J. L., Probability & Statistics for Engineering and the Sciences, 8th Edition, Cengage Learning, 2012.

## 4. Reference Books:


1. Milton, J. S. and Arnold J. C., Introduction to Probability and Statistics: Principles and Applications for Engineering and the Computing Sciences, 4th Edition, Tata McGraw-Hill, 2007.
2. Walpole, R. E., Myers, R. H., Myers, S. L., Ye, K. E., Probability & Statistics for Engineers and Scientists, 9th Edition, Pearson Education, 2016.
3. Johnson, R. A., Miller Freund's Probability and Statistics for Engineers, 8th Edition, PHI, 2010.
4. Meyer, P. L., Introductory Probability and Statistical Applications, 2nd Edition, Addison-Wesley, 1970.
5. Ross, S. M., Introduction to Probability Models, 11th Edition, Academic Press, 2014.

**5. Lecture Plan:**

| Module | Lecture Session | Sections | Learning Outcome |
|---|---|---|---|
| **1.Various Concepts in Probability Theory** | **L 1** Brief introduction to probability, sample spaces, events, permutations and combinations<br><br>**L 2-4** Axioms, interpretations and properties of probability, conditional probability, independence and the multiplication rule, Bayes' theorem | 2.1, 2.3<br><br>2.2, 2.4, 2.5 | Formulating the foundations for probability vis-a-vis practical notions |
| **2.Discrete Distributions** | **L 5-7** Random variables, discrete probability densities, cumulative distribution, expectation, variance and standard deviation, concept of moment generating function<br><br>**L 8-10** Binomial distribution, hypergeometric distribution, geometric distribution, Poisson distribution | 3.1, 3.2, 3.3, class notes<br><br>3.4, 3.5, 3.6 | Understanding random variable, basic theory of discrete distributions and studying a few important discrete distributions |
| **3. Continuous Distributions** | **L 11-14** Continuous densities, cumulative distribution and distribution parameters, uniform distribution, normal distribution, standard normal distribution, normal approximation to binomial distribution<br>**L 15-17** Gamma distribution, exponential and chi-squared distribution. | 4.1, 4.2, 4.3<br><br>4.4 | To understand theory of continuous distributions and study a few important continuous distributions |
| **4. Joint Distributions** | **L 18-21** Joint densities and independence, marginal distribution, conditional density, expectation, covariance and correlation | 5.1, 5.2 | Simultaneous behavior of several random variables |
| **5. Descriptive Statistics and Estimation** | **L 22-24** Random sampling, sample statistics, functions of random variables – distribution of sample mean, central limit theorem<br>**L 25-26** Point estimation, method of moments & maximum likelihood | 5.3, 5.4, 5.5, class notes<br>6.1, 6.2 | Concepts of sampling and their applications to estimate population parameters |
| **6. Statistical Inference** | **L 27-29** Concept of confidence interval, interval estimation of population mean, proportion and variability, Student-t | 7.1, 7.2, 7.3, 7.4, | Applications to estimation of intervals and testing of hypotheses |

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| | distribution<br>**L 30-33** Concept of hypothesis testing, hypothesis tests on the mean and population proportion<br>**L 34-35** Concept of *p*-values | 8.1, 8.2, 8.3<br>8.4 | on population parameters |
| **7. Simple Linear Regression Model** | **L 36-37** Simple linear regression model, estimating model parameters. | 12.1, 12.2 | To explain the linear relationship between a dependent and an independent variable |

**6. Evaluation Scheme:**

| EC No. | Evaluation Component | Duration | Weightage (%) | Marks | Date & Time | Remarks |
|---|---|---|---|---|---|---|
| 1 | Mid-Semester | 90 minutes | 30 | 90 | To be announced | Closed/open book |
| 2 | Quizzes | 45 minutes and 45 marks each) | 30 | 90 | To be announced | Closed / open book (Only two quizzes) |
| 3 | Comprehensive | 120 minutes | 40 | 120 | 19-06-2021 | Closed / open book |

**7. Chamber Consultation Hours:**

To be announced in the respective tutorial class by the respective instructor.

**8. Notices:**

All notices in relation to the above course will be put up on NALANDA.

**9. Make-up policy:**

Make-up for the mid-semester/comprehensive examination/quizzes will be given to genuine cases with prior permission only.

**Instructor-In-Charge**
**MATH F113**