# COURSE HANDOUT

## B.Tech- 4th Semester

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| Course Title | : Probability and Statistics | Dated: 04-12-2017 |
| Course Code | : 16MA405 | Academic Year: 2017-18 |
| Course Structure | : 3-1-0-3 | |
| Course coordinator | : Mr. P.Vamsi Sagar | |
| Instructor(s) | : Mr. P.Vamsi Sagar and Dr. R.L.Naidu | |

**Course Description**: Probability, Conditional Probability, Random Variables and Distribution, Binomial, Poisson, Exponential, Normal, Expectations and higher order moments, Central limit theorem and other limit theorems, Sampling distributions of means, proportions, sums and differences, Tests of significances, Linear correlation coefficient Linear regression, Statistical Quality Control Methods.

**Scope:** This course is designed for CSE and IT fourth semester B.Tech. students. The course will provide an overview of the probability and applications of statistics related to computer application problems.

**Objective:** Students undergoing this course are expected to:

1. Solve problems related to conditional, Baye's theorem.
2. Learn about Binomial, Poisson, Exponential and Normal distributions to compute probabilities.
3. Apply the concept of sampling distribution of the means in general situations and how to use the Central Limit Theorem.
4. Learn about one tail and two tail tests and how to give conclusion about null or alternative hypotheses using the suitable test statistic.
5. Apply the regression analysis to fit the curves.
6. Learn various statistical quality control methods.

**Text book (s)**

1. B.V.Ramana, Engineering Mathematics, TMH-publications, 4th Edition, 2009.
2. Miller and J. E. Freund, Probability & Statistics for Engineers, Prentice Hall of India, 8th Edition, 2011.
3. T. K. V. Iyengar, B. Krishna Gandhi *et. al*, Probability & Statistics, S. Chand & Company, 2012.

**Reference (s)**

1. Arnold O. Allen, Probability & Statistics, Academic Press, 2nd Edition, 2005.
2. Shahnaz Bathul, A text book of Probability & Statistics, V. G. S. Book Links, 2nd Edition, 2007.
3. Murugesan and Gurusamy, A text book of Probability & Statistics, Anuradha Publications, 2011.

## Syllabus

**UNIT – I** (11+4 hours)

**Probability& Random variables**

Sample space and events – Probability – The axioms of probability – Some Elementary theorems – Conditional probability – Baye's theorem, Random variables – Discrete and continuous Distributions and properties-Expectations – MGFs

*Real time problems of Baye's theorem, Construction of discrete probability distributions*

UNIT-II (11+4 hours**)**

**Probability Distributions**

Binomial, Poisson, Exponential, Normal distributions and their MGFs – related properties

*Limiting cases from Binomial distribution to Poisson and Normal distribution*

**UNIT-III** (11+4 hours)

**Sampling distribution& Testing of hypothesis**

Populations and samples - Sampling distributions of mean (known and unknown)-Central limit theorem. Test of Hypothesis– Type I and Type II errors. One tail and two-tail tests –tests of Hypothesis concerning one and two means & Proportions-Z test, Maximum error and interval estimation of means and proportions. Tests of significance – Student's t-test, F-test, Chi-square test for independence of attributes

*Real time problems in construction of confidence intervals and Testing of Hypothesis*

**UNIT-IV** (12+3 hours)

**Statistical Quality control, Correlation and Regression**

Statistical Quality Control methods-Methods of preparing Control charts-X-bar, p and R-charts-curve fitting by the method of least squares- linear, polynomial and exponential curves-Correlation-Pearson's correlation coefficient and Spearman's Rank correlation and linear Regression.

*Construction of np-chart*

**Course Outcomes:**

After completion of the course, students are able to:

1. Understand basic probability axioms and apply Baye's theorem related to engineering problems.
2. Identify the suitable distribution among Binomial, Poisson, exponential, normal in engineering applications.
3. Make use of the sampling distribution of the sample mean in general situations, using the Central Limit Theorem.
4. Decide the null or alternative hypotheses using the suitable test statistic.
5. Apply the regression analysis to fit the curves.
6. Understand the methods and applications of Control charts like X-bar, p and R-charts.

**Course plan:**

| Lecture No | Learning objective | Topic(s) to be covered | Chapter in the textbook/reference |
|---|---|---|---|
| 1 | Introduction to probability | **Unit-I :** Introduction to probability and definitions | T1-32.3 |
| 2 | To know the basic axioms of probability | Basic axioms of probability | T1-32.3 |
| 3 | To learn the applications of Addition theorem | Addition theorem and problems | T1-32.3 |
| 4 | To learn the applications of multiplication theorem | Conditional probability and multiplication theorem | T1-32.3 |
| 5 | To identify the importance of conditional probability | Problems on Conditional Probability | T1-32.3 |
| 6 | To solve the problems using Baye's theorem | Baye's theorem | T1-32.4, 32.5 |
| 7 | | Tutorial-1 | |
| 8 | To learn the importance of defining random variables | Random variables, Probability functions | T3-2.2,2.4 |
| 9 | To know about discrete and continuous random variables | Discrete and continuous random variables | T3-2.3 |
| 10 | | Tutorial-2 | |
| 11 | To define probability mass and density functions | Probability mass function and Probability density function | T3-2.5,2.7 |
| 12 | To solve the problems on Random variables and distributions | Problems on random variables | T3-2.5,2.7 |

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| 13 | | Tutorial-3 | |
| 14 | To learn how to find expectation and variance and MGFs | Expectation, variance and MGFs | T3-2.6 |
| 15 | | Tutorial-4 | |
| 16 | To know about the Binomial distribution | **Unit-II :** Probability Distributions-Binomial Distribution | T1-24.3 |
| 17 | To study the properties and solve the problems on binomial distribution | Properties and Problems on Binomial distribution | T1-24.3 |
| 18 | To know about Poisson distribution, Mean and variance | Poisson distribution, Mean and Variance | T3-3.10, 3.12 |
| 19 | To learn about Mode, MGF and recurrence relation | Mode, MGF, Recurrence relation | T3-3.12,3.13 |
| 20 | To solve the problems on Poisson distribution | Problems on Poisson distribution | T3-3.13 |
| 21 | | Tutorial-5 | |
| 22 | To know about the exponential distribution | Exponential distribution | R3- 4.7 |
| 23 | To solve the problems on exponential distribution | Problems on exponential distribution | R3- 4.7 |
| 24 | | Tutorial-6 | |
| 25 | To realize the normal distribution features and importance | Normal distribution-features and importance | T3-3.14,3.20 |
| 26 | To learn MGF | Mean, Variance and Mode of N.D. | T3-3.17 |
| 27 | | Tutorial-7 | |
| 28 | To learn about standard normal variate | Standard Normal variate | T3-3.18, 3.19 |
| 29 | To learn problems on normal distribution | Problems on Normal distribution | T3-3.20 |
| 30 | | Tutorial-8 | |
| 31 | To know about sampling | **Unit-III:** Sampling | T3-4.1 to 4.10 |

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| | distributions-Definitions-sampling distribution of mean | distributions-Definitions-Sampling distribution of Means(Large sample) | |
| 32 | To know about sampling distribution of mean(small samples)t-distribution | Sampling distribution of mean(Small samples)-t-distribution | T3-4.10 |
| 33 | To solve the problems on t-distribution | Problems on t-distribution | T3-4.12 |
| 34 | | Tutorial-9 | |
| 35 | To know about sums and differences | Sums and Differences | T3-4.12 |
| 36 | To know the Null and Alternate Hypothesis, Types of errors-critical region-one tailed and two tailed tests | Null and Alternate Hypothesis, Types of errors-critical region-one tailed and two tailed tests | T3-6.2,6.3,6.5 |
| 37 | To know about Testing a hypothesis for single Mean (Large sample) | Test a hypothesis for single Mean (Large sample) | T3-6.7 |
| 38 | | Tutorial-10 | |
| 39 | To learn about testing a hypothesis for difference of means | Test a hypothesis for difference of means | T3-6.8 |
| 40 | To learn about testing a hypothesis for proportions | Test a hypothesis for Proportions | T3-6.9,6.10 |
| 41 | | Tutorial-11 | |
| 42 | To learn about Test of significances : t-test and problems | Test of significances : t-test and problems | T3-7.9-7.12 |
| 43 | To learn about F-test and problems | F-test and problems | T3-7.14 |
| 44 | To learn about Chi-square test and problems | Chi-square test and problems | T3-7.15-7.18 |
| 45 | | Tutorial-12 | |
| 46 | To learn about statistical quality control methods | **Unit-IV:** Statistical Quality control methods | T3-8.2 |
| 47 | To learn about bar charts | Bar charts | T3-8.14 |
| 48 | To solve the problems on Bar charts | Problems on Bar Charts | T3-8.14 |

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| 49 | To learn about p-charts and solve the problems | p-Charts and problems | T3-8.20 |
| 50 | To learn about R-Charts and solve the problems | R-Charts and problems | T3-8.15 |
| 51 | | Tutorial-13 | |
| 52 | To know how to fit a straight line by least square method | Fitting a straight line by least square method | T3-10.5 |
| 53 | To learn about fitting of a polynomial | Fitting of polynomial | T3-10.11 |
| 54 | To learn about fitting of an exponential curve and solve the problems | Fitting of exponential curve and problems | T3-10.11 |
| 55 | | Tutorial-14 | |
| 56 | Introduction to correlation and its types | Introduction to correlation and its types | T3-9.1,9.2,9.3 |
| 57 | To learn about linear and non-linear correlation | Linear and Non-linear correlation | T3-9.3(4) |
| 58 | To learn about Karl Pearson coefficient of correlation | Karl Pearson coefficient of correlation | T3-9.9 |
| 59 | To learn about linear regression | Linear regression | T3-10.6 |
| 60 | | Tutorial-15 | |

**Evaluation Scheme:**

| Component | Duration (minutes) | Marks | % of weightage | Date & Time | Venue |
|---|---|---|---|---|---|
| Internal Test – 1 | 90 | 30 | 30(80% of marks secured in 1st best internal test + 20% marks secured in 2nd best internal test) | 29-01-18 to 03-02-18 | Block-1,5 |
| Internal Test – 2 | 90 | 30 | | 26-03-18 to 31-03-18 | Block-1,5 |
| Comprehensive Test | 20 | 10 | 10 | 09-04-18 to 14-04-18 | Block-1,5 |
| Semester end exam | 180 | 60 | 60 | 23-04-18 to 05-05-18 | Will be informed |

**Chamber Consultation Hour:** Will be announced by respective faculty

**Venue:** Block -5 staff room

**Notices:** Dept. notice boards located in block 1 and 5

**Signature of the Instructors**

1. **P.Vamsi Sagar**
2. **Dr. R.L.Naidu**

**Signature of the course-coordinator**

**(P.Vamsi Sagar)**