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|---|---|---|---|---|---|
| Programme | BSc Statistics | | | | |
| Course Code | STA3MN210 (P) | | | | |
| Course Title | Probability theory and sampling techniques | | | | |
| Type of Course | Minor | | | | |
| Semester | III | | | | |
| Academic Level | 200 - 299 | | | | |
| Course Details | Credit | Lecture per week | Tutorial per week | Practical per week | Total Hours |
| | 4 | 3 | - | 2 | 75 |
| Pre-requisites | Understanding of basic algebraic operations and set theory. Familiarity with functions, graphs and their properties. | | | | |
| Course Summary | Through theoretical concepts and practical applications, students will develop the skills necessary to analyze uncertainty, conduct sample surveys, and implement statistical quality control methods. | | | | |

**Course Outcomes (CO):**

| CO | CO Statement | Cognitive Level* | Knowledge Category# | Evaluation Tools used |
|---|---|---|---|---|
| CO1 | Define and apply basic concepts of probability, including classical probability and the axiomatic approach, to analyze uncertain events and outcomes. | U | C | Instructor-created exams / Quiz |
| CO2 | Differentiate between census and sampling methods and recognize the advantages and limitations of each approach in data collection and critically evaluate ethical implications of statistical methods aligning with human values. | Ap | F | Practical Assignment / Observation of Practical Skills/ Instructor-created exams |
| CO3 | Describe the principal steps involved in sample surveys, including the organization and execution of large sample surveys. | U | C | Seminar Presentation / Group Tutorial Work/ Instructor-created exams |
| CO4 | Define life tables and understand their construction, including calculating measures such as the force of mortality, and interpreting results in demographic analysis and analyze data to help entrepreneurial decisions using critical thinking skills. | U | C | Instructor-created exams / Home Assignments |
| CO5 | Explain the concept of statistical quality control and differentiate between assignable causes and chance causes of variation in processes. | Ap | C | One Minute Reflection Writing assignments/ Instructor-created exams |
| CO6 | Create basic plots in R to visualize range, variance and correlation between variables. | Ap | P | Viva Voce/ Instructor-created exams |
| * - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)<br># - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M) | | | | |

**Detailed Syllabus:**

| Module | Unit | Content | Hrs (45 +30 ) | Marks (70) |
|---|---|---|---|---|
| I | | **Probability** | **10** | **15** |
| | 1 | Basic concepts of Probability ,Classical definition of Probability ,Axiomatic approach to Probability | 2 | |
| | 2 | Addition Theorem, Multiplication Theorem | 3 | |
| | 3 | Conditional Probability | 3 | |
| | 4 | Independence of events | 2 | |
| | Sections from References:<br>Unit 1: 3.3-3.8 [Ref 1]<br>Unit 2: 3.9,3.11 [Ref 1]<br>Unit 3: 3.10[Ref 1]<br>Unit 4: 3.11-3.15 [Ref 1] | | | |
| II | | **Random Variables** | **8** | **15** |
| | 5 | Random Variables, Discrete and continuous random variables | 2 | |
| | 6 | Probability distribution , Distribution function (Applications in discrete case) | 2 | |
| | 7 | Mathematical expectation ( Applications in discrete case) | 2 | |
| | 8 | Variance ( Applications in discrete case) | 2 | |
| | Sections from References:<br>Unit 5&6: 5.1-5.4.2 [Ref 1]<br>Unit 7: 6.1-6.4 [Ref 1]<br>Unit 8: 6.6 [Ref 1] | | | |
| III | | **Sampling theory** | **19** | **25** |
| | 9 | Population and Sample | 2 | |
| | 10 | Census and Sampling Method | 3 | |
| | 11 | Advantages and Limitations of Sampling | 1 | |
| | 12 | principal steps in sample survey | 3 | |
| | 13 | Sampling Errors | 3 | |
| | 14 | Non-Sampling Errors | 3 | |
| | 15 | Simple random sampling( Concept and Methods of selection) | 1 | |
| | 16 | Stratified random sampling | 1 | |
| | 17 | Systematic Sampling | 2 | |
| | Sections from References:<br>Unit 9: 15.2,15.3,15.6 [Ref 1]<br>Unit 10: 15.6,15.7[Ref 1]<br>Unit 11: 15.8 [Ref 1]<br>Unit 12: 15.9.1[Ref 1]<br>Unit 13&14:15.10[Ref 1]<br>Unit 15:15.11,15.11.1 [Ref 1]<br>Unit 17: 15.12,15.12.1 [Ref 1]<br>Unit 17: 15.13 [Ref 1] | | | |

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|---|---|---|---|---|
| **IV** | **R programming** | | **8** | **15** |
| | 18 | Range | 2 | |
| | 19 | Variance | 2 | |
| | 20 | Loops- Brief explanation | 2 | |
| | 21 | Pearson's correlation | 1 | |
| | 22 | Conditional statements(Brief) | 1 | |
| | Sections from References:<br>Unit 18&19: 2.1-2.3[Ref 3]<br>Unit 20: 7.5 [Ref 2]<br>Unit 21: 6.2 [Ref 2]<br>Unit 22: 7.3 [Ref 2] | | | |
| **V** | **PRACTICUM** | | **30** | |
| | | Do practice problems in R software from any 5 units of the given list and one additional problem decided by the teacher-in-charge, related to the content of the course. Other units listed here may be used as demonstrations of the concepts taught in the course.<br>1. Range<br>2. Mean Deviation<br>3. Quartile Deviation<br>4. Standard Deviation<br>5. Variance<br>6. Covariance<br>7. Correlation<br>8. Rank correlation | | |
| | Sections from References:<br>Unit 1,2: 2.1 [Ref 3]<br>Unit 3: 2.2 [Ref 3]<br>Unit 4,5: 2.3 [Ref 3]<br>Unit 6,7,8: 6.2-7.5 [Ref 2] | | | |

Books and References:


1. Gupta, S. C. and Kapoor, V. K. (2020). Fundamentals of Mathematical Statistics, 12th edition, Sulthan Chand, New Delhi
2. Douglas, Alex, Deon Roos, Francesca Mancini, Ana Couto, and David Lusseau. (2020), *An Introduction to R*. https://intro2r.com/index.html**.**
3. Sudha G Purohith, Sharad D Core, Shailaja R Deshmukh (2015), Statistics Using R.


**Mapping of COs with PSOs and POs :**

| | PSO 1 | PSO 2 | PSO 3 | PSO4 | PSO 5 | PSO6 | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 2 | 1 | - | - | - | - | 3 | - | - | - | - | - |
| CO 2 | - | - | 1 | - | - | 2 | - | - | - | - | - | 3 |
| CO 3 | - | - | - | 1 | 2 | - | - | - | 3 | - | 2 | - |
| CO 4 | - | - | - | - | - | 2 | - | 1 | 2 | - | - | - |
| CO 5 | - | - | 2 | - | - | - | 1 | - | - | - | - | - |
| CO 6 | - | - | 3 | - | - | 2 | - | - | - | 2 | 1 | 3 |

**Correlation Levels:**

| Level | Correlation |
|---|---|
| - | Nil |
| 1 | Slightly / Low |
| 2 | Moderate / Medium |
| 3 | Substantial / High |

**Assessment Rubrics:**

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

**Mapping of COs to Assessment Rubrics :**

| | Internal Exam | Assignment | Project Evaluation | End Semester Examinations |
|---|---|---|---|---|
| CO 1 | ✓ | | | ✓ |
| CO 2 | ✓ | ✓ | | ✓ |

| | | | | |
|---|---|---|---|---|
| CO 3 | ✓ | | | ✓ |
| CO 4 | | ✓ | | ✓ |
| CO 5 | ✓ | ✓ | | ✓ |
| CO 6 | ✓ | | | |