# KANNUR UNIVERSITY

## (Abstract)

Complementary Elective Course (Statistics) for Integrated M.Sc. Computer Science with Specialization in Artificial Intelligence & Machine Learning programme (CBCSS ) w.e.f 2020 admission - Scheme ,Syllabus (I, II, III, IV Semesters) and Pattern of Question Paper - implemented - Orders issued.

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**ACADEMIC C SECTION**

Acad/C2/16586/NGCI/2021                                                        Dated: 30.07.2021

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Read:-1. U.O Acad/C2/16586/NGCI/2021 dated 31.05.2021

2. Syllabus for Integrated M.Sc. in Computer Science with Specialization in Artificial Intelligence & Machine Learning Programme CBCSS submitted by the Convenor , Expert Committee.

3. U.O No.Acad.C2/12349/201 Dated 20/06/2019.

4. Syllabus of Complementary Elective Courses (Statistics) submitted by the former Chairperson, BoS in Statistics (UG) dated 07.07.2021

5. Order of the Vice-Chancellor dated 20.07.2021

## ORDER

1. As per paper read (1), sanction was accorded by the Vice Chancellor to implement the Regulations for the Integrated M.Sc. in Computer Science with Specialization in Artificial Intelligence & Machine Learning programme (CBCSS) w.e.f 2020 admission.

2. As per paper read (2), One of the Complementary Elective Courses offered for Integrated M.Sc. in Computer Science with Specialization in Artificial Intelligence & Machine Learning programme is, Statistics.

3. As per paper read (3), the existing Syllabus of the B.Sc. Statistics does not provide any Complementary Elective Course for the Integrated M.Sc. in Computer Science with Specialization in Artificial Intelligence & Machine Learning Programme, as the same was revised w.e.f 2019 admission itself.

4. As per the recommendation of CSMC, the former Chairperson,Board of Studies in Statistics(UG), prepared and submitted the Scheme, Syllabus (i, II, III, IV Semesters) and Pattern of Question Paper of the Complementary Elective Courses in Statistics for the New Generation Programme Integrated M.Sc. in Computer Science with Specialization in Artificial Intelligence & Machine Learning Programme -CBCSS w.e.f 2020, as per paper read (4).

5. The Vice Chancellor, after considering the matter in detail and exercise of the powers of the Academic Council conferred under section 11(1), Chapter III of Kannur University Act 1996, accorded sanction to implement Scheme, Syllabus (I, II, III, IV Semesters) and Pattern of Question Paper of the Complementary Elective Courses in Statistics for the New Generation Programme Integrated M.Sc. in Computer Science with Specialization in Artificial Intelligence & Machine Learning programme CBCSS w.e.f 2020, subject to reporting to the Academic Council.

6. The Scheme, Syllabus (I, II, III, IV Semesters) and Pattern of Question Paper of Complementary Elective Courses in Statistics for the New Generation Programme Integrated M.Sc. in Computer Science with Specialization in Artificial Intelligence & Machine Learning programme CBCSS w.e.f 2020, are uploaded in the University website (www.kannuruniversity.ac.in).

7. U.O read (3) above, stands modified to this extent.

Orders are issued accordingly.

sd/-

**BALACHANDRAN V K**
**DEPUTY REGISTRAR (ACAD)**
For REGISTRAR

To:     1.The Principal, NAS College, Kanhangad
        2. Former Chairperson, Board of Studies in Statistics (UG)

Copy To: 1. The Examination Branch (through PA to CE)
         2. PS to VC/PA to PVC/ PA to Registrar
         3. DR/AR Academic
         4. The Computer Programmer (for uploading website)
         6. SF/DF/FC

Forwarded / By Order

SECTION OFFICER

# SYLLABI OF STATISTICS COMPLEMENTARY ELECTIVE COURSES
# [FOR INTEGRATED M.Sc. in COMPUTER SCIENCE WITH SPECIALISATION IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING.]

## WORK AND CREDIT DISTRIBUTION

| COURSE CODE | COURSE TITLE | SEMESTER | HOURS PER WEEK | CREDIT | EXAM HOURS | CE | ESE | TOTAL |
|---|---|---|---|---|---|---|---|---|
| 1C01 STA-ICS | BASIC STATISTICS | I | 4 | 3 | 3 | 10 | 40 | 50 |
| 2C02 STA-ICS | PROBABILITY THEORY AND RANDOM VARIABLES | II | 4 | 3 | 3 | 10 | 40 | 50 |
| 3C03 STA-ICS | PROBABILITY DISTRIBUTIONS | III | 5 | 3 | 3 | 10 | 40 | 50 |
| 4C04 STA-ICS | STATISTICAL INFERENCE | IV | 5 | 3 | 3 | 10 | 40 | 50 |

## EVALUATION

| ASSESSMENT | WEIGHTAGE |
|---|---|
| INTERNAL | 1 |
| EXTERNAL | 4 |

## INTERNAL ASSESSMENT

| COMPONENT | WEIGHTAGE | REMARKS |
|---|---|---|
| COMPONENT 1 TEST PAPER | 2 | For each theory course there shall be a minimum of 3 written tests and the average mark of the best two tests is to be considered for internal mark. Each test paper may have duration of minimum one hour. |
| COMPONENT 2 ASSIGNMENT | 2 | For each theory course each student is required to submit a record of assignments of numericall illustrations of problems in the course using R programme. |

| SEMESTER | COURSE CODE | HOURS PER WEEK | CREDIT | EXAM Hrs |
|----------|-------------|----------------|--------|----------|
| I | 1C01 STA-ICS | 4 | 3 | 3 |

**COURSE OUTCOME**

Student should be able to

**CO1:** understand the different types of data and methods presenting data.

**CO2:** compute various measures of central tendency, measures of variation.

**CO3:** analyse the relationship between two variables.

**CO4:** acquire knowledge in analysing time series.

**Unit I : Data Presentation –** Collection of data, primary and secondary data, Scales of measurement - Nominal, Ordinal, Ratio and Interval, Numerical presentation – raw data, discrete and continuous frequency distributions, Diagrammatic representation of data- line diagram, bar diagram, sub divided bar diagram, histogram, frequency curve, frequency polygon, Pie diagram and bixplot, Illustration using R*.

(20 Hrs.)

**Unit II : Summary Statistics -** Definition and properties of various measures of central tendency - A.M,weighted A.M, Median, Mode, G.M., H.M. , Partition values - Quartiles, Deciles, Percentiles, Measures of Dispersion - Definition and properties of various measures of dispersion - Range, Q.D, M.D, S.D, and relative measures of dispersion, Moments - raw moments, central moments and relation between them, Skewness and Kurtosis - Definition and various measures of skewness and kurtosis, Illustration using R*.

(25 Hrs)

**Unit III: Correlation and Regression Analysis -** Correlation analysis – Scatter diagram, Definition and properties of correlation coefficient, Rank correlation coefficient-formula and problems only, Definitions of partial and multiple correlation coefficients (trivariate case only). Regression analysis - linear regression, fitting of linear regression lines, Method of least squares, regression coefficients and their properties, Fitting of quadratic and exponential curves, Illustration using R*.

(20 Hrs)

**Unit IV: Time Series Analysis-** Time series - Meaning, need, components and models of time series, estimation of linear trend by moving average method and least square method, Illustration using R*.

(7 Hrs)

*Illustrations using R is only for CE(Continuous Evaluation) and shall not be considered for ESE(End Semester Evaluation)

**Books for Study:**
1. Robert V Hogg, Allen T Craig, (2005). Introduction to Mathematical Statistics - Macmillan Publishing Co. Inc. NEW YORK.

**Books for Reference:**
1. Gupta, S. C. & Kapoor, V. K. (1980). Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. Mukhopadhyay, P. (1996). Mathematical Statistics, New Central Book Agency (P) Ltd., Kolkata.
3. Agarwal, B. L. (2006). Basic Statistics, 4 th Edition, New Age International (P) Ltd., New Delhi.

**Marks including choice:**

| Unit | Unit I | Unit II | Unit III | Unit IV | Total |
|------|--------|---------|----------|---------|-------|
| Marks | 10 | 20 | 15 | 15 | 60 |

**Pattern of Questions:**

**Pattern of Questions:**

| | PART A<br>Short Answer | PART B<br>Short Essay | PART C<br>Essay | PART D<br>Long Essay | TOTAL |
|---|---|---|---|---|---|
| Number of questions | 6 | 8 | 6 | 4 | 24 |
| Number of questions to be answered | 6 | 6 | 4 | 2 | 18 |
| Marks | 1 each | 2 each | 3 each | 5 each | |

Total marks including choice     - **60**
Maximum marks of the course     - **40**

## COMPLEMENTARY ELECTIVE COURSE II
## PROBABILITY THEORY AND RANDOM VARIABLES

| SEMESTER | COURSE CODE | HOURS PER WEEK | CREDIT | EXAM Hrs |
|---|---|---|---|---|
| II | 2C02 STA-ICS | 4 | 3 | 3 |

**COURSE OUTCOME**

Student should be able to

**CO1:** evaluate the probability of events.

**CO2:** understand the concept of random variables with examples in real life

**CO3:** calculate the probability distribution of discrete and continuous random variables.

**CO 4:** understand the change of variable technique.

**Unit I**: **Basic Concepts of Probability -** Random experiments, sample space, events, classical definition and frequency approach to probability, laws of events, sigma field, axiomatic definition of probability, probability space, addition theorem (2 and 3 events), Boole's inequalities.

(20 Hrs)

**Unit II**: **Conditional Probability -** Conditional probability, multiplication theorem, independence of events, pair wise and mutual independence, Baye's theorem and its applications, Illustration using R*.

(16 Hrs)

**Unit III**: **Random Variables** - Discrete and continuous random variables, probability mass function and probability density function, distribution function - definition and properties, transformation of random variables-discrete and continuous, Illustration using R*.

(20 Hrs)

**Unit IV: Bivariate Random Variables** - Definitions, joint probability distributions, marginal and conditional distributions, independence of random variables, transformations of bivariate random variables, Illustration using R*.

(16 Hrs)

*Illustrations using R is only for CE(Continuous Evaluation) and shall not be considered for ESE(End Semester Evaluation)

**Books for Study:**

1. Robert V Hogg, Allen T Craig, (2005). Introduction to Mathematical Statistics - Macmillan Publishing Co. Inc. NEW YORK.

**Books for Reference:**

1. Gupta, S. C. &Kapoor, V. K. (1980). Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. Lipschutz, S.& Schiller, J. J. (1998). Schaum's Outline of Theory and Problems of Introduction to Probability and Statistics, The McGraw-Hill Companies, Inc., New York.

**Marks including choice:**

| Unit | Unit I | Unit II | Unit III | Unit IV | Total |
|---|---|---|---|---|---|
| Marks | 20 | 15 | 15 | 10 | 60 |

**Pattern of Questions:**

### Pattern of Questions:

| | PART A Short Answer | PART B Short Essay | PART C Essay | PART D Long Essay | TOTAL |
|---|---|---|---|---|---|

| Number of questions | 6 | 8 | 6 | 4 | 24 |
|---|---|---|---|---|---|
| Number of questions to be answered | 6 | 6 | 4 | 2 | 18 |
| Marks | 1 each | 2 each | 3 each | 5 each | |

Total marks including choice      - **60**
Maximum marks of the course      - **40**

## COMPLEMENTARY ELECTIVE COURSE III
## PROBABILITY DISTRIBUTIONS

| SEMESTER | COURSE CODE | HOURS PER WEEK | CREDIT | EXAM Hrs |
|----------|-------------|----------------|--------|----------|
| III | 3C03 STA-ICS | 5 | 3 | 3 |

**COURSE OUTCOME**

Student should be able to

**CO1:** compute mathematical expectation of a random variable.

**CO2:** familiarize with different discrete probability distribution associated with real life situations.

**CO3:** understand the characteristics of different continuous distributions.

**CO4:** identify the appropriate probability model that can be used.

**Unit I**: Mathematical Expectation: Definition and properties of mathematical expectation, Addition and multiplication theorem on expectation, Expectation of functions of random variables, Moments - Definition of raw and central moments, relation between raw and central moments, Expectation of bivariate random variables, conditional mean and variance, Coefficient of correlation between random variables. Moment generating function - Definition and properties, Characteristic function - Definition and properties.

(22 Hrs)

**Unit II**: Discrete Distributions - Definition, moments, MGF, characteristic function, properties and different characteristics of discrete uniform distribution, Bernoulli distribution, Binomial distribution, Poisson distribution and Geometric distribution, Illustration using R*.

(25 Hrs)

**Unit III**: Continuous Distributions Definition, moments, MGF, characteristic function, properties and different characteristics of Uniform distribution, Normal distribution, Standard normal distribution, Exponential distribution, Gamma distribution with one and two parameters, Beta distributions of I and II kind, Illustration using R*.

(25 Hrs)

**Unit IV**: Sampling distributions - Definition, standard error, sampling distribution of sample mean and sample variance, Chi-square, Student's t and F distributions, Interrelations between chi-square, t and F distributions, Illustration using R*.

(18Hrs)

*Illustrations using R is only for CE(Continuous Evaluation) and shall not be considered for ESE(End Semester Evaluation)

**Books for Study:**
1. Robert V Hogg, Allen T Craig, (2005). Introduction to Mathematical Statistics - Macmillan Publishing Co. Inc. NEW YORK.
2. Goon, A. M., Gupta, M. K. & Dasgupta, B. (2003). An Outline of Statistical Theory, Volume I, 4 th Edn, The World Press Pvt. Ltd., Kolkata.

**Books for Reference:**
1. GuptaS. C. &Kapoor, V. K. (1980). Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. John E. Freund (1980). Mathematical Statistics, Prentice Hall of India, New Delhi.
3. Mood, A. M., Graybill, F. A. &Boes, D. C. (2007). Introduction to the Theory of Statistics, 3rd Edn (Reprint). Tata McGraw-Hill Publishing Company Ltd., New Delhi.

**Marks including choice:**

| Unit | Unit I | Unit II | Unit III | Unit IV | Total |
|------|--------|---------|----------|---------|-------|
| Marks | 14 | 17 | 17 | 12 | 60 |

**Pattern of Questions:**

| | PART A Short Answer | PART B Short Essay | PART C Essay | PART D Long Essay | TOTAL |
|---|---|---|---|---|---|
| Number of questions | 6 | 8 | 6 | 4 | 24 |
| Number of questions to be answered | 6 | 6 | 4 | 2 | 18 |
| Marks | 1 each | 2 each | 3 each | 5 each | |

Total marks including choice    - **60**
Maximum marks of the course    - **40**

## COMPLEMENTARY ELECTIVE COURSE IV
## STATISTICAL INFERENCE

| SEMESTER | COURSE CODE | HOURS PER WEEK | CREDIT | EXAM Hrs |
|----------|-------------|----------------|--------|----------|
| IV | 4C04 STA-ICS | 5 | 3 | 3 |

**COURSE OUTCOME**

Student should be able to

**CO1:** understand the uses of Chebychev's Inequality and Central Limit Theorem.

**CO2:** apply various method of estimation

**CO3:** understand the concept of testing statistical hypotheses and its importance in real life situation

**CO4:** apply ANOVA

**Unit I**: Chebychev's Inequality and Law of Large Numbers Chebychev's Inequality and its applications, convergence in probability, Weak law of large numbers, Bernoulli's law of large numbers, Convergence in distribution and central limit theorem for IID random variables (Statement only).

(15 Hrs)

**Unit II**: Theory of Estimation Point estimation, Desirable properties of a good estimator, Cramer-Rao inequality (statement only), Methods of estimation - method of MLE and method of moments. Interval estimation - Confidence interval for mean, proportion, variance, difference of means, difference of proportions, Illustration using R*.

(25 Hrs)

**Unit III :** Testing of Hypotheses - Statistical hypotheses, Simple and composite hypotheses, Null and alternative hypotheses, Types of errors, Critical region, Size and power of test – Definition and problems, most powerful test, Neyman – Pearson lemma (without proof), Illustration using R*.

(20 Hrs)

**Unit IV:** Large and small sample tests - Test for mean, proportion, equality of means, equality of proportions, paired t-test, test for variance and equality of variance, Chi-square test for goodness of fit, test for independence of attributes, One-way ANOVA (assumptions and problem only), Illustration using R*.

(30 Hrs)

*Illustrations using R is only for CE(Continuous Evaluation) and shall not be considered for ESE(End Semester Evaluation)

**Books for Study:**

1. K. M. Ramachandran,  C. P. Tsokos (2009) Mathematical Statistics with Applications, Elsevier

**Books for Reference:**

1. Gupta, S. C. & Kapoor, V. K. (1980). Fundamentals of Mathematical, Sultan Chand & Sons, New Delhi.
2. John E. Freund (1980). Mathematical Statistics, Prentice Hall of India, New Delhi.
3. Gupta, S. C. &Kapoor, V. K. (1994). Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.

**Marks including choice:**

| Unit | Unit I | Unit II | Unit III | Unit IV | Total |
|------|--------|---------|----------|---------|-------|
| Marks | 10 | 17 | 13 | 20 | 60 |

**Pattern of Questions:**

|  | PART A Short Answer | PART B Short Essay | PART C Essay | PART D Long Essay | TOTAL |
|---|---|---|---|---|---|
| Number of questions | 6 | 8 | 6 | 4 | 24 |
| Number of questions to be answered | 6 | 6 | 4 | 2 | 18 |
| Marks | 1 each | 2 each | 3 each | 5 each |  |

Total marks including choice     - **60**
Maximum marks of the course     - **40**