# Course Syllabus

**Jump to Today**

**Subject Code: 01CT1401**
**Subject Name: Probability and Statistics**
**B. Tech. Year – II (Semester IV)**

Objective:
To provide a foundation in probability theory and statistical method in order to solve applied problems and to prepare for more advanced courses in probability and statistics.

Credits Earned: 04 Credits

Course Outcomes: After completion of this course, student will be able to:
1. Understand the needs of probability and distribution
2. Apply the mathematical treatment for random variable and joint probability distribution
3. Draw various graphs for the descriptive statistical analysis for the given data set and develop basic inference sense from it.
4. Apply appropriate probability distribution model, central limit for the given test cases.
5. Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases also Learn non-parametric test such as the Chi-Square test for Independence as well as Goodness of Fit.
6. Perform Statistical analysis study like descriptive statistics, correlation and regression using professional software.

**Pre-requisite of course:**
**Differential and Integral Calculus and Basic Integration**

Teaching and Examination Scheme:

Teaching Scheme (Hours) Credits

Theory Marks Tutorial /

Practical Marks Total Marks

| | | | | E | I | | V | | T |
|---|---|---|---|---|---|---|---|---|---|
| Theory | Tutorial | Practical | Total | ESE | IA | CSE | Viva | Term Work | |
| 03 | 01 | 00 | 04 | 50 | 30 | 20 | 25 | 25 | 150 |

2w

**Contents:**
**Unit Topics Hours**

**1**

**Introduction to Probability**

**Classical and axiomatic definitions of probability, sample space, probability of an event, addition rule and conditional probability, multiplication rule, total probability, Bayes' theorm and independence.**

**06**

**2**

**Random variable**

**Introduction to the concept, Discrete and continuous random variable: definitions and examples, Probability density function and cumulative distribution functions of continuous random variables, Probability mass function of discrete random variables, expected values and variance of discrete random variable.**

**08**

**3**

**Probability distribution**

**Moments, probability and moment generating functions, Some special probability distributions: Uniform, Exponential, Poisson, geometric, Binomial and Normal distribution.**

**06**

**4 Two – dimensional random variable**

**Joint distributions – Marginal and Conditional distributions, Covariance, regression, correlation, Independence of random variables.**

**06**

**5**

**Transformation**

**Transformation of random variables of two dimensions, Central limit theorem (for independent and identically distributed random variables), convergence in probability. Introduction to statistics, Measure of central tendency (mean, median, mode) and measures of dispersion (standard deviation, mean deviation, range, variance etc.)**

**04**

**6**

**Estimation**

**Consistency, Unbiasedness, the method of moments and the method of maximum likelihood estimation, confidence intervals for proportions, confidence intervals for parameters in one sample and two sample problems of normal populations.**

**06**

**7**

**Testing of Hypotheses**

**Null and alternative hypotheses, the critical and acceptance regions, two types of error, power of the test, tests for one sample and two sample problems for normal populations, tests for proportions the most powerful test and Neyman- Pearson Fundamental Lemma, Chi square goodness of fit test and its applications.**

**06**

**Total Hours 42**

**Suggested Text books / Reference books:**
**1. Introduction to Probability and Statistics for Engineers and Scientists, S. M. Ross, Academic**
**Press, 2009.**
**2. Introduction to Probability and Statistics, J.S. Milton & J. C. Arnold, Cengage Learning, 2008**
**3. A First Course in Probability, S.M. Ross, Prentice Hall, 2001.**
**4. Introduction to Probability Theory and Statistical Inference, H.J. Larson, Wiley, 1982**
**5. Introductory Statistics, Neil A. Weiss, 10th Edition, Pearson**

Suggested Theory distribution:
The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as

guidelines for teachers and students to achieve effective teaching-learning process.

Distribution of Theory for course delivery and evaluation

| Remember | Understand | Apply | Analyze | Evaluate | Create |
|----------|-----------|-------|---------|----------|--------|
| 20% | 20% | 30% | 15% | 10% | 5% |

**Suggested List of Tutorial:**
**1. Plot different graph using excel.**
**2. Plot different graph using R and Python.**
**3. Write a program to generate random numbers for given range and find mean, median and mode**
**using R/Python.**
**4. Calculation of deviation, variance, correlation coefficient and code for it.**
**5. Calculation on basics of probability concepts.**
**6. Examples on moment, Probability distributions.**
**7. Calculation of Binomial, Poisson, and Hyper Geometric.**
**8. Calculation of Gaussian, Standard, Normal distribution, Confidence interval and P test.**
**9. Simulation for continuous and discrete distributions.**
**10. Calculation on central limit theorem (with simulation).**
**11. Calculation on hypothesis problems (with simulation).**
**12. Calculation on chi square goodness fit test.**
**13. Case study on regression.**
**14. Case study on correlation.**

Technology Supplementary Resources:

1. https://www.mathsisfun.com/data

2. https://nptel.ac.in/courses/111/105/111105041

3. https://www.coursera.org/browse/data-science/probability-and-statistics

4. https://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-andstatistics- spring-2014/

# Course Summary:

| Date | Details | Due |
|------|---------|-----|
| Sat Jan 13, 2024 | 📝 **Session 1_Nature of Statistics_CO3_PO1** (https://canvas.instructure.com/courses/8401785/assignments/43083825) | due by 7pm |
| Tue Jan 16, 2024 | 📝 **Peer reviewed home work submission - 11 Jan 2024** (https://canvas.instructure.com/courses/8401785/assignments/43291076) | due by 7pm |
| Thu Jan 18, 2024 | 📝 **Session 2 & 3_Organizing Data_CO3_PO1** (https://canvas.instructure.com/courses/8401785/assignments/43083924) | due by 7pm |
| Thu Jan 25, 2024 | 📝 **Peer reviewed home work submission -18 Jan 2024** (https://canvas.instructure.com/courses/8401785/assignments/43540704) | due by 7pm |
| Thu Feb 8, 2024 | 🚀 **Quiz 1 -Probability test(CO1)** (https://canvas.instructure.com/courses/8401785/assignments/43867329) | due by 2:35pm |
| | 📝 **Peer reviewed home work submission - 1 Feb 2024** (https://canvas.instructure.com/courses/8401785/assignments/43873493) | due by 7pm |
| | 📝 **Peer reviewed home work submission - 19 Jan 2024** (https://canvas.instructure.com/courses/8401785/assignments/43873476) | due by 7pm |
| Sat Feb 10, 2024 | 📝 **Peer reviewed home work submission - 2 Feb 2024** (https://canvas.instructure.com/courses/8401785/assignments/43873532) | due by 7pm |
| Sun Feb 11, 2024 | 🚀 **Selection of Statistical analytical tools** (https://canvas.instructure.com/courses/8401785/assignments/43873677) | due by 7pm |

| Date | Details | Due |
|------|---------|-----|
| Sun Feb 18, 2024 | 🚀 **Quiz 3- Statistics -Descriptive analysis - CO3** (https://canvas.instructure.com/courses/8401785/assignments/43084326) | due by 11:59pm |
| Wed Feb 21, 2024 | 📝 **TW Tutorial Probability - Tutorial 2** (https://canvas.instructure.com/courses/8401785/assignments/44133198) | due by 11:59pm |
| Sun Feb 25, 2024 | 📝 **TASK 1 - Regression Case study assignment** (https://canvas.instructure.com/courses/8401785/assignments/43084345) | due by 11:59pm |
| Thu Apr 4, 2024 | 📝 **TASK 4 - Data Story Telling Assignment** (https://canvas.instructure.com/courses/8401785/assignments/43951994) | due by 7pm |
| Sat Apr 13, 2024 | 🚀 **Quiz 4 - Statistics - Distribution - CO4** (https://canvas.instructure.com/courses/8401785/assignments/43084328) | due by 11:59pm |
| Mon Apr 15, 2024 | 📝 **Task 7 - Probability worksheet** (https://canvas.instructure.com/courses/8401785/assignments/45402654) | due by 11:59pm |
| Tue Apr 16, 2024 | 📝 **TW Tutorial Statistics - Tutorial 1** (https://canvas.instructure.com/courses/8401785/assignments/43944328) | due by 7pm |
| Thu Apr 18, 2024 | 🚀 **Quiz 5 - Statistics - Hypothesis testing and regression- CO5,CO6** (https://canvas.instructure.com/courses/8401785/assignments/43867300) | due by 9:30pm |
| Fri Apr 19, 2024 | 📝 **TASK -2 - Statistics -Case study - simulation -Data exploration - visualization, descriptive analysis, Hypothesis testing, regression** (https://canvas.instructure.com/courses/8401785/assignments/43084351) | due by 7pm |
| | 📝 **TASK 3 - Statistical Anlysis tool to explore various case studies** (https://canvas.instructure.com/courses/8401785/assignments/43084355) | due by 7pm |
| | 📝 **TW Tutorial Statistics - Tutorial 3** | due by 11:59pm |

| Date | Details | Due |
|------|---------|-----|
| | [(https://canvas.instructure.com/courses/8401785/assignments/43084321)](https://canvas.instructure.com/courses/8401785/assignments/43084321) | |
| Sat Apr 20, 2024 | 📝 **TW Tutorial Statistics - Tutorial 2** [(https://canvas.instructure.com/courses/8401785/assignments/43084320)](https://canvas.instructure.com/courses/8401785/assignments/43084320) | due by 11:59pm |
| Tue Apr 23, 2024 | 🚀 **quiz 2 prob co2,6** [(https://canvas.instructure.com/courses/8401785/assignments/43867331)](https://canvas.instructure.com/courses/8401785/assignments/43867331) | due by 11am |
| | 📝 **Task 6 - Probability test** [(https://canvas.instructure.com/courses/8401785/assignments/45402609)](https://canvas.instructure.com/courses/8401785/assignments/45402609) | due by 6:59pm |
| Mon Apr 29, 2024 | 🚀 **TASK 5 Surprise test - Statistic portion** [(https://canvas.instructure.com/courses/8401785/assignments/43867323)](https://canvas.instructure.com/courses/8401785/assignments/43867323) | due by 9:17pm |
| Tue Apr 30, 2024 | 📝 **ESE Practical exam 40 marks** [(https://canvas.instructure.com/courses/8401785/assignments/46056162)](https://canvas.instructure.com/courses/8401785/assignments/46056162) | due by 3:45pm |
| | 📝 **TW Tutorial Probability - Tutorial 3** [(https://canvas.instructure.com/courses/8401785/assignments/44748328)](https://canvas.instructure.com/courses/8401785/assignments/44748328) | due by 11:59pm |