# COURSEPACK-2025-26

**SCHEME**

### The scheme is an overview of work-integrated learning opportunities and gets students out into the real world. This will give what a course entails.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Title** | Probability and Statistics | | | | **Course Type** | | | **Theory** | | |
| **Course Code** | C1UC322T | | | | **Class** | | |  | | |
| **Instruction delivery** | **Activity** | **Credits** | **Credit Hours** | | **Total Number of Classes per Semester** | | | | **Assessment in Weightage** | |
| **Lecture** | **3** | **3** | |
| **Tutorial** | **0** | **0** | | **Theory** | **Tutorial** | **Practical**  **Practical** | **Self-study** | **CIE** | **SEE** |
| **Practical** | **0** | **0** | |
| **Self-study** | **0** | **0** | |
| **Total** | **3** | **3** | | 45 | 0 | 0 | 0 | 50% | 50% |
| **Course Lead** | Dr A.D.Jauhari | | | **Course Coordinator** | Dr Aradhana Dutt Jauhari, Dr. Sapna Jain | | | | | |
| **Names Course Instructors** | **Theory** | | | | **Practical** | | | | | |
|  | | | |  | | | | | |

**COURSE OVERVIEW:**

* The aim of this course is to enhance student’s skills to analyze ad apply various concepts of statistics.
* This course contains measures of central tendency and dispersion, curve fitting, correlation regression, probability, various distributions and test of hypothesis
* In measures of central tendency and dispersion, concept and visualization of mean, median and deviation of various data involved.
* Correlation and Regression provides concepts of numerical relation between two or more data.
* Random variables and distributions gives concepts of various discrete and continuous probability distributions.
* Sampling and test of Hypothesis provides knowledge of small and large samples and testing of hypothesis.

**PREREQUISITE COURSE**

|  |  |  |
| --- | --- | --- |
| **PREREQUISITE COURSE REQUIRED** | **Yes** | |
| **If, yes please fill in the Details** | **Prerequisite course code** | **Prerequisite course name** |
| **NA** | **Algebra** |

**COURSE OBJECTIVE:**

The objective of the course is to make students to understand, analyze and apply the various concepts of probability and statistics to meet requirement of industry and society.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

|  |  |
| --- | --- |
| **CO No**. | **Course Outcomes** |
| **CO1** | Explore the basic concept of statistical techniques & probability theory. |
| **CO2** | Apply various methods to measure central tendencies, curve fitting and correlation regression concepts |
| **CO3** | Examine the concept of various probability distributions and its hypothetical testing. |
| **CO4** | Analyze the concept of sampling theory and its applications. |

## BLOOM’S LEVEL OF THE COURSE OUTCOMES

Bloom's taxonomy is a set of hierarchical models used for the classification of educational learning objectives into levels of complexity and specificity. The learning domains are cognitive, affective, and psychomotor.

**THEORY**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CO No. | Remember  **BTL1** | Understand **BTL2** | Apply  **BTL3** | Analyse **BTL4** | Evaluate **BTL2** | Create **BTL6** |
| 1 |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |

PROGRAM OUTCOMES (POs): AS DEFINED BY CONCERNED THE APEX BODIES

|  |  |
| --- | --- |
| **PO1** | **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. |
| **PO2** | **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| **PO3** | **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. |
| **PO4** | **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| **PO5** | **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. |
| **PO6** | **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues, and the consequent responsibilities relevant to the professional engineering practice. |
| **PO7** | **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, demonstrate the knowledge of, and need for sustainable development. |
| **PO8** | **Ethics:** Apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice. |
| **PO9** | **Individual and Teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| **PO10** | **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| **PO11** | **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. |
| **PO12** | **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. |

**PSO1:** Ability to work with emerging technologies in computing requisite to Industry.

**PSO2:** Demonstrate Engineering Practice learned through industry internship to solve live

problems in various domains.

## COURSE ARTICULATION MATRIX

The Course articulation matrix indicates the correlation between Course Outcomes and Program Outcomes and their expected strength of mapping in three levels (low, medium, and high).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **COs#/ POs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
| CO204T1 | 3 | 3 | 1 |  |  | 2 |  |  |  |  |  | 1 | 2 | 2 |
| CO204T2 | 3 | 3 | 1 |  |  | 2 |  |  |  |  |  | 1 | 2 | 2 |
| CO204T3 | 3 | 3 | 1 |  |  | 2 |  |  |  |  |  | 1 | 2 | 2 |
| CO204T4 | 3 | 3 | 1 |  |  | 2 |  |  |  |  |  | 1 | 2 | 2 |

**Note:** 1-Low, 2-Medium, 3-High

## COURSE ASSESSMENT

The course assessment patterns are the assessment tools used both in formative and summative examinations.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Sno | Assessment Tools | CIE | | | | Total CIE  marks | SEE |
| QUIZ1  /AAT | MTE | QUIZ2 AAT |  |
| 1 | Theory | X | X | X |  |  |  |
| 25 | 50 | 25 |  | 100 | 100 |

## COURSE CONTENT

|  |
| --- |
| **Content** |
| Measures of Central Tendency, Measures of dispersion, Curve Fitting , Method of least squares, Fitting of straight lines, Fitting of second degree parabola, Exponential curves, Correlation and Rank correlation, Regression Analysis: Regression lines of y on x and x on y, regression coefficients, properties of regressions coefficients and non-linear regression.  Probability and Distribution: Introduction, Addition and multiplication law of probability, Conditional probability, Baye’s theorem, Random variables (Discrete and Continuous Random variable) Probability mass function and Probability density function, Expectation and variance, Discrete and Continuous Probability distribution: Binomial, Poission and Normal distributions.  Sampling, Testing of Hypothesis and Statistical: Introduction, Sampling Theory (Small and Large) , Hypothesis, Null hypothesis, Alternative hypothesis, Testing a Hypothesis, Level of significance, Confidence limits, Test of significance of difference of means, T-test, F-test and Chi-square test, One way Analysis of Variance (ANOVA). Quality Control. |

**LESSON PLAN FOR THEORY COURSES (THEORY AND TUTORIAL CLASSES)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **L-No** | **Topic for Delivery** | **Theory/Practical** | **Skill** | **Competency** |
|  | Introduction | Theory | Measurement of central tendency and dispersion of data | Students will be competent in Critical thinking ,data analysis and decision making |
|  | Mean for grouped and ungrouped data | Theory |
|  | Median for grouped and ungrouped data | Theory |
|  | Mode for grouped and ungrouped data | Theory |
|  | Range, Mean deviation, Standard deviation , Variance | Theory |
|  | Curve fitting with Least square method | Theory | Fitting various curves by least square method |
|  | Fitting of Straight line | Theory |
|  | Fitting of parabola | Theory |
|  | Fitting of exponential curve | Theory |
|  | Correlation ,Karl Pearson coefficient of correlation | Theory | Correlation and regression of data |
|  | Rank Correlation (Repeated and Non repeated) | Theory |
|  | Regression, Lines of regression | Theory |
|  | Regression continued | Theory |
|  | Non-linear regression | Theory |
|  | Concepts of probability, Addition and multiplication Rule | Theory | Concept of probability |
|  | Conditional probability | Theory |
|  | Bayes theorem | Theory |
|  | Random variables, Discrete Random variables | Theory | Concepts of random variables , mass and density functions |
|  | Continuous Random variables. | Theory |
|  | Revision before MTE | Theory |
|  | Probability mass function | Theory |
|  | Probability density function | Theory |
|  | Expectation of random variable | Theory |
|  | Variance of random variable | Theory |
|  | Joint probability distribution | Theory |
|  | Joint probability distribution continued | Theory |
|  | Binomial distributions | Theory | Various discrete and continuous probability distributions |
|  | Poisson distributions | Theory |
|  | Normal distributions | Theory |
|  | Normal distributions continued | Theory |
|  | Normal distributions continued | Theory |
|  | Sampling concepts, Central limit theorem. | Theory | Concepts of sampling ,testing of Hypothesis and various tests of samples |
|  | Hypothesis testing , basic concepts | Theory |
|  | z-test for single mean | Theory |
|  | z-test for difference of means | Theory |
|  | T-test for single mean and difference of means | Theory |
|  | T-test for large sample. | Theory |
|  | Test for single variance | Theory |
|  | F-test for ratio of variance | Theory |
|  | Chi-square test for goodness of fit | Theory |
|  | Chi-square test for independence of attributes | Theory |
|  | One way ANOVA | Theory |
|  | One way ANOVA Continued | Theory |
|  | Quality Control | Theory |

**IBLIOGRAPHY**

# Text Books:

1. *R. E. Walpole, R. H. Mayers, S. L. Mayers and K. Ye* (2007), **Probability and Statistics for Engineers and Scientists**, 9th Edition, Pearson Education, ISBN:978-0-321-62911-1.
2. *Sheldon M. Ross* (2011), **Introduction to Probability and Statistics for Engineers and Scientists**, 4th Edition, Academic Foundation, ISBN:978-8-190-93568-5.

# Reference Books:

1. *Douglas C. Montgomery* (2012), **Applied Statistics and Probability for Engineers**, 5th Edition, Wiley India, ISBN: 978-8-126-53719-8.
2. *M. R. Spiegel, J. Schiller and R. A. Srinivasan* (2010), **Probability & Statistics**, 3rd Edition, Tata- McGraw Hill, ISBN:978-0-070-15154-3.

https://nptel.ac.in/courses/111102160 https://onlinecourses.nptel.ac.in/noc21\_ma74/preview

**PROBLEM-BASED LEARNING**

Exercises in Problem-based Learning (Assignments)

|  |  |  |
| --- | --- | --- |
| **SN0** | **Problems** | **KL** |
| 1 | Write Addition Law of Probability | KL1 |
| 2 | Define Null and alternate hypothesis | KL1 |
| 3 | Define discrete and continuous random variables and give one example of each | KL2 |
| 4 | How many sample points are there in the sample space when a pair of dice is thrown once? | KL2 |
| 5 | |  | | --- | | On average, a text book author makes two-word processing errors per page on the ﬁrst draft of her text book. What is the probability that on the next page she will make 4 or more errors. | |  | |  | | KL3 |
| 6 | A manufacturer of a certain brand of rice cereal claims that the average saturated fat content does not exceed 1.5 grams per serving. State the null and alternative hypotheses to be used in testing this claim and determine where the critical region is located. | KL3 |
| 7 | Test the hypothesis that *σ*2 = 0*.*03 against the alternative that  for the random sample of 10 containers if the contents of a random sample are 10.2, 9.7, 10.1, 10.3, 10.1, 9.8, 9.9, 10.4, 10.3, and 9.8 liters. Use a 0.01 level of significance and assume that the distribution of contents is normal | KL4 |
| 8 | An article manufactured by a company consist of two parts A and B where 6 out of 100 parts A is defective whereas 2 out of 100 part B is defective. Find the probability that assembled part will be defective. | KL4 |
| 9 | Find coefficient of correlation when lines of regression are  2x-9y+6=0 and x-2y+1=0 | KL5 |
| 10 | A dry cleaning establishment claims that a new spot remover will remove more than 70% of the spots to which it is applied. To check this claim, the spot remover will be used on 12 spots chosen at random. If fewer than 11 of the spots are removed, we shall not reject the null hypothesis that *p* = 0*.*7; otherwise, we conclude that *p >* 0*.*7. (a) Evaluate *α*, assuming that *p* = 0*.*7. (b) Evaluate *β* for the alternative *p* = 0*.*9. | KL5 |
| 11. | Fit a second degree parabola to the following data (y=1.2+1.1x+1.5x2)   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | x | 1 | 2 | 3 | 4 | 5 | | y | 1090 | 1220 | 1390 | 1625 | 1915 | | KL6 |
| 12 | An examination was given to two classes consisting of 40 and 50 students, respectively. In the first class the mean grade was 74 with a standard deviation of 8, while in the second class the mean grade was 78 with a standard deviation of 7. Is there a significant difference between the performance of the two classes at a level of significance of (a) 0.05, (b) 0.01? (c) What is the *P* value of the test? | KL6 |