# THIRUVALLUVAR UNIVERSITY

**SERKKADU, VELLORE–632115**

# B.Sc. STATISTICS

## SYLLABUS

**FROM THE ACADEMIC YEAR**

**2023 – 2024**

# Contents

## Scheme of Examination and Course Structure

**(From 2023 –2024 Onwards)**

**(Semester-wise)**

## THIRUVALLUVAR UNIVERSITY.

# B.Sc STATISTICS

**(The Revised Syllabus shall be Effective from the Academic Year 2023-2024 Onwards)**

**Introduction:**

**Programme Outcome, Programme Specific Outcome and Course out come**

Statistics is the study of Data and extracting knowledge in the data using various methods and techniques, analyze and interpret data, taking data driven predictions and decisions. It also helps data collection through sampling techniques, that is to collect data focusing on problem solving, and presenting it with wider scope of application in science, social sciences, medical science, life sciences, country‘s official statistics etc. Statistical methods are used as research methodology in all most all domains. The key core areas of study in Statistics include Descriptive Statistics, Probability Theory, Sampling techniques, Matrix and Linear Algebra, Distribution Theory, Estimation Theory, Testing of Statistical hypotheses, Stochastic processes, Regression analysis, Design of Experiments, Demography and Official Statistics. The Bachelor‘s Degree B.Sc. Statistics is awarded to the students on the basis of knowledge, understanding, skills, attitudes, values and academic achievements expected to be acquired by learners at the end of the Programme. Learning outcomes of Statistics are aimed at facilitating the learners to acquire these attributes, keeping in view of their preferences and aspirations for gaining knowledge of Statistics.

Bachelor‘s degree in Statistics is the culmination of in-depth knowledge in both theoretical and practical methods and techniques of Statistics. This also leads to study of related areas like Computer science, Industrial Statistics, Mathematical Statistics, Business Statistics and many more. Thus, this programme helps learners in building a solid foundation for higher Studies in Statistics.

The skills and knowledge gained have intrinsic aesthetics leading to proficiency in analytical reasoning. This can be utilized in Statistical modeling and solving real life problems.

Students completing this programme will be able to present Statistics clearly and precisely, make abstract ideas precise by formulating them in the language of Statistics, describe Statistical ideas from multiple perspectives and explain fundamental concepts of Statistics to those non-Statistics users.

This syllabus is aimed at preparing the students to cope with the latest developments and compete with students from other universities and put them on the right track. Along with this, students are equipped with skill enhancement courses like Research methodology, Statistical packages and R language.

## ❖ CARRIER IN STATISTICS

After the completion of under graduate course, students can pursue higher education in the field of statistics, professional courses and research level studies.

| Postgraduates | Professional Courses | Statistical Software | Competitive Exams |
|---|---|---|---|
| M.Sc Statistics | M.B.A | STATA | UPSC |
| M. Stat | M.C. A | SPSS | SSC |
| M.Sc Data Science/ Data Analytics | C.A | Minitab | IAS |
| M.Sc Operations Research | I.C.W.A | R | IFS |
| M.Sc Actuarial Science | F.R.M | SAS | ISS |
| M.Sc in Library and Information Science | C.F.A | SAP | SSS |
| M.Sc in Quantitative Economics | C.C.A | ERP | CSO |
| M.A Economics | | Python | NSSO |
| M.Pharm | | MATLAB | IAMR |
| P.G Diploma in Statistical Methods with Applications | | Max Stat. | ICMR |

## ❖ JOB OPPURTUNITIES

| Jobs opportunities in Statistics Field | Job opportunities in other fields |
|---|---|
| Statistician | Business Analyst |
| Statistics Investigator(TNPSC) | Chartered Accountant |
| Actuarial Analyst | Economist |
| Block Health Statistician(TNPSC) | Financial Manager |
| Data Scientist | Financial Trader |
| Data Analyst | Insurance Underwriter |
| Market Researcher | Machine Learning Engineer |
| Operational Researcher | Research Scientist (Maths) |
| Bio-Statistician | Python Developers |
| Meteorologist | Assistant Director(DPES) |
| Statistics Subject Matter Expert | Senior Manager–Research |
| Statistics at Upthink Expert(Tutor) | Civil Service Fast Streamer |
| Young professional(Statistics) in MOSPI | Project Technical Officer |
| Agriculture Statistical Officer | Banking Sectors |
| Field Officer(Statistics) | Trainee Data Analyst |

| **LEARNING OUTCOMES-BASED CURRICULUM FRAME WORK GUIDELINES BASED REGULATIONS FOR UNDERGRADUATE PROGRAMME** | |
|---|---|
| **Programme:** | **U.G.** |
| **Duration:** | **3years[UG]** |
| **Programme Outcomes:** | **PO1: Disciplinary Knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study<br><br>**PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.<br><br>**PO3: Critical Thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; |

| | |
|---|---|
| | identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.<br><br>**PO4: Problem solving:** Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one‘ learning to real life situations.<br><br>**PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples and addressing opposing viewpoints.<br><br>**PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesizing and articulating; Ability to recognize cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan ,execute and report the results of an experiment or investigation<br><br>**PO7: Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the partof a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team<br><br>**PO8: Scientific reasoning**: Ability to analyze, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.<br><br>**PO9: Reflective thinking**: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.<br><br>**PO10: Information/digital literacy:** Capability to use ICT in a variety of learning situations, demons treatability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.<br><br>**PO11: Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion. |

| | |
|---|---|
| | **PO12: Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.<br><br>**PO13: Moral and ethical awareness/reasoning**: Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demon starting the ability to identify ethical issues related to one's work, avoid unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.<br><br>**PO14:Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination in a smooth and efficient way.<br><br>**PO15: Lifelong learning:** Ability to acquire knowledge and skills, including learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives and adapting to changing trades and demands of workplace through knowledge/skill development/ re skilling. |
| **Programme Specific Outcomes:** | **PSO1**: To enable students to apply basic microeconomic, macroeconomic and monetary concepts and theories in real life and decision making.<br>**PSO2**:To sensitize students to various economic issues related to Development, Growth, International Economics, Sustainable Development and Environment.<br>**PSO3**: To familiarize students to the concepts and theories related to Finance, Investments and Modern Marketing.<br>**PSO4**: Evaluate various social and economic problems in the society and develop answer to the problems as global citizens.<br>**PSO5:** Enhance skills of analytical and critical thinking to analyze effectiveness of economic policies. |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|---|---|---|---|---|---|---|---|---|
| **PSO1** | Y | Y | Y | Y | Y | Y | Y | Y |
| **PSO2** | Y | Y | Y | Y | Y | Y | Y | Y |
| **PSO3** | Y | Y | Y | Y | Y | Y | Y | Y |
| **PSO4** | Y | Y | Y | Y | Y | Y | Y | Y |
| **PSO5** | Y | Y | Y | Y | Y | Y | Y | Y |

**3–Strong,2-Medium,1-Low**

❖ **Highlights of the Revamped Curriculum**:

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands- on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.
- The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising mathematical models and algorithms for providing solutions to industry/real life situations. The curriculum also facilitates peer learning with advanced mathematical topics in the final semester, catering to the needs of stakeholders with research aptitude.
- The General Studies and Mathematics based problem solving skills are included as mandatory components in the Training for Competitive Examinations course at the final semester, a first of its kind.
- The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
- The Industrial Statistics course is newly introduced in the fourth semester, to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
- The Internship during the second year vacation will help the students gain valuable work experience, that connects classroom knowledge to real world experience and to narrow down and focus on the career path.
- Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations.

The state of art technologies in Conducting a Explain in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.

- State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective courses, covering conventional topics to the latest - Artificial Intelligence.

**Value additions in the Revamped Curriculum:**

| Semester | Newly introduced Components | Outcome/Benefits |
|---|---|---|
| **I** | **Foundation Course**<br>To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning Literature and analyzing the world through the literary lens gives rise to a new perspective. | ➢ Instill confidence among students<br>➢ Create interest for the subject |
| **I,II,III,IV** | **Skill Enhancement papers** (Discipline centric / Generic / Entrepreneurial) | ➢ Industry ready graduates<br>➢ Skilled human resource<br>➢ Students are equipped with essential skills to make them employable |
| | | ➢ Training on language and communication skills enable the students gain knowledge and exposure in the competitive world. |
| | | ➢ Discipline centric skill willim prove the Technical know how of solving real life problems<br>. |
| **III,IV,V&VI** | **Elective papers** | ➢ Strengthening the domain knowledge<br>➢ Introducing the stakeholders the State- of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature<br>➢ Emerging topics in higher education/ industry/communication network / health sector etc. are introduced with hands-on-training. |
| **IV** | Elective Papers | ➢ Exposure to industry moulds students in to solution providers<br>➢ Generates Industry ready graduates<br>➢ Employment opportunities enhanced |

| | | |
|---|---|---|
| **V** | Elective papers | ➢ Self-learning is enhanced<br>➢ Application of the concept to real situation is conceived resulting in tangible outcome |
| **VI** | Elective papers | ➢ Enriches the study beyond the course.<br>➢ Developing a research frame work and presenting their independent and intellectual ideas effectively. |
| **Extra Credits: for advanced Learners/Honors degree** | | ➢ To cater to the needs of peer learners /research aspirants |
| **Skills acquired from the Courses** | | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |

## Credit Distribution for UG Programmes

| SemI | Credit | H | SemII | Credit | H | SemIII | Credit | H | SemIV | Credit | H | SemV | Credit | H | SemVI | Credit | H |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Part 1. Language – Tamil | 3 | 6 | Part..1. Language –Tamil | 3 | 6 | Part..1. Language– Tamil | 3 | 6 | Part..1. Language – Tamil | 3 | 6 | 5.1 Core Course –\CC IX | 4 | 5 | 6.1Core Course– CC XIII | 4 | 6 |
| Part.2 English | 3 | 6 | Part..2 English | 3 | 6 | Part..2 English | 3 | 6 | Part..2 English | 3 | 6 | 5.2 Core Course –CCX | 4 | 5 | 6.2Core Course– CC XIV | 4 | 6 |
| 1.3Core Course– CC I | 5 | 6 | 2..3 Core Course – CCIII | 5 | 5 | 3.3Core Course– CC V | 5 | 5 | 4.3Core Course– CC VII Core Industry Module | 5 | 5 | 5. 3.Core Course CC-XI | 4 | 5 | 6.3Core Course– CC XV | 4 | 6 |
| 1.4Core Course– CC II | 5 | 5 | 2.4 Core Course –CCIV | 5 | 5 | 3.4Core Course– CC VI | 5 | 5 | 4.4Core Course– CC VIII | 5 | 5 | 5. 4.Core Course –/ Project with viva-voce CC-XII | 4 | 5 | 6.4 Elective-VII Generic/ DisciplineSpecific | 3 | 5 |
| 1.5 Elective I Generic/ Discipline Specific | 3 | 5 | 2.5 Elective II Generic/ DisciplineSpecific | 3 | 6 | 3.5Elective III Generic/ Discipline Specific | 3 | 5 | 4.5 Elective IV Generic/ Discipline Specific | 3 | 6 | 5.5 Elective V Generic/ Discipline Specific | 3 | 4 | 6.5 Elective VIII Generic/ DisciplineSpecific | 3 | 5 |
| 1.6 Skill EnhancementCourse SEC-1 | 2 | 2 | 2.6Skill Enhancement Course SEC-2 | 2 | 2 | 3.6 Skill Enhancement Course SEC-4, (Entrepreneurial Skill) | 1 | 1 | 4.6 Skill EnhancementCourse SEC-6 | 2 | 2 | 5.6 Elective VI Generic/ Discipline Specific | 3 | 4 | 6.6 Extension Activity | 1 | - |
| 1.7 Skill Enhancement - (Foundation Course) | 2 | 2 | 2.7Skill Enhancement Course– SEC-3 | 2 | 2 | 3.7 Skill Enhancement Course SEC-5 | 2 | 2 | 4.7 Skill EnhancementCourse SEC-7 | 2 | 2 | 5.7 Value Education | 2 | 2 | 6.7 Professional CompetencySkill | 2 | 2 |
| | | | | | | 3.8E.V.S. | 2 | 2 | | | | 5.8 SummerInternship /Industrial Training | 2 | | | | |
| | **23** | **32** | | **23** | **32** | | **24** | **32** | | **23** | **32** | | **26** | **30** | | **21** | **30** |
| **Total–140Credits** | | | | | | | | | | | | | | | | | |

**Consolidated Semester wise and Component wise Credit distribution**

| Parts | Sem I | Sem II | Sem III | Sem IV | Sem V | Sem VI | Total Credits |
|---|---|---|---|---|---|---|---|
| **Part I** | 3 | 3 | 3 | 3 | - | - | 12 |
| **Part II** | 3 | 3 | 3 | 3 | - | - | 12 |
| **Part III** | 13 | 13 | 13 | 13 | 22 | 18 | 92 |
| **Part IV** | 4 | 4 | 3 | 6 | 4 | 3 | 24 |
| **Part V** | - | - | - | - | - | - | - |
| **Total** | 23 | 23 | 22 | 25 | 26 | 21 | **140** |

***Part I. II, and Part III components will be separately taken into account for CGPA calculation and classification for the undergraduate programme and the other components. IV, V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.**

| **Methods of Evaluation** | | |
|---|---|---|
| **Internal Evaluation** | Continuous Internal Assessment Test | 25Marks |
| | Assignments | |
| | Seminars | |
| | Attendance and Class Participation | |
| **External Evaluation** | End Semester Examination | 75Marks |
| | Total | 100Marks |
| **Methods of Assessment** | | |
| **Recall (K1)** | Simple definitions ,MCQ, Recall steps ,Concept definitions | |
| **Understand/ Comprehend(K2)** | MCQ, True/False, Short essays, Concept explanations, Short summary or Overview | |
| **Application(K3)** | Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain | |
| **Analyze (K4)** | Problem-solving questions, Finish a procedure in many steps, Differentiate | |
| | between various ideas, Map knowledge | |
| **Evaluate (K5)** | Longer essay /Evaluation essay, Critique or justify with pros and cons | |
| **Create(K6)** | Check knowledge in specific or off beat situations, Discussion, Debating or Presentations | |

## ❖ ELIGIBILITYCONDITIONFORADMISSION

Candidates who seek admission to the Degree of Bachelor of Science in Statistics are required to have passed the Higher Secondary Examinations (Academic or Vocational Stream) conducted by the Government of Tamil Nadu or an examination accepted as equivalent there to by the Thiruvalluvar University, with Statistics/ Mathematics/Business Mathematics as one of the subjects.

## ❖ DURATION OF THE COURSE

a) Each academic year will be divided into two semesters. The first academic year will comprise the first and second semester, the second academic year - the third and fourth semester and the third academic year – the fifth and sixth semester.
b) The odd semesters consist of the duration from June to November of each year and the even semesters consist of the duration from December to April of each year. There won‘t be less than 90 working days for each semester.

## ❖ COURSE OF STUDY

In the following subjects, the course of study will comprises instruction according to the syllabus and books, prescribed from time to time.

## ❖ EXAMINATIONS

During semester examination for each theory examination three hours is allotted. For practical examination also three hours is allotted. It will be conducted at the end of each the year. The candidate who has failed in any subject will be permitted to attend the arrear subject(s) along with the subsequent examination.

## ❖ PROJECT

The aim of the course is to initiate students to write and present a statistical report, under the supervision of a faculty, on some area of social interest. The project work will provide hands on training to the students to deal with data emanating from some real – life situation and propel them to do well on so theory or relate it to some theoretical concepts. The project should be prepared based on the own idea and interpretation of the student. It should not be copied from anywhere. A student must consult his/her supervisor for the preparation of the project.

While writing a project, a student must present two seminars before the faculties/ supervisor from the department.

**Internal–25 Marks**

**ProjectViva–Voce–75 Marks**

**Total – 100 Marks**

## ❖ INTERNSHIP

Students should undergo the internship for a duration of fifteen days at the end of the fourth semester. The eligible agencies to undergo internship shall be reputed multinational companies, Banking organizations, State/Central government governing agencies' faculty in- charge from the department will be allotted to such students. The internship result will be declared in the fifth semester mark sheet. The internship programme does not carry any marks. The mark sheet will be showing the report of the guide after the viva-voce examination as Commended or Highly Commended.

## ❖ SCHEME OF EXAMINATIONS

**The scheme of examination for different semesters shall be as follows:**

**Course structure under OBE (Semester-wise Details)**

## Branch: STATISTICS

**(For the students admitted from the Academic year 2023-2024 onwards)**

| PART | PAPER CODE | COURSE | TITLE OF THE PAPER | HOURS | CREDIT | MARKS | | TOTAL |
|---|---|---|---|---|---|---|---|---|
| | | | | | | CIA | UE | |
| **SEMESTER – I** | | | | | | | | |
| I | | Part – 1 Language | Tamil – I | 6 | 3 | 25 | 75 | 100 |
| II | | Part – 2 Language | English – I | 6 | 3 | 25 | 75 | 100 |
| III | | Core Theory – I | Descriptive Statistics | 6 | 5 | 25 | 75 | 100 |
| | | Core Theory – II | Probability Theory | 5 | 5 | 25 | 75 | 100 |
| | | Elective – I | Mathematics for Statistics | 5 | 3 | 25 | 75 | 100 |
| IV | | **SEC – I | Bio - Statistics | 2 | 2 | 25 | 75 | 100 |
| | | Foundation Course | Elementary Statistics | 2 | 2 | 25 | 75 | 100 |
| **NO. OF COURSES – 7** | | | **TOTAL** | **32** | **23** | **175** | **525** | **700** |
| **SEMESTER – II** | | | | | | | | |
| I | | Language | Tamil – II | 6 | 3 | 25 | 75 | 100 |
| II | | Language | English – II | 6 | 3 | 25 | 75 | 100 |
| III | | Core Theory – III | Matrix and Linear Algebra | 4 | 4 | 25 | 75 | 100 |
| | | Core Theory - IV | Distribution Theory | 4 | 4 | 25 | 75 | 100 |
| | | Core Practical-1 | Practical - I | 2 | 2 | 40 | 60 | 100 |
| | | Elective - II | Real Analysis | 6 | 3 | 25 | 75 | 100 |
| | | ** SEC – 2 | Basic Computers(MS Excel) | 2 | 2 | 25 | 75 | 100 |
| IV | | ** SEC – 3 | Quantitative Aptitude | 2 | 2 | 25 | 75 | 100 |
| **NO. OF COURSES – 8** | | | **TOTAL** | **32** | **22** | **215** | **585** | **800** |
| **SEMESTER – III** | | | | | | | | |
| I | | Language | Tamil – III | 6 | 3 | 25 | 75 | 100 |
| II | | Language | English – III | 6 | 3 | 25 | 75 | 100 |
| III | | Core Theory – V | Estimation Theory | 4 | 4 | 25 | 75 | 100 |
| | | Core Theory – VI | Sampling Techniques | 4 | 4 | 25 | 75 | 100 |
| | | Core Practical-II | Practical - II | 2 | 2 | 40 | 60 | 100 |
| | | Elective III | Numerical Methods | 5 | 3 | 25 | 75 | 100 |
| | | ** SEC – 4 | Database Management System | 2 | 2 | 25 | 75 | 100 |
| IV | | ** SEC – 5 | Entrepreneur Development | 1 | 1 | 25 | 75 | 100 |
| | | ** EVS | ** EVS | 2 | 2 | 25 | 75 | 100 |
| **NO. OF COURSES – 7** | | | **Total** | **32** | **24** | **240** | **660** | **900** |

## Third Year

| SEMESTER – IV | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | HOURS | CREDIT | CIA | UE | TOTAL |
| I | Language | Tamil – IV | 6 | 3 | 25 | 75 | 100 |
| II | Language | English – IV | 6 | 3 | 25 | 75 | 100 |
| III | Core Theory – VII | Testing of Statistical Hypothesis | 4 | 4 | 25 | 75 | 100 |
| | Core Theory – VIII | Actuarial Statistics | 4 | 4 | 25 | 75 | 100 |
| | Elective – IV | Economic & Official Statistics | 6 | 3 | 25 | 75 | 100 |
| | Core Practical-III | Practical III | 2 | 2 | 40 | 60 | 100 |
| IV | ** SEC - 6 | Python | 2 | 2 | 25 | 75 | 100 |
| | ** SEC - 7 | Fundamental of Human Rights. | 2 | 2 | 25 | 75 | 100 |
| **NO. OF COURSES – 9** | | **TOTAL** | **32** | **23** | **240** | **660** | **900** |

### Semester-V

| Part | List of Courses | Hours | Credit | CIA | UE | TOTAL |
|---|---|---|---|---|---|---|
| Part-3 | | | | | | |
| | Core IX – Stochastic Process | 4+1 | 4 | 25 | 75 | 100 |
| | Core X – Regression Analysis | 4+1 | 4 | 25 | 75 | 100 |
| | Core XI – Practical IV – (Core IX & X) | 4 | 4 | 40 | 60 | 100 |
| | Core XII – Project (Core with Viva voce) | 4 | 4 | 25 | 75 | 100 |
| | Elective V – Operations Research (Discipline Specific) | 4 | 3 | 25 | 75 | 100 |
| | Elective VI – Econometrics / Population Studies | 4 | 3 | 25 | 75 | 100 |
| Part-4 | Value Education | 2 | 2 | 25 | 75 | 100 |
| | Internship / Industrial Visit / Field Visit | 2 | 2 | 25 | 75 | 100 |
| | | **30** | **26** | **215** | **585** | **800** |

### Semester-VI

| Part | List of Courses | Hours | Credit | CIA | UE | TOTAL |
|---|---|---|---|---|---|---|
| Part-3 | | | | | | |
| | Core XIII – Design of Experiments | 6 | 4 | 25 | 75 | 100 |
| | Core XIV – Demography | 6 | 4 | 25 | 75 | 100 |
| | Core XV – Practical V – (Core XIII & XIV) | 5 | 4 | 40 | 60 | 100 |
| | Elective VII - Statistical Quality Control | 6 | 3 | 25 | 75 | 100 |
| | Elective VIII –Time Series / Index numbers | 5 | 3 | 25 | 75 | 100 |
| Part-4 | Extension Activity | - | 1 | - | - | 100 |
| | Professional Competency Skill<br>Introduction to R Language | 2 | 2 | 25 | 75 | 100 |
| Total | | **30** | **21** | **215** | **585** | **700** |

**Remarks: English Soft Skill Two Hours will be handled by English Teachers (4+2 = 6 hours for English).**

**TABLE SHOWING THE COURSES OFFERED WITH CREDITS UNDER VARIOUS PARTS**

**OBE Pattern With effect from the Academic Year 2023-24 onwards**

## Course Structure

**BRANCH: STATISTICS**

| Sem I | Credit | Sem II | Credit | SemIII | Credit | SemIV | Credit | SemV | Credit | SemVI | Credit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.1. Language | 3 | 2.1. Language | 3 | 3.1.Language | 3 | 4.1.Language | 3 | 5.1Core Course– \CCIX | 4 | 6.1Core Course– CC XIII | 4 |
| 1.2English | 3 | 2.2English | 3 | 3.2English | 3 | 4.2English | 3 | 5.2Core Course– CCX | 4 | 6.2Core Course– CCXIV | 4 |
| 1.3Core Course– CCI | 5 | 2.3Core Course – CC III | 5 | 3.3 Core Course–CCV | 5 | 4.3CoreCourse – CCVII Core Industry Module | 5 | 5.3.Core Course CC -XI | 4 | 6.3Core Course– CC XV | 4 |
| 1.4Core Course– CCII | 5 | 2.4Core Course – CC IV | 5 | 3.4 Core Course–CC VI | 5 | 4.4CoreCourse – CCVIII | 5 | 5.3.Core Course–/ Project withviva-voce CC-XII | 4 | 6.4Elective -VII Generic/ Discipline Specific | 3 |
| 1.5 Elective I Generic/ Discipline Specific | 3 | 2.5 Elective II Generic/ Disciplin e e Specific | 3 | 3.5 Elective III Generic/ Discipline Specific | 3 | 4.5ElectiveIV Generic/ Discipline Specific | 3 | 5.4 ElectiveV Generic/ Discipline Specific | 3 | 6.5Elective VIII Generic/ Discipline Specific | 3 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.6 Skill Enhancement Course SEC-1 (NME) | 2 | 2.6 Skill Enhancement Course SEC-2 (NME) | 2 | 3.6 Skill Enhancement CourseSEC-4, (Entrepreneurial Skill) | 1 | 4.6 Skill Enhancement Course SEC-6 | 2 | 5.5 ElectiveVI Generic/ Discipline Specific | 3 | 6.6 Extension Activity | 1 |
| 1.7 Skill Enhancement- (Foundation Course) | 2 | 2.7 Skill Enhancement Course– SEC-3 | 2 | 3.7 Skill Enhancement CourseSEC-5 | 2 | 4.7 Skill Enhancement CourseSEC-7 | 2 | 5.6Value Education | 2 | 6.7 Professional Competency Skill | 2 |
| | | | | 3.8E.V.S | - | | | 5.8Summer Internship /Industrial Training | 2 | | |
| | **23** | | **23** | | **24** | | **23** | | **26** | | **21** |
| | **Total Credit Points** | | | | | | | | | | **140** |

## DIFFERENT TYPES OF COURSES

### Core Courses CC

| S. No. | Course No. | Title of the course |
|---|---|---|
| 1 | I | Descriptive Statistics |
| 2 | II | Probability Theory |
| 3 | III | Matrix and Linear Algebra |
| 4 | IV | Distribution Theory |
| 5 | V | Estimation Theory |
| 6 | VI | Sampling Techniques |
| 7 | VII | Testing of Statistical Hypothesis |
| 8 | VIII | Actuarial Statistics |
| 9 | IX | Stochastic Processes |
| 10 | X | Regression Analysis |
| 11 | XI | Practical-IV |
| 12 | XII | Project(Core with Viva Voce) |
| 13 | XIII | Design of Experiments |
| 14 | XIV | Demography |
| 15 | XV | Practical- V |

# SEMESTER-I

<table>
<tr><td colspan="8">(For the candidates admitted from the academic year 2023-2024 onwards)</td></tr>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Descriptive Statistics</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE -I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>4</td><td colspan="2">1</td><td colspan="2">--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basic Arithmetic</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">The main objectives of this course are:<br>1. It explains the important concepts of statistics and statistical data.<br>2. It provides to formulate the visualization of frequency distribution.<br>3. Also they measure the averages, dispersions, lack of symmetry, moments, relationship among variables.<br>4. Estimate and predict the unknown and future values.<br>5. Study of non- linear and consistency of the data.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">Unit-I Statistics<br>Introduction - Definition –Collection of Data: Primary and secondary data - Methods of collecting primary data - Sources of secondary data. Sampling: Census and Sample methods. Classification-Types - Formation of frequency distribution-Tabulation - parts of a Table - Types. Diagrammatic representation–Types .Graphical representation-<br>Graphs of frequency distributions. Merits and Limitations of diagrams and graphs.</td></tr>
<tr><td colspan="6">Unit-II Measures of Central tendency<br>Introduction-Definitions- Types - Mean-Median-Mode-Geometricmean-HarmonicMean-WeightedmeanMeritsandDemerits-Measuresof Dispersion: Introduction–Definition–Types–Range-Quartile Deviation - Mean deviation - Standard deviation - Co-efficient of variation.</td></tr>
<tr><td colspan="6">Unit-III Skewness<br>Introduction-Definition-Types-Karl Pearson‘s – Bowley‘s - Kelly‘s methods – Their merits and demerits. Kurtosis: Introduction-Definition-Types-Its merits and demerits. Moments :Introduction-Definition- Types-Raw, Central moments and their relations.</td></tr>
<tr><td colspan="6">Unit-IV Correlation analysis<br>Introduction - Definition - Types – Ungrouped and Grouped data – Probable error – properties - Rank correlation –Regression analysis: Introduction - Definition – Regression Equations -Multiple regression.</td></tr>
<tr><td colspan="6">Unit-V Theory of Attributes<br>Introduction – Definition-Classes and Class frequencies-Consistency of data-Independence of attributes- Association of attributes-Yule‘s coefficient and-Coefficient of Colligation.</td></tr>
</table>

| | |
|---|---|
| Extended Professional Component(is a part of internal component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC –CSIR/GATE/TNPSC/others to be solved (To be discussed during the Tutorial hour) |
| Skills acquired from this Course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| Recommended Text | 1. Gupta,S.P. (2017):Statistical Methods, Sultan Chand &Sons Pvt Ltd, New Delhi, 35th Revised Edition.<br>2. GuptaS.CandKapoor,V.K.(2002).Fundamentals of Mathematical Statistics, Sultan Chand&SonsPvt. Ltd.,New Delhi |
| Reference Books | **1.** Goon A.M. Gupta.A. K. and Das Gupta,B(1987). Fundamental of Statistics, vol.2 World Press Pvt. Ltd., Kolkata<br>**2.** G. U. Yule and M.G. Kendall (1956). An introduction to the theory of Statistics, Charles Griffin.<br>**3.** M.R. Spiegel (1961). Theory and problems of Statistics, Schaum's outline series.<br>**4.** Anderson, T.W. and Sclove SL.(1978). Anintroductionto statistical analysis of data, Houghton Miffin &co.<br>**5.** Pillai,R.S.,andBagavathi(2003):Statistics,S.Chandand Company Ltd., New Delhi. |
| Website and e-Learning Source | e-books, tutorials on MOOC/SWAYAM courses on the subject<br>https://en.wikipedia.org/wiki/Statisticshttps://en.wikipedia.org/wiki/Descriptive_statisticshttps://socialresearchmethods.net/kb/statdesc.php<br>http://onlinestatbook.com/2/introduction/descriptive.html |

**Course Learning Outcome(for Mapping with POs and PSOs)**

Students will be able to

**CLO-1:** Describe the scope, functions, applications and limitations of Statistics.

**CLO-2:**Also to explain the statistical survey, collection of data, sampling and presentation of data.

**CLO-3:**Discuss the importance and uses of central values and dispersions for the various types of data.

**CLO-4:** Also to measure the various measures of averages and scatteredness of the mass of data in a series.

**CLO-5:**Explain about the lack of symmetry ,$r^{th}$ moments and peakedness of the frequency distributions.

**CLO-6:** Ability to apply in data

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| CLO1 | S | S | M | M | M | S | M | S | M |
| CLO2 | S | S | S | S | M | S | M | S | M |
| CLO3 | S | S | S | M | S | S | M | S | S |
| CLO4 | M | S | S | S | S | S | S | S | M |
| CLO5 | S | S | S | S | M | S | S | S | M |
| CLO6 | S | S | S | S | M | S | S | S | M |

**CLO-PSO Mapping (Course Articulation Matrix)S-Strong, M- Medium-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 |
| Weight age | 15 | 15 | 15 | 15 | 15 |
| Weighted percentage of Course Contribution to Pos | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Probability Theory</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE- II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">4</td><td colspan="2">1</td><td>--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basic Knowledge on events and set theory</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">The main objectives of this course are:<br>1. To describe the importance and scope of probability theory and to predict the chance of an experimental outcomes.<br>2. It provides the study of random variable, distribution function, mathematical expectation,<br>3. Two-dimensional variables and its distributions</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">Unit-I Theory of Probability<br>Introduction-Basic terminology- Definition - Axiomatic approach – Types of Events-Conditional Probability – Addition and MultiplicationtheoremsofProbabilityfor_two‘events(StatementandProof)– Bayestheoremof Probability (Statement and Proof)-Simple problems<br>.</td></tr>
<tr><td colspan="6">Unit-II Random variables and Distribution functions<br>Introduction - Discrete random variable: Probability mass function-Discrete distribution function, Properties. Continuous random variable: Probability density function and properties.</td></tr>
<tr><td colspan="6">Unit-III Two dimensional random variables<br>Joint probability mass function- Marginal probability function, Conditionalprobabilityfunction.Twodimensionaldistributionfunctions-Marginal distribution functions-Joint density function-Marginal density function-Conditional distribution function Conditional probability density function only.</td></tr>
<tr><td colspan="6">Unit-IV Mathematical Expectations<br>Introduction- Expected value of a random variable (Discrete and Continuous)-Expected value of function of a random variable - Properties of Expectation-Propertiesofvariance-Covariance.Inequalitiesinvolving Expectation.</td></tr>
<tr><td colspan="6">Unit-V Generating functions<br>M.G.F-Properties-Uniqueness theorem - C.G.F-Properties- P.G.F-Properties. Characteristic Function: Properties– Inversion theorems (Statement only)- Uniqueness theorem (Statement only). Chebychev‘s Inequality (Statement and Proof).</td></tr>
</table>

| | |
|---|---|
| Extended Professional Component( is a part of internal component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/others to be solved(To be discussed during the Tutorial hour) |
| Skills acquired from this Course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| Recommended Text | 1. Gupta S.C. and Kapoor V.K (2015): Fundamentals of Mathematical Statistics, Sultan Chand & Sons. |
| Reference Books | 1. Rohatgi, V.K. (1984): An introduction to probability theory and mathematical statistics.<br>2. Hogg. R.V. and Craig. A.T. (1978) :Introduction to Mathematical Statistics, McGraw Hill Publishing Co. Inc. New York.<br>3. Mood A.M. Gray bill, F.A. and Bose. D.C. (1974): Introduction to the theory of Statistics, McGraw Hill Publishing Co. Inc. New York.<br>4. Sanjay Arora and Bansilal (1989): New Mathematical Statistics, Satya prakashan, New Delhi |
| Website and e-Learning Source | e-books, tutorials on MOOC/SWAYAM courses on the subject www.khanacademy.org/math/statistics-probability/random-variables-stats-library https://ocw.mit.edu/courses/mathematics/18-440-probability-and-random-variables-spring-2014/ |

**Course Learning Outcome (for Mapping with POs and PSOs)**

Students will be able to

**CLO-1:** Understand concepts of probability and identify the different approaches of probability theory

**CLO-2:** Define the random variable and its respective probability values and to compare a discrete and continuous random variable.

**CLO-3:** Calculate the expected value of a random variable variance, covariance, and moments and find the conditional expectation and variance of bi-variate random variable.

**CLO-4:** Estimate them erasures of central values, Dispersions, Skewness and Kurtosis through the generating function

**CLO-5:** Understand bi-variate random variables and its distributions

**CLO-6:** Application of probability theory in real life

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | M | M | S | M | S | M |
| **CLO2** | S | S | S | S | M | S | M | S | M |
| **CLO3** | S | S | S | M | S | S | M | S | S |
| **CLO4** | S | S | S | M | S | S | S | S | M |
| **CLO5** | S | S | S | S | M | S | S | S | M |
| **CLO6** | S | S | S | S | M | S | S | S | M |

**CLO-PSO Mapping (Course Articulation Matrix)S-Strong ,M-Medium, W-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weight age** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">Mathematics for Statistics</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">Elective I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>3</td><td colspan="2">1</td><td colspan="2">--</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">Calculus–Basic arithmetic</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">The main objectives of this course are:<br>1. The overall objective of the study is to create deep interest in learning mathematics which develop broad and balance knowledge and understanding definitions, concepts, principles and theorems.<br>2. It helps the students to enhance the ability of learners to apply the knowledge and skill acquired by them to solve specific theoretical and applied problems in mathematics.<br>3. It also encourages the students to develop a range of generic skill helpful in employment, internships in social activities.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="7">Unit-I Rational fractions: Proper and improper rational fractions. Partial fractions: Forms of partial fractions.</td></tr>
<tr><td colspan="7">Unit-II Series: Summation and approximations related to Binomial, Exponential and Logarithmic series -Taylor‘s series.</td></tr>
<tr><td colspan="7">Unit-III Theory of equations: Polynomial equations with rea coefficients imaginary and irrational roots-solving equations with related roots-equatio with given numbers as roots.</td></tr>
<tr><td colspan="7">Unit-IV Differential calculus: Functions – Different types – simple valued and many valued –Implicit and Explicit functions, Odd and even functions periodic functions, algebraic and transcendental functions.</td></tr>
<tr><td colspan="7">Unit-V Successive differentiation: Leibnitz‘s theorem, nth derivatives o standard functions – simple problems. Partial differentiation: Successive partial differentiation.</td></tr>
</table>

| | |
|---|---|
| Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/TRB/NET /UGC – CSIR/ GATE /TNPSC /others to be solved<br>(To be discussed during the Tutorial hour) |
| Skills acquired from this Course | Knowledge, Problem Solving, Analytical ability, Professional Competency ,Professional Communication andTransferrable Skill |
| Recommended Text | **1.** Duraipandian, P. and Udaya Baskaran, S. (2014): Allied Mathematics,Vol. – I&II,S.Chand &CompanyPvt. Ltd.<br>**2.** Vittal,P.R(2012).AlliedMathematics,MarghamPublications.<br>**3.** Narayanan,SManickavachagamPillai(1993): Ancillary Mathematics, Book II : (ContainingDifferential Calculus) S. ViswanathanPvt,Ltd. |
| Reference Books | **1.** Narayanan,S and ManickavachagamPillai (1993): Ancillary Mathematics (Vol. II,Part I) : (Containing Trignometry) S. ViswanathanPvt.Ltd.<br>**2.** Narayanan, S and ManickavachagamPillai (1993): Ancillary Mathematics, Book I: (ContainingAlgebra). S. Viswanathan Pvt.Ltd.<br>**3.** S.J.Venkatesan (2019), Algebra,Sri Krishna Publications ,Chennai-77 , skhengg1999@gmail.com |
| Website and e-Learning Source | e-books,tutorialsonMOOC/SWAYAMcoursesonthesubject |

**Course Learning Outcome(for Mapping with POs and PSOs)**

Students will be able to

**CLO-1** Distinguish between proper and improper fractions. Express an algebraic fraction as the sum of its partial fractions.

**CLO-2**Demonstrate the knowledge to determine the sums, expansion and approximation of series including binomial, exponential, logarithmic.

**CLO-3**Solveproblemsaboutpolynomialswithrealcoefficients,imaginary and irrational roots.

**CLO-4**Calculate limits of a function.

**CLO-5** Obtain then the derivative in successive differentiation.

**CLO-6** Obtain the mathematical knowledge and skills for the better understanding of statistics as a mathematical science

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| CLO1 | S | S | M | M | M | S | M | S | M |
| CLO2 | S | S | S | S | M | S | M | S | M |
| CLO3 | S | S | S | M | S | S | M | S | S |
| CLO4 | S | S | S | M | S | S | S | S | M |
| CLO5 | S | S | M | M | M | S | S | S | M |
| CLO6 | S | S | S | S | M | S | S | M | M |

**CLO-PSO Mapping (Course Articulation Matrix)S-Strong, M- Medium, W-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 |
| Weight age | 15 | 15 | 15 | 15 | 15 |
| Weighted percentage of Course Contribution to Pos | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

| Title of the Course | | SEC-I : Bio-Statistics | | | | | |
|---|---|---|---|---|---|---|---|
| Paper Number | | | | | | | |
| Category | Core | Year | I | Credits | 2 | Course Code | |
| | | Semester | I | | | | |
| Instructional Hours per week | | Lecture | | Tutorial | | Lab Practice | Total |
| | | 2 | | - | | -- | 2 |
| Pre-requisite | | Basics of distribution theory and Regression analysis | | | | | |
| Objectives of the Course | | The main objectives of this course are to:<br>1. Initiate the awareness of Biostatistics and its need.<br>2. Make the students have a clear understanding of special kinds of various statistical tools used in biostatistics.<br>3. Be knowledgeable about the potential applications of these tools. | | | | | |
| | | **Unit I -** Introduction to Bio statistics – Various types of studies – Ethics – Measures of disease frequency and disease burden. Clinical trials – Goals of Clinical trials – Phases of clinical trials – Classification of clinical trials | | | | | |
| | | **Unit II -**Randomization: Fixed Allocation, Simple , Blocked, Stratified, Baseline Adaptive and Response Adaptive – Blinding: Single, Double and triple- Designs for clinical Trials : Parallel Groups Design, Cluster Randomization Designs, Crossover Designs. | | | | | |

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|---|---|
| **Course Outline** | **Unit III -**Multiple Regression – Assumptions – Uses – Estimation and interpretation of regression coefficients – Testing the regression coefficients – Coefficient of determination – Testing model Adequacy. |
| | **Unit IV -**Logistic Regression : Introduction – Logistic regression model – Relative risk – Logistic– odds Ratio – Properties of odds ratio – the relationship between the odds ratio and relative risk |
| | **Unit V -**Maximum likelihood estimates and interpretation of coefficients – Test for coefficients – Test for overall regression and goodness of fit using Maximum Likelihood technique – Deviance Statistics, Wald Test, LR Test and score test. |
| Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour) |
| Skills acquired from this Course | Knowledge, Problem Solving, Analytical ability ,Professional Competency, Professional Communication and Transferrable Skill |
| Recommended Books | 1. Chow,S. C., and Liu, J.P.(2013). Design and Analysis of Clinical Trials: Concepts and Methodologies, Third Edition, Wiley – Interscience, John Wiley & Sons, NJ.<br>2. Friedman, l. M., Furberg, C. D., and DeMets, D. L. (2015), Fundamentals of Clinical Trials, Fifth edition, Springer– Verlag, NY. |

| | |
|---|---|
| | 3. Van Belle, G., Fisher, L. D., Heagerty, P.J.,and Lumley,T. (2004). Bio-Statistics - A Methodology for the Health Science,Second Edition,Wiley, NY.<br>4. Daniel, W. W. and Chad L. Cross(2018). Bio-Statistics: A foundation for analysis in the Health Sciences ,EleventhEdition,John Wiley&Sons,NY.<br>5. Kleinbaum,D. G., and Klein,M.(2012): Logistic regression:A Self-Learning Text, Third Edition ,Springer– Verlag,NY. |
| Reference Books | 1. Hosmer,Jr. D. W., Lemeshow, S., and Sturdivant, R. X.(2013). Applied Logistic Regression, Third Edition, John Wiley & Sons, Inc., NY.<br>2. Rossi, R.J. (2010). Applied Biostatisticsfor HealthSciences, John Wiley & Sons, Inc., NY |
| **Website and e-Learning Source** | 1. Prof.Shamik Sen, Department of Bioscience and Bio engineering, IIT Bombay, ―Introduction to Biostatistics‖, NPTEL. [https://swayam.gov.in/nd1_noc20_bt28/preview]<br>2. Dr.Felix Bast, Central University of Punjab, Bathinda, 2020,―Biostatisticsand Mathematical Biology‖, (NPTEL). [https://swayam.gov.in/nd2_cec20_ma05/preview] |

**Course Learning Outcome (for Mapping with POs and PSOs)**

Students will be able to

**CLO-1**Understand the concepts and statistical tools used in Biostatistics

**CLO-2**Effectively apply these tools on solving the biological problems occur in real life

**CLO-3**Analyze the given Bio-statistical data as per the objectives of the problem

**CLO-4**Interpret the outcomes of the analyses meaningfully

**CLO-5**Create research problems of his own and able to proceed with them

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| CLO1 | S | S | M | M | M | S | M | S | M |
| CLO2 | S | S | S | S | M | S | M | S | M |
| CLO3 | S | S | S | M | S | S | M | S | S |
| CLO4 | S | S | S | M | S | S | S | S | M |
| CLO5 | S | S | M | M | M | S | S | S | M |

**CLO-PSO Mapping(Course Articulation Matrix)S-Strong, M-Medium, W-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weight age** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

| **Title of the Course** | | **Foundation Course–Elementary Statistics** | | | | | |
|---|---|---|---|---|---|---|---|
| **Paper Number** | | **Foundation Course** | | | | | |
| **Category** | Core | **Year** | I | **Credits** | 2 | **Course Code** | |
| | | **Semester** | I | | | | |
| **Instructional Hours per week** | | **Lecture** | **Tutorial** | **Lab Practice** | **Total** | | |
| | | 2 | - | -- | 2 | | |
| **Pre-requisite** | | Uses and its basics | | | | | |
| **Objectives of the Course** | | 1. To enable the students to understand the basic concepts of set theory.<br>2. Appreciate the basics of functions and relations.<br>3. Understand the types of functions and relations.<br>4. To acquire knowledge the Sequence and series of Arithmetic and Geometric. Find useful applications in commercial problems among others.<br>5. To know the difference between permutation and combination for the purpose of arranging different objects. | | | | | |
| **Course Outline** | | **Unit–I**<br>Set Theory – Subset, Types of Sets, Relations, Functions – Simple problems. | | | | | |
| | | **Unit–II**<br>Sequence and Series of Arithmetic and Geometric Progressions – Introduction to Sequence, Series, Arithmetic Progression, Geometric Progression – Simple Problems. | | | | | |
| | | **Unit–III**<br>Basic Concepts of Permutations & Combination – Fundamental Principles of Counting, Factorial, Permutations, Circular Permutations, Permutation with Restrictions, Combinations – Simple Problems. | | | | | |
| | | **Unit–IV**<br>Logical Reasoning– Number Series, Coding and decoding and odd man out. | | | | | |

| | |
|---|---|
| | **Unit –V**<br>Statistics – Importance of statistics, concept of statistical population and a sample – quantitative and qualitative data. Collection of primary and secondary data, Measurement scales – nominal, ordinal interval and ratio. |
| Extended Professional Component (is a part of internal component only, not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved. |
| Skills acquired from this Course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |

| | |
|---|---|
| reference Books | 1. V.K. Kapoor andS.C. Gupta: Fundamentalsof Mathematical Statistics, Sultan Chand & Sons, New Delhi.<br>2. Charles C.Pinter : ABook of Set Theory–Dover Publications, Inc, Mineola, New York.<br>3. Dr.R.S. Aggarwal : AModern Approachto Logical Reasoning, Sultan & Chand- 2018. |
| **Website and e-Learning Source** | https://www.icai.org/post.html?post_id=17790 |

**Course Learning Outcome(for Mapping with POs and PSOs)**

Students will be able to

**CLO-1: Describe** the rule that definition, relations and functions of set theory.

**CLO-2**:To develop the skill of computation with real sequences and series.

**CLO-3: Students** should be able to determine the number of out comes in a problem.

**CLO-4: Students** should be able to apply the fundamental principle of counting to find out the total number of outcomes in problem.

**CLO-5:** Understand of data and its relevance in business and develop an understanding of quantitative techniques.

**CLO-6:** Ability to apply in data.

| | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** | **PSO6** | **PSO7** | **PSO8** | **PSO9** |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | M | M | S | M | S | M |
| **CLO2** | S | S | S | S | M | S | M | S | M |
| **CLO3** | S | S | S | M | S | S | M | S | S |
| **CLO4** | S | S | S | M | S | S | S | S | M |
| **CLO5** | S | S | M | M | M | S | S | S | M |
| **CLO6** | S | S | S | S | M | S | S | M | M |

**CLO-PSO Mapping(Course Articulation Matrix)S-Strong, M-Medium, W-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weight age** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution toPos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO'sandCO's**

## SEMESTER-II

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Matrix and Linear Algebra</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">Core III</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">4</td><td colspan="2">--</td><td>--</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basic vector and matrix theory</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">The main objectives of this course are:<br>1. To study the basic operations of transpose and inverse of matrices<br>. 2. To know the structure of orthogonal and unitary matrices<br>3. To learn the invariance properties of ranks<br>4. To know and to apply the concepts of vector space and matrix polynomials.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">Unit I Matrices-Transpose-Conjugate transpose- Reversal law for the transpose and conjugate transpose. Ad joint of a matrix, Inverse of a matrix, Singular and Non -Singular matrices,</td></tr>
<tr><td colspan="6">Unit II Reversal law for the inverse of product of two matrices. Commutatively of inverse and transpose of matrix, Commutatively of inverse and conjugate transpose of matrix.</td></tr>
<tr><td colspan="6">Unit III Rank of a matrix, Echelon form, Rank of transpose, Elementary transformations, Elementary matrices, Invariance of rank through elementary transformations, Reduction to Normal form, Equivalent matrices.</td></tr>
<tr><td colspan="6">Unit-IV Vector space – Linear Dependence - Basis of a vector space –Sub-space- Properties of Linearly Independent and dependent system, Row and Column spaces, Equality of Row and Column ranks, Rank of Sum and Product of matrices</td></tr>
<tr><td colspan="6">Unit-V Matrix polynomials, Characteristic roots and vectors, Relation between characteristic roots and characteristic vectors, Algebraic and Geometric multiplicity, Clayey- Hamilton theorem.</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="6">1. Vasishtha.A.R (1972) : Matrices, KrishnaprakashanMandir, Meerut.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="6">1. Shanthinarayan, ( 2012 ) : A Text Book of Matrices, S.Chand& Co, New Delhi<br>2. M.L.Khanna (2009), Matrices, Jai PrakashNath& Co</td></tr>
<tr><td colspan="2">Website and e-Learning Source</td><td colspan="6">e-books, tutorials on MOOC/SWAYAM courses on the subject<br>https://samples.jbpub.com/9781556229114/chapter7.pdf</td></tr>
</table>

| | |
|---|---|
| | https://www.vedantu.com/maths/matrix-rank<br>https://textbooks.math.gatech.edu/ila/characteristic-polynomial.html<br>https://www.aitude.com/explain-echelon-form-of-a-matrix/ |

# Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1** Do basic operations of matrices
**CLO-2** Understand various transactions of matrices and its applications
**CLO-3** Understand various properties of matrices
**CLO-4** Able to understand vector space and its applications
**CLO-5** Able understand Eigen vector and its applications
**CLO-6** Able understand vector and matrix applications

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | M | M | S | M | S | M |
| **CLO2** | S | S | S | S | M | S | M | S | M |
| **CLO3** | S | S | S | M | S | M | M | S | S |
| **CLO4** | S | S | S | M | S | S | S | S | M |
| **CLO5** | S | S | M | M | M | S | S | S | M |
| **CLO6** | S | S | M | S | M | S | S | M | M |

**CLO-PSO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weight age** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

| Title of the Course | **Distribution Theory** | | | | | |
|---|---|---|---|---|---|---|
| **Paper Number** | **Core IV** | | | | | |
| **Category** Core | **Year** | I | **Credits** | 4 | **Course Code** | |
| | **Semester** | II | | | | |

| **Instructional Hours per week** | **Lecture** | **Tutorial** | **Lab Practice** | **Total** |
|---|---|---|---|---|
| | 4 | -- | -- | 4 |

| | |
|---|---|
| **Pre-requisite** | Calculus |
| **Objectives of the Course** | The main objectives of this course are:<br>1.To learn discrete distributions<br>2. To learn continuous distributions<br>3. to understand Distributions generated from mathematical functions<br>4. learn normal distribution and its properties<br>5. understand about sampling distributions |
| **Course Outline** | **Unit I**<br>Binomial distribution – moments, recurrence relation, mean deviation, mode, moment generating function, characteristic function, cumulants. Fitting of Binomial Distribution. Poisson distribution – moments, mode, recurrence relation, moment generating function, characteristic function, cumulants. Fitting of Poisson distribution. Negative binomial distribution – m.g.f., cumulants. |
| | **Unit II** Geometric distribution – lack of memory, moments, m.g.f.- Hyper geometric distribution – mean, variance, approximation to Binomial, recurrence relation – Multinomial distribution – m.g.f., mean and variance. |
| | **Unit III** Normal Distribution – chief characteristics of the normal distribution and normal probability curve, mean, median, mode, m.g.f. characteristic function, moments, points of inflexion, mean deviation, Area property -Importance of Normal Distribution. |
| | **Unit-IV** Exponential distribution – m.g.f., characteristic function, memory less property – Gamma distribution – m.g.f., cumulants and central moments, reproductive property – Beta distribution – First kind and second kind – constants. |
| | **Unit-V** Functions of Normal random variables leading to t, Chi-square and F-distributions (derivations, properties and interrelationship) |
| Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour) |
| Skills acquired from this course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| Recommended Text | 1. Gupta, S.C. Kapoor, V.K. (2007) Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi<br>2. Goon, A.M. Gupta M.K. and Das Gupta B (1977) An Outline of Statistical Theory, Vol I, 6/e, World Press, Calcutta.<br>3. Hogg, R.V. and Graig, A.T. (1978) : Introduction to Mathematical Statistics, A/e, Mc.Graw Hill Publishing Co.Inc., New York.<br>4. |
| Reference Books | 1. Mood, A.D. Graybill, F.A. and Boes, D.C (1974): Introduction to the Theory of Statistics, 3/e, Mc.Graw Hill, New York. |



## Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1** identify discrete distributions appeared in real life situations

**CLO-2** understand some continuous distributions and its applications

**CLO-3** connection between some of the real values mathematical functions and its application in distribution theory

**CLO-4** understand normal distribution and its properties

**CLO-5** understand sampling distributions and its applications in real life

**CLO-6** identify probability models in real data and estimate population parameters

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | M | M | S | M | S | M |
| **CLO2** | S | S | S | S | M | S | M | S | M |
| **CLO3** | S | S | S | M | S | M | M | S | M |
| **CLO4** | S | S | S | M | S | S | S | M | M |
| **CLO5** | S | M | M | M | M | S | S | S | M |
| **CLO6** | S | M | M | S | M | S | S | S | M |

**LO-PSO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weight age** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Real Analysis</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">Elective – II (Discipline specific)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td colspan="2">-</td><td>--</td><td colspan="2">4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Number theory and Arithmetic</td></tr>
<tr><td colspan="2">Objectives of theCourse</td><td colspan="6">The main objectives of this course are:<br>1. To study the basic operations of sets and functions<br>2. To know the structure of the real sequence and its convergence<br>3. To learn series and its convergence<br>4. To learn the limits, continuity and derivative of real valued functions<br>5. To know and to apply the Riemann integration</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">Unit I<br>Operations on sets, Functions, Real valued functions, Equivalence, Countability, Real Numbers, Cantor set, Least Upper Bounds, Greatest Lower Bound.<br><br>Unit II Definition of Sequence, Subsequence, Limit of a sequence, Convergent and Divergent sequences, Oscillating sequence, Bounded and Monotone sequences, Operations on convergent sequences, Limit Infimum, Limit Supremum.<br><br>Unit III Definition of Series, Convergent and Divergent series, series with nonnegative terms, alternating series, conditional convergence, absolute convergences and test for absolute convergence<br><br>Unit-IV Limit of a function on the real line, Increasing and Decreasing functions, Continuous function, Derivatives, Derivative and continuity, Rolle's Theorem, Mean value theorem, Taylor's theorem<br><br>Unit-V Concept of Riemann Integral, Upper and Lower sums, Upper integral and Lower Integral Riemann integrability, Necessary and Sufficient condition for Riemann integrable, Properties of Riemann integrals, Fundamental theorem</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this Course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="6">1. Goldberg .R R(1976) : Methods of Real Analysis, Oxford &IBH.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="6">1. Shanthi narayan, ( 2012 ) : Real Analysis, S.Chand& Co, New Delhi<br>2. Walter Rudin (2017), Principles of Mathematical Analysis, 3rd Edition, McGraw-Hill</td></tr>
</table>

| | |
|---|---|
| Website and e-Learning Source | e-books, tutorials on MOOC/SWAYAM courses on the subject<br>https://tutorial.math.lamar.edu/classes/calci/thelimit.aspx<br>https://www.mathsisfun.com/calculus/derivatives-introduction.html<br>https://www.math.ucdavis.edu/~hunter/m125b/ch1.pdf<br>https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-tutorials/single-variable-calculus/taylors-theorem/<br>http://www.ms.uky.edu/~droyster/courses/fall06/PDFs/Chapter06.pdf |

# Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1** do basic operations of sets and understand set functions
**CLO-2** understand sequence and its convergence
**CLO-3** understand series and its convergence
**CLO-4** identify real valued functions and its discontinuity
**CLO-5** understand integration concepts
**CLO-6** understand probability functions as set functions and get knowledge on discrete and continuous nature of it

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | M | M | S | S | S | M |
| **CLO2** | S | S | S | S | M | S | S | S | M |
| **CLO3** | S | S | S | M | S | M | S | S | M |
| **CLO4** | S | S | S | M | S | S | S | S | M |
| **CLO5** | S | S | M | M | M | S | S | S | M |
| **CLO6** | S | M | M | S | M | S | S | S | M |

**CLO-PSO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weight age** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

| Title of the Course | | (Data Analysis Using MS – Excel) | | | | | |
|---|---|---|---|---|---|---|---|
| Paper Number | | CORE PARACTICAL-1 | | | | | |
| Category | Core | Year | I | Credits | 2 | Course Code | |
| | | Semester | II | | | | |
| Instructional Hours per week | | Lecture | Tutorial | Lab Practice | Total | | |
| | | - | - | 2 | 2 | | |

## Objectives:

1. To enable the students to gain computer practical knowledge about the concepts of statistics.
2. To apply the measures of descriptive statistics and probability in real life situations using MSexcel
3. To provide practical knowledge in random variables, probability distributions, expectation,moment generating function, matrices, Rank of matrices.

## Practical Exercises:

1. Computation of Measures of Central Tendency for discrete data using MS Excel (Mean,Median, Mode, Geometric Mean, Harmonic Mean)
2. Computation of Measures of Central Tendency for Continuous data using MS Excel (Mean,Median, Mode, Geometric Mean, Harmonic Mean)
3. Computation of Measures of dispersion for discrete data using MS Excel ()
4. Computation of Measures of dispersion for Continuous data using MS Excel ()
5. Graphical Presentation of data (Histogram, Frequency Polygon, Ogives) Using MS Excel.
6. Computation of Co-efficient of Skewness and Kurtosis – Karl Pearson‘s and Bowley‘s datausing MS Excel
7. Fitting of Binomial distribution – Direct Method using MS Excel.
8. Fitting of Poisson distribution – Direct Method using MS Excel.
9. Fitting of Exponential distribution – Direct Method using MS Excel.
10. Problems based on univariate probability distributions.
11. Problems based on probability.
12. Calculating Inverse matrix in Excel.
13. Calculating Transpose matrix in Excel.
14. Calculating Rank matrix in Excel.

## Note:

**Question Paper Setting:**
5 questions are to be set without omitting any unit. All questions carry equal marks.Any 3 questions are to be answered in 3 hours duration out of 5.

## Examinations Distribution of Marks

| | |
|---|---|
| University Examinations (Computer Practical) | 60 |
| MarksCIA (Including Practical Record) | 40 |
| Marks | |
| Total | 100 Marks |

## SEMESTER II

## SEC- 2: MS EXCEL

**Hours/Week: 2** **Credits: 2**

**Unit I**

Introduction to MS Excel - Introduction, Navigating MS Excel, Cells, Rows, and Columns, Formulas, Sheet Tabs, Page Margins, Page Orientation, Page Breaks and Printing. Worksheets and Workbooks: Definition of Worksheets and Workbooks, Naming of Worksheets, Adding and Deleting Worksheets, Hiding/ Un hiding Worksheets, Hiding Columns and Rows, Saving Workbooks, Saving an Existing File, Headers and Footers, Inserting, Deleting, copy and Renaming of Worksheets.

**Unit II**

Entering & Editing Information - Entering Data, Labels and Values, Copying Cells, Rows and Columns, Pasting Cells, Rows, and Columns, Paste an Item from the Clipboard, Inserting and Deleting Rows and Columns, Filling and Editing Cell Data, Find and Replace, Go to Cell Data, Locking Rows and Columns, Spell Check, AutoCorrect.

**Unit III**

Formatting & Adding Elements to a Worksheet - Change Font Styles and Sizes, Adding Borders and Colours to Cells, change a Column Width and Row Height, Merge Cells, Applying Number Formats, Creating Custom Number Formats, Align Cell Contents, Cell Styles, Conditional Formatting, Freeze and Unfreeze Rows and Columns, Adding and Modifying Images, Removing A Background, Cropping and Rotating an image, compressing a Picture, Inserting AutoShapes, Adding WordArt, Clip Art, and a Hyperlink.

**Unit IV**

Advance Excel - What if Analysis – Goal Seek, Scenario Analysis, Data Tables, Solver Tool, Logical Function – if, nested if. Lookup Functions – Vlookup / HLookup, Index and Match, User Interface using Lookup, Nested VLookup. Pivot Tables.

Data Visualization – Charts Elements, Customizing Layouts & Styles, Formatting Chart Elements, Bar and Columns Chart, Histogram and Pareto Charts, Line Charts and Trendlines, Pie and Donut Charts, Scatter Plots, Bubble Charts, Box and Whisker Charts in Excel.

**Unit V**

MS Excel using the Data Analysis TookPak - Descriptive Statistics in Excel - Central Tendency (Mean, Median, Mode), Variability (Standard Deviation, Variance, Range).

Inferential Statistics - t tests (Independent t and Dependent t), Analysis of Variance (ANOVA), Post Hoc Tests, Correlation, Simple and Multiple Regression.

**BOOKS FOR REFERENCE**


1. Beverly Dretzke, Statistics with Microsoft Excel Fourth Edition
2. Neil J.Salkind, Excel Statistics
3. Larry Pace, The Excel Data and Statistics Cookbook, Third Edition
4. **Kumar Bittu, Microsoft Office 2010**
5. Frag Curtis, Step by Step Microsoft Excel 2013
6. John Walkenbach, 101 Excel 2013 Tips, Tricks and Time severs
7. Salkind Neil J, Statistics for people who (Think They) Hate Statistics, Using MS- Excel


| | | |
|---|---|---|
| **SEMESTER: II**<br>**PART: IV** | SEC-3<br><br>**QUANTITATIVE APPTITUDE** | **Credit:2**<br>**Hours:2** |

**Course Objectives**

1. This course is designed to suit the need of the outgoing students. and
2. To acquaint them with frequently asked patterns in quantitative aptitude
3. To acquaint them with logical reasoning during various examinations and campus Interviews.

**Unit I:**

Ratio And Proportion, Percentages, Square root and Cube Root, Lowest Common Multiple (LCM) and Highest Common Factor (HCF).

**Unit II:** Logarithm, Permutation and Combinations, Simple Interest and Compound Interest.

**Unit III:** Time and Work, Time, Speed and Distance.

**Unit IV:** Data Interpretation, Tables, Column Graphs, Bar Graphs and Venn Diagrams.

**Unit V:** Blood Relation, Coding and Decoding, Calendars and Seating Arrangements.

**Course Outcomes**

On successful completion of the course the students will be able to:

1. Understand the basic concepts of quantitative ability
2. Understand the basic concepts of logical reasoning Skills
3. Acquire satisfactory competency in use of reasoning
4. Solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning Ability.
5. Compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

**Text Books (In API Style)**


1. Agarwal , R. S. *A Modern Approach To Verbal & Non Verbal Reasoning*
2. Sijwali, B. S. *Analytical and Logical reasoning.*
3. Agarwal , R. S. *Quantitative aptitude for Competitive examination.*


**Supplementary Readings**

Sijwali, B. S. *Analytical and Logical reasoning for CAT and other management entrance tes*

## SEMESTER-III

<table>
<tr><td>Title of the Course</td><td colspan="6">Estimation Theory</td></tr>
<tr><td>Paper Number</td><td colspan="6">Core - V</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>II</td><td>Credits</td><td>4</td><td>Course Code</td></tr>
<tr><td></td><td></td><td>Semester</td><td>III</td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2"></td><td>4</td><td colspan="2">--</td><td>--</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="5">Number theory and Arithmetic</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="5">The main objectives of this course are:<br>1. To Emphasize on the Concept of Point Estimation and Interval Estimation.<br>2. To learn properties of a good estimator<br>3. To understand various methods of estimation</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="5">Unit I<br>Point estimation – Estimator – Consistency and Un biasedness – Efficiency and asymptotic efficiency – Estimators based on sufficient statistics – Neyman Factorization theorem (statement only) – Simple illustrations<br><br>Unit II Minimum variance unbiased estimators – Cramer – Rao Inequality – Rao Blackwell theorem – Simple illustrations<br><br>Unit III Methods of Estimation – Methods of Maximum likelihood and moments – Properties of estimators obtained by these methods – Simple illustrations<br><br>Unit-IV Method of Minimum Chi-Square-Method of Minimum Variance-Methods of moments -Methods of Least squares- Interval estimation.<br><br>Unit-V Notion of Bayes estimation – concept of prior, posterior and conjugate priors. Simple problems involving quadratic error loss function – Notion of Minimax estimation – Simple illustrations.</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="5">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="5">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="5">1. Gupta S.C. and Kapoor V.K. (2007) : Fundamentals of Mathematical Statistics, Sultan Chand Sons, New Delhi.<br>2. P.R. Vittal(2002) : Mathematical Statistics, Margham Publications, Chennai.<br>3. Ashok K. Bansal(2007): Bayesian Parametric Inference, Narosa Publishing House.<br>4. Mood, A.M. Graybill, F.A. and Boes D.C. (1974): Introduction to Theory of Statistics, McGraw – Hill.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="5">1. Rohatgi, V. (1976) : An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.<br>2. Goon A.M. Gupta M.K. and Das B. (1980): An Outline of Statistical Theory, Vol II, World Press, Calcutta<br>3. Sanjay Arora and Bansi Lal (1989) : New Mathematical</td></tr>
</table>

| | |
|---|---|
| | Statistics, Satya Prakasam, New Delhi.<br>4. Hodges, J.L. and Lehman, E.L (1964): Basic Concepts of Probability and Statistics, Holden Day.<br>5. Dr. A. Santhakumaran(2004): Probability Models and their Parametric Estimation |
| Website and e-Learning Source | e-books, tutorials on MOOC/SWAYAM courses on the subject |

# Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1** estimate population parameters
**CLO-2** identify good estimators and its properties
**CLO-3** derive interval estimators of a parameter
**CLO-4** estimate parameters using various estimation methods and identify the best among the estimators
**CLO-5** handle data and can estimate population parameters
**CLO-6** realize the application of different types of estimators

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | M | M | S | S | S | M |
| **CLO2** | S | S | S | S | M | S | S | S | M |
| **CLO3** | S | S | S | M | S | M | S | S | M |
| **CLO4** | S | S | S | M | S | S | S | S | M |
| **CLO5** | S | S | M | M | M | S | S | S | M |
| **CLO6** | S | M | M | S | M | S | S | S | M |

**CO-PO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">Sampling Techniques</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">Core - VI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">4</td><td colspan="2">--</td><td>--</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Descriptive statistics and Probability theory</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">The main objectives of this course are:<br>1. To know the basic operations of sampling<br>2. To study the theory and applications of SRS<br>3. To learn practical uses of Stratification<br>4. To apply Systematic and PPS Sampling in real time problems.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">Unit I<br>Basic concepts of sample surveys – Advantages of Sampling – Principal steps in Sample survey, Sampling unit – Sampling frame – Census – Probability Sampling, Alternatives to probability sampling, Mean Square Error.</td></tr>
<tr><td colspan="6">Unit II<br>Simple random sampling, Methods of selection, Sampling with and without replacement – Properties of estimates, Finite population correction, Estimation of Standard error, Confidence limits – Simple random sampling for Qualitative characteristics, Sample size determination for proportions and continuous data.</td></tr>
<tr><td colspan="6">Unit III<br>Stratified random sampling, principles of stratification, Notations – Estimation of population mean and its variance – Estimated variance and confidence limits, Allocation techniques -equal allocation, proportional allocation, Neyman allocation and optimum allocation, Estimation of gain due to stratification.</td></tr>
<tr><td colspan="6">Unit-IV<br>Systematic sampling –Relation to cluster sampling, Estimation of population mean and its sampling variance – Comparison of systematic sampling with stratified random samples. Systematic sampling in two dimensions.</td></tr>
<tr><td colspan="6">Unit-V<br>Varying Probability sampling, Selection of one unit with PPS, PPS Sampling with replacement, Estimator for population total and its variance, Selection procedures,</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="6">1. Cochran, W.G. (1978) : Sampling Techniques, John Wiley Eastern<br>2. Murthy M.N. (1967):Sampling Theory and Methods, Statistical Publishing Society, Calcutta</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="6">1. Singh. D. and ChaudryF.S. (1986) : Theory and Analysis of Sample Surveys Design Wiley Eastern Ltd.</td></tr>
</table>

| | |
|---|---|
| | 2. Sampath.S, (2001), Sampling Theory and Methods, CRC Press. |
| Website and e-Learning Source | e-books, tutorials on MOOC/SWAYAM courses on the subject<br>http://ocw.jhsph.edu/courses/statmethodsforsamplesurveys/pdfs/lecture2.pdf<br>https://www.questionpro.com/blog/stratified-random-sampling/<br>https://www.scribbr.com/methodology/systematic-sampling/<br>http://home.iitk.ac.in/~shalab/sampling/chapter7-sampling-varying-probability-sampling.pdf |

# Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1** Know the difference between census and sampling.
**CLO-2** Understand basic operations and advantages of sampling
**CLO-3** Understand widely used sampling techniques
**CLO-4** Know to estimate population information using sampling
**CLO-5** Apply sampling techniques in real time problems
**CLO-6** identify suitable sampling technique for a real life survey

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | M | M | S | S | S | M |
| **CLO2** | S | S | S | S | M | S | S | S | M |
| **CLO3** | S | S | S | M | S | M | S | S | M |
| **CLO4** | S | S | S | M | S | S | S | S | M |
| **CLO5** | S | S | M | M | M | S | S | S | M |
| **CLO6** | S | M | M | S | M | S | S | S | M |

**CO-PO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td>Title of the Course</td><td colspan="6">Numerical Methods</td></tr>
<tr><td>Paper Number</td><td colspan="6">Elective – III (Discipline Specific)</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>II</td><td>Credits</td><td>3</td><td>Course Code</td></tr>
<tr><td></td><td></td><td>Semester</td><td>III</td><td></td><td></td><td></td></tr>
<tr><td>Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td></td><td colspan="2">4</td><td colspan="2"></td><td>--</td><td>4</td></tr>
<tr><td>Pre-requisite</td><td colspan="6">Basic Arithmetic and calculus</td></tr>
<tr><td>Objectives of the Course</td><td colspan="6">The main objectives of this course are:<br>1. To introduce the study of algorithms that used numerical approximation for the problems of Mathematical analysis.<br>2. To solve mathematical problems numerically</td></tr>
<tr><td>Course Outline</td><td colspan="6">Unit I The Solution of Numerical Algebraic and Transcendental Equations: Bisection Method, Iteration Method, Regular Falsi Method, Newton – Raphson Method.</td></tr>
<tr><td></td><td colspan="6">Unit II Solution of Simultaneous Linear Algebraic Equations:Guass – Elimination Method, Guass–Jordan Method, Guass – Jacobi Method, Guass –Seidel Method.<br>Finite Differences: Operators. Interpolation for Equal intervals: Newton’s Forward Interpolation Formula and Newton’s Backward Interpolation Formula, Evaluation of missing terms.</td></tr>
<tr><td></td><td colspan="6">Unit III Central Difference Interpolation Formula For Equal Intervals: Guass Forward Interpolation Formula, Guass Backward Interpolation Formula, Sterling’s Formula.</td></tr>
<tr><td></td><td colspan="6">Unit-IV Interpolation with Unequal Intervals:<br>Divided Differences, Newton’s Divided Differences Interpolation Formula, Lagrange’s Interpolation Formula and Inverse Lagrange’s Interpolation.</td></tr>
<tr><td></td><td colspan="6">Unit-V Numerical Differentiation: Numerical Differentiation based on Newton’s Forward and Backward Interpolation Formula – Computation of Second order derivatives.<br>Numerical Integration: General Quadrature formula for equidistant ordinates, Trapezoidal Rule, Simpson’s 1/3$^{rd}$ Rule, Simpson’s 3/8$^{th}$ Rule and Weddle’s Rule.<br>Numerical Solution of Ordinary Differential Equations: Taylor Series Method and Runge – Kutta Method. (Simple Problems Only Without Derivation)</td></tr>
<tr><td>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour)</td></tr>
<tr><td>Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td>Recommended Text</td><td colspan="6">1. Kandasamy, P., Thilagavathy, K. (2003): Calculus of Finite Differences and Numerical Analysis, S.Chand Publications.<br>2. Balasubramaniam and Venkatraman(1972): Numerical mathematics part I and II by Rochouse and Sons</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. Kalavathy, S., and Thomson. (2004): Numerical Methods, Vijay Nico::le Publications.<br>2. Gupta, B.D. (2004): Numerical Analysis, Konark Publications.<br>3. Venkatachalapathy, S.G. (2004): Calculus of Finite Differences and Numerical Analysis, Margam Publications.<br>4. Gerald Wheatley, (1970): Applied Numerical Analysis, Pearson</td></tr>
</table>

| | |
|---|---|
| | Education Publications.<br>5. Jain, M.K., Iyengar, S.R., Jain, R.K., (1994): Numerical Methods Problems and Solutions, New Age International Publishers. |
| Website and e-Learning Source | e-books, tutorials on MOOC/SWAYAM courses on the subject<br><br>www.nptel.com |

# Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1** Solve numerically equations that cannot have direct solution
**CLO-2** solve system of linear equations
**CLO-3** understand the need of interpolation
**CLO-4** handle numerical differentiation
**CLO-5** do integration numerically
**CLO-6** get a foundation on algorithms to solve a mathematical problem

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | M | M | S | S | S | M |
| **CLO2** | S | S | S | S | M | S | S | S | M |
| **CLO3** | S | S | S | M | S | M | S | S | M |
| **CLO4** | S | S | S | M | S | S | S | S | M |
| **CLO5** | S | S | M | M | M | S | S | S | M |
| **CLO6** | S | M | M | S | M | S | S | S | M |

**CO-PO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Practical – II (Calculator Based)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE PRACTICAL-II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">2</td><td colspan="2">-</td><td>--</td><td>2</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">The main objectives of this course are:<br>1. To enable the students to gain practical knowledge of estimation of parameters and its interval.<br>2. To know the basic operations of sampling<br>3. To study the theory and applications of SRS<br>4. To learn practical uses of Stratification<br>5. To apply Systematic and PPS Sampling in real time problems.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">Unit I Estimation of parameters of statistical model – Multinomial distribution, exponential, binomial and Poisson distribution –Construction of Confidence intervals for mean and variance</td></tr>
<tr><td colspan="6">Unit II Method of maximum likelihood and method of moments.</td></tr>
<tr><td colspan="6">Unit III Simple random Sampling<br>Drawing Sample from the Population with and without Replacement – Estimation of Population Mean, Total Variance and its Standard Error.</td></tr>
<tr><td colspan="6">Unit IV Stratified random Sampling<br>Estimation of Mean, Variance of the Population Means – Variance of the estimator of Mean under Proportional and Optimal allocations.</td></tr>
<tr><td colspan="6">Unit V Systematic random sampling<br>Estimation of Mean and Variance – Comparison of Simple Random Sampling, Stratified Random Sampling and Systematic Random Sampling.</td></tr>
</table>

## Note:

**Question Paper Setting:**

5 questions are to be set without omitting any unit. All questions carry equal marks.Any 3 questions are to be answered in 3 hours duration.

## Examinations Distribution of Marks

| | |
|---|---|
| University Examinations (Written Practical) | 60 |
| MarksCIA (Including Practical Record) | 40 |
| Marks | |
| Total | 100 Marks |

## SKILL ENHANCEMENT V:DATABASE MANAGEMENT SYSTEMS

**Hours/Week: 2** **Credits: 2**

**Unit 1**

Introduction to Databases and Transactions What is database system, purpose of database system, view of data, relational databases, database architecture, transaction management.

**Unit 2**

Database design and ER Model: Overview, ER-Model, Constraints, ER-Diagrams, ERD Issues, weak entity sets, Codd's rules, Relational Schemas.

**Unit 3**

Relational Algebra and Calculus Relational algebra: introduction, Selection and projection, set operations, renaming, Joins, Division, syntax, semantics.

**Unit 4**

Operators, grouping and ungrouping, relational comparison. Calculus: Tuple relational calculus, Domain relational Calculus, calculus vs. algebra, computational capabilities.

**Unit 5**

A constraint, Views and SQL what is constraints, types of constrains, Integrity constraints, SQL: data definition, aggregate function, Null Values, nested sub queries, Joined relations.

**BOOKS FOR REFERENCES**


1. A Silberschatz, H Korth, S Sudarshan, "Database System and Concepts", fifth Edition
2. McGraw-Hill, Rob, Coronel, "Database Systems", Seventh Edition, Cengage Learning.

## SKILL ENHANCEMENT VI: ENTREPRENEUR DEVELOPMENT

**Hours/Week: 2** **Credits: 1**

**Unit I**

Introduction to Entrepreneurship: Meaning and concept of entrepreneurship.

**Unit II**

History of entrepreneurship development, role of entrepreneurship in economic development, Myths about entrepreneurs, agencies in entrepreneurship management - types of entrepreneurs.

**Unit III**

The Entrepreneur - Why to become entrepreneur, the skills/ traits required to be an entrepreneur, Creative and Design Thinking, the entrepreneurial decision process, skill gap analysis, and role models.

**Unit IV**

Communication - Importance of communication, barriers and gateways to communication, listening to people, the power of talk, personal selling, risk taking & resilience, negotiation.

**Unit V**

Introduction to various forms of business organization (sole proprietorship, partnership, corporations, Limited Liability Company), mission, vision and strategy formulation.

**BOOKS FOR REFERENCE**


1. Ramachandran, Entrepreneurship Development, Mc Graw Hill
2. Katz, Entrepreneurship Small Business, Mc Graw Hill
3. Byrd Megginson,Small Business Management An Entrepreneur's Guidebook 7th ed, McGrawHill

## SEMESTER-IV

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Testing of Statistical Hypothesis</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">Core VII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">3</td><td colspan="2">1</td><td>--</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Estimation theory and distribution theory</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">The main objectives of this course are:<br>1. To make familiar with testing concepts<br>2. To understand the concept of Most Powerful test<br>3. To understand the Likelihood ratio tests and their uses<br>4. To apply tests for samples from unknown distributions</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">Unit I<br>Statistical Hypothesis – Null and Alternative Hypothesis – Simple and Composite hypothesis – Critical region – Type-I and Type-II error – Most Powerful test – Uniformly Most powerful test – Neyman Pearson Lemma – Simple problems.</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit II<br>Likelihood ratio test – Tests of mean of a normal population – Equality of two means of normal populations – test for variance of a normal population – Equality of variances of two normal populations.</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit III<br>Chi-square tests, Distribution of quadratic forms, Test of equality of several means, Analysis of Variance. Correlation and Regression testing.</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit-IV<br>Exact tests based on t distribution – One sample tests - one sided and two sided tests – Variance known and Variance unknown – Two sample tests – One sided and two sided - Variance known and Variance unknown.</td></tr>
<tr><td colspan="2"></td><td colspan="6">Unit-V<br>Nonparametric methods – Confidence interval for distribution quantiles – Tolerance limits for distributions. Sign test, Wilcox on test.</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this Course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="6">1. Robert V. Hogg and Allen T.Craig (1978), Introduction to Mathematical Statistics, 4th edition, Macmillan Publishing Co., Inc. New York<br>2. An Introduction to Probability and Statistics (2001), Rohatgi.V.K, and A.K.Md.EhsanesSaleh, John Wiley & Sons</td></tr>
</table>

| | |
|---|---|
| Reference Books | 1. GuptaS.C. and Kapoor V.K. (1991) : Fundamentals of Mathematical Statistics, Sultan Chand & Sons.<br>2. Goon A.M. Gupta M.K. and Das Gupta B (1980) : An outline of Statistical Theory, Vol.II World Press Calcutta.<br>3. Mood A.M. Graybill F.A. and Boes D.C.B (1980) : Introduction to the Theory of Statistics 3/e, McGraw Hill, New York.<br>4. Gibbons, J.D. (1971) : Non-Parametric Statistical Inference, McGraw Hill. |
| Website and e-Learning Source | e-books, tutorials on MOOC/SWAYAM courses on the subject<br>http://fisher.stats.uwo.ca/faculty/kulperger/SS3858/Handouts/np-lemma.pdf<br>https://www.sciencedirect.com/topics/mathematics/uniformly-most-powerful-test<br>https://www.probabilitycourse.com/chapter8/8_4_5_likelihood_ratio_tests.php<br>https://www.statisticshowto.com/probability-and-statistics/statistics-definitions/parametric-and-non-parametric-data/ |

# Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1** frame hypotheses about population in real life research
**CLO-2** identify suitable testing procedure for given hypotheses
**CLO-3** compare two populations using samples taken from them
**CLO-4** Compare populations in its means and variances separately
**CLO-5** identify situations to apply parametric and nonparametric tests
**CLO-6** interpret results of a hypothesis testing

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | S | M | S | S | S | S |
| **CLO2** | S | S | S | S | M | S | S | S | S |
| **CLO3** | S | S | S | M | S | M | S | S | M |
| **CLO4** | S | S | S | M | S | S | S | S | M |
| **CLO5** | S | S | S | M | M | S | S | S | M |
| **CLO6** | S | M | M | S | M | S | S | S | M |

**CO-PO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">Actuarial Statistics</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">Core VIII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">3</td><td colspan="2">1</td><td>--</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basic arithmetic</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">The main objectives of this course are:<br>1. It develops a greater understanding of statistical principles and their application in actuarial statistics.<br>2. Describe the core areas of actuarial practice and relate to those areas actuarial principles, theories andmodels.<br>3. It gives the understanding of the application knowledge of the life insurance environment.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">Unit I<br>Simple and compound interest, present value and accumulated values of fixed rate, varying rate of interest</td></tr>
<tr><td colspan="6">Unit-II Mortality : Gompertz - Makeham laws of mortality - life tables. Annuities: Endowments, Annuities, Accumulations, Assurances, Family income benefits.</td></tr>
<tr><td colspan="6">Unit III Policy Values : Surrender values and paid up policies, industrial assurances, Joint life and lastsurvivorship, premiums.</td></tr>
<tr><td colspan="6">Unit-IV Contingent Functions: Contingent probabilities, assurances. Decrement tables. Pension funds: Capitalsums on retirement and death, widow’s pensions, benefits dependent on marriage.</td></tr>
<tr><td colspan="6">Unit-V<br>Principles of insurance, pure endowment, whole life assurance, Net premium for assurance and annuity plans-level annual premium under temporary assurance.</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /I AS IF oA there to be solved<br>(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this Course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="6">1, Hooker,P.F., Longley, L.H.-Cook (1957) : Life and other contingencies, Cambridge.<br>2 Alistair Neill(1977) : Life contingencies, Heinemann professional publishing.<br>3. Gupta and Kapoor (2001) Fundamentals of Applied Statistics</td></tr>
</table>

| | |
|---|---|
| Reference Books | 1. Study material of IAI/IFoA of Actuarial Societies<br>2. Hosack,I.B., Pollard, J.H. and Zehnwirth, B.(1999) : introductory statistics with applications in general insurance, Cambridge University. |
| Website and e-Learning Source | e-books, tutorials on MOOC/SWAYAM courses on the subject |

## Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO1**: To explain the utility theory and insurance terminologies.

**CLO2:** To articulate the insurance and annuity benefits through multiple life functions Evaluation for specialmortality laws.

**CLO3**To describe the various types of premium and their numerical evaluations.

**CLO4**:To explain implementation of the Life insurance policies.

**CLO5**: To describe Insurance payable at the moment of death and at the end of the year of death-level benefitinsurance.

**CLO6:** To understand real life problems related to insurance

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | S | M | S | S | S | S |
| **CLO2** | S | S | S | S | M | S | S | S | S |
| **CLO3** | S | S | S | M | S | M | S | S | M |
| **CLO4** | S | S | S | M | S | S | S | S | M |
| **CLO5** | S | S | S | M | M | S | S | S | M |
| **CLO6** | S | M | M | S | M | S | S | S | M |

**CO-PO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Economic & Official Statistics</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">Elective – IV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>3</td><td colspan="2">--</td><td>--</td><td colspan="2">3</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Not needed</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">The main objectives of this course are:<br>1. To understand Indian official statistical system and data collection<br>2. To know Indian economic and agricultural surveys<br>3. To know index numbers and consumer price index<br>4. To know time series analysis<br>5. To learn demand analysis and its concepts</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">Unit I<br>Indian Statistical System: Data Collection for Governance – NSSO and its role in national data collection. NSSO reports and publications</td></tr>
<tr><td colspan="6">Unit II<br>Economic Statistics: Information collection for Socio-Economic Survey – Agricultural, Industrial, Crime Statistics and Statistical methods applied to analyse large volumes of data</td></tr>
<tr><td colspan="6">Unit III<br>Index numbers: Basic problems in construction of index numbers. Methods- Simple and Weighted aggregate-Average of price relatives-Chain base method. Criteria of goodness-Unit test , Time Reversal Factor Reversal and Circular tests.</td></tr>
<tr><td colspan="6">Unit-IV<br>Time Series: Measurement of Trend : Graphic, Semi-averages, Moving averages. Least Squares – Straight line, Second degree parabola, Exponential curve, Modified Exponential curve, Gompertz curve and Logistic curve. Measurement of Seasonal variation by Ratio-to-Moving average method.</td></tr>
<tr><td colspan="6">Unit-V Demand Analysis: Introduction-Demand and Supply, Price elasticity of demand and supply, partial and cross elasticities of demand. Types of data required for estimating elasticity. Methods of estimating demand functions: Leontief's and Pigou's methods.</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC IES-ISS/ TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved<br>(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this Course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="6">3. Gupta S.C. and Kapoor V.K. (2007) :Fundamentals of Applied Statistics , 4th edition ,Sultan Chand &Sons</td></tr>
</table>

| | |
|---|---|
| | Publishers, New Delhi.<br>4. Gupta S.P. (2011) :Statistical Methods , Sultan Chand &Sons Publishers, NewDelhi.<br>5. Spyros Makridakis, Steven C. Wheelwright and Rob J .Hyndman ( 2003):Forecasting Methods and Applications , 3rd Edition ,John Wiley and Sons Inc.<br>6. Websites of Government of India – Ministry of Statistics & Programme Implementation |
| Reference Books | 3. Spyros Makridakis, Steven C. Wheelwright and Rob J .Hyndman (2003) :ForecastingMethods and Applications , 3rd Edition ,John Wiley and Sons Inc. .<br>4. Irving W. Burr (1974): Applied Statistical Methods, Academic Press. |
| Website and e-Learning Source | e-books, tutorials on MOOC/SWAYAM courses on the subject |

# Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1**: understand Indian official statistics and offices related to it
**CLO-2** understand Indian surveys for collecting official statistics
**CLO-3** know uses of index numbers
**CLO-4** know demand analysis and its need
**CLO-5** to understand economic India by knowing agricultural and economic surveys
**CLO-6** to know the time series and prediction

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | S | M | S | S | S | S |
| **CLO2** | S | S | S | S | M | S | S | S | S |
| **CLO3** | S | S | S | S | S | M | S | S | S |
| **CLO4** | S | S | S | M | S | S | S | S | M |
| **CLO5** | S | S | S | M | M | S | S | S | M |
| **CLO6** | S | S | M | S | M | S | S | S | M |

**CLO-PSO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

| Title of the Course | | Practical – III | | | | | |
|---|---|---|---|---|---|---|---|
| Paper Number | | CORE- PRACTICAL-III | | | | | |
| Category | Core | Year | II | Credits | 2 | Course Code | |
| | | Semester | IV | | | | |
| Instructional Hours per week | | Lecture | | Tutorial | | Lab Practice | Total |
| | | - | | - | | 2 | 2 |

## Objectives:

The main objectives of this course are:

1. To enable the students to gain practical knowledge of test of significance in large and smallsamples.
2. To provide practical application of hypothesis testing based on single sample and two samples,using averages and proportions.
3. To provide practical application knowledge of the life insurance environment.
4. Understand the methods of computing assurance benefits and premiums of various insuranceplans and to apply the various methods in framing mortality tables.

## Programming Exercises:

1. Large Sample tests for means, proportions
2. Large Sample tests for standard deviations and correlation coefficient.
3. Small sample tests for single mean.
4. Small sample tests for difference of means and correlation coefficient.
5. Paired t –test.
6. Chi – square test for goodness of independence of attributes.
7. Non parametric test for single and related samples
a. Sign Test , b. Wilcoxon signed rank test
8. Non parametric test for two independent samples
a. Median test, b. Wilcoxon Mann Whitney U – test
9. Creating an Actuarial table to input interest rate.
10. Creating functions Increasing and decreasing life insurances.
11. Increaing and decreasing annuities both due and immediate.
12. Calculates the values of risk free rate.

## Note:

**Question Paper Setting:**

5 questions are to be set without omitting any unit. All questions carry equal marks.Any 3 questions are to be answered in 3 hours duration.

## Examinations Distribution of Marks

| | |
|---|---|
| University Examinations (Written Practical) | 60 |
| MarksCIA (Including Practical Record) | 40 |
| Marks | |
| Total | 100 Marks |

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Introduction to Python Programming</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>2</td><td colspan="2">-</td><td>--</td><td colspan="2">2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Knowledge of R/Python</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">Upon completing this course, students will be able to:<br>1. Develop a regular workflow to execute reproducible research and analysis using Python programming.<br>2. Install and use Python language for specific application.<br>3. Import data from a variety of external sources<br>4. Write basic python functions using control and data structures<br>5. To know the basic concepts of Python.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT – I<br>Introduction to python – Data types, Variables, Basic Input – Output Operations, Basic Operators</td></tr>
<tr><td colspan="6">UNIT – II<br>Control statements, if statements, while loop, for loop, infinite loop, nested loop, else suit, break, continue, pass, assert, return statements, command line arguments.</td></tr>
<tr><td colspan="6">UNIT - III<br>Arrays in python, advantages using arrays, creating arrays, importing the array module, indexing and slicing on arrays, Processing the arrays, Comparing arrays.<br>Strings in Python, Creating strings, Length of a string, Indexing in strings, Slicing strings, Concatenation and Comparing Strings.</td></tr>
<tr><td colspan="6">Unit – IV<br>Functions in Python, Define a function, Calling a function, return from function, pass by object reference, Positional arguments, Default arguments, excursive functions. Introduction to OOP, features of OOP, Creating classes, the self variable, constructor, types of variables.</td></tr>
<tr><td colspan="6">Unit – V<br>Inheritance: Define inheritance, types of inheritance, constructors in inheritance, overriding super class constructors & methods, the super() method.<br>Exceptions: Errors in a python program, Exceptions, Exception handling, Type of Exceptions, The Exception block, the assert Statement, user defined exceptions.</td></tr>
<tr><td colspan="2">Skills acquired from this Course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">References Books</td><td colspan="6">1. Allen Downey, Jeffrey Elkner, Chris Meyers, How to think like a computer scientist: learning with Python, Freely available Online. 2012</td></tr>
</table>

| | |
|---|---|
| **Website Links** | 1. Python Tutorial/Documentation www.python.or 2015<br>2. http://docs.python.org/3/tutorial/index.html<br>3. http://interactivepython.org/courselib/statis/pythonds<br>4. http://www.ibiblio.org/g2swap/byteofpython/read/ |

## Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1** Students will able to install, code and use basic Python
**CLO-2** Describe key terminologies, concepts and techniques employed in statistical analysis
**CLO-3** Understand how to write simple coding
**CLO-4** Compile and run the program
**CLO-5** Interpret the result

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | M | M | S | M | S | M |
| **CLO2** | S | S | S | S | M | S | M | S | M |
| **CLO3** | S | S | S | M | S | S | M | S | S |
| **CLO4** | S | S | S | M | S | S | S | S | M |
| **CLO5** | S | S | M | M | M | S | S | S | M |

## CLO-PSO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Fundamentals of Human Rights</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">SEC - VII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>2</td><td colspan="2">-</td><td>--</td><td colspan="2">2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6"></td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">Unit I<br>Definition of Human Rights-Nature and Content-Legitimacy and Priority-Theories Human rights-Historical Development of Human rights-(6 hours).</td></tr>
<tr><td colspan="6">UNIT II<br>International Human Rights-Prescription and Enforcement up to world war-II Human Rights and the U.N.O –Universal Declaration of Human Rights –International Covenant on Civil and Political rights – International Covenant on Economic, Social and Cultural Rights and optional Protocol-(6 hours)</td></tr>
<tr><td colspan="6">Unit III<br>Human Rights Declarations – U.N.Human Rights Declarations – U.N. Human Commissioner-(6-hours).</td></tr>
<tr><td colspan="6">Unit IV<br>Amnesty International – Human Rights and Helsinki Process – Reginal Developments- European Human Rights system-African Human Rights System – International Human Rights in Domestic Courts-(6 hours)</td></tr>
<tr><td colspan="6">Unit V Contemporary Issues on Human Rights: Children’s Rights – Women’s-Dalit’s Rights-Bonded Labour and Wages-Refugees-Capital Punishment – Fundamental Rights in the Indian Constitution – Directive Principles of state policy – Fundamental Duties – National Human Rights Commision-(6 hours)</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">References Books</td><td colspan="6">1. International Bill of Human Rights, Amnesty International Publications 1988<br>2. Human Rights Questions and Answers,UNESCO,1982<br>3. Mausice Cranston – what is human Rights<br>4. Desai,A.R-Violation of Democratic Rights in india<br>5. Pandey- Constitutional law<br>6. Timm.R.W,-Working for Justice and Human Rights<br>7. Human Rights,A Selected Bibliography,USIS<br>8. J.C. Johari-Human Rights and New World order<br>9. G.S.Bajwa-Human Rights in India<br>10. Amnesty International Human Rights in India<br>11. P.C.Sinha & K.Cheous(Ed)-International Encyclopedia of Peace,Security Social Justice and Human Rights(vol1-7)<br>12. Devasia, V.V –Human Rights and Victimology.</td></tr>
</table>

**SEMESTER-V**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Stochastic Processes</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">Core IX</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">4</td><td colspan="2">1</td><td>--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Probability theory</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">The main objectives of this course are:<br>1. To study the basic concepts of theory of Stochastic Processes, the most important types of Stochastic Processes, various properties and characteristics (Poisson, Markov and others).<br>2. To learn the notions of ergodicity, stationarity and applications.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">Unit I<br>Notion and specification of Stochastic Processes – Stationary Process – Markov Chains – Definition and examples – Higher transition probabilities: Chapman – Kolmogorov equations. Classification of States and Chains</td></tr>
<tr><td colspan="6">Unit II<br>Markov Chains – Determination of Stability of a Markov System –Limiting Behavior – Ergodic theorem. One dimensional randomwalk</td></tr>
<tr><td colspan="6">Unit III<br>Markov Processes with discrete state space: Poisson Process – Postulates of Poisson process Properties of Poisson Process – Poisson process and related distributions. Pure Birth process – Yule-Furry process. Pure Death Process – Simple Birth and Death Process.</td></tr>
<tr><td colspan="6">Unit-IV<br>Renewal Process – Definition, related concepts and examples – Renewal equation – Elementary Renewal Theorem – Basic Renewal Theorem.</td></tr>
<tr><td colspan="6">Unit-V<br>Applications in Stochastic Models: Queuing Systems and Models: Simple queuing models M/M/1, M/M/s queuing systems (finite and infinite) steady state solution-simple problems with finite and infinite capacities.</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
</table>

| | |
|---|---|
| ecommended Text | 1. Medhi, J. (2019): Stochastic Processes, New Age International Publishers.<br>2. KantiSwarup, Gupra.P.K. Man Mohan.,(2010): Operations Research, Sultan Chand & Sons |
| Reference Books | 1. Karlin ,S. and Taylor, H.M.(1975): A first Course in Stochastic Processes, Academic Press, New York.<br>2. Ross, S.M. (1983): Stochastic Processes. John Wiley Eastern Ltd., New York. |
| Website and e-Learning Source | e-books, tutorials on MOOC/SWAYAM courses on the subject<br>http://www.randomservices.org/random/<br>https://www.britannica.com/science/stochastic-process |

## Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1** Understand stochastic nature of random variable and different stochastic processes
**CLO-2** know about transition matrix and its calculations
**CLO-3** understand Markov chain and its applications
**CLO-4** understand Markov process and its applications
**CLO-5** understand renewal process and its applications
**CLO-6** know about various stochastic modeling and its applications

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | S | M | S | S | S | S |
| **CLO2** | S | S | S | S | M | S | S | S | S |
| **CLO3** | S | S | S | S | S | M | S | M | S |
| **CLO4** | S | S | S | M | S | S | S | S | M |
| **CLO5** | S | S | S | M | M | S | M | S | M |
| **CLO6** | S | S | M | S | M | S | S | M | M |

## CO-PO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Regression Analysis</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">Core X</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">4</td><td colspan="2">1</td><td>--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Linear regression analysis, Estimation theory</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">The main objectives of this course are:<br>1. To understand linear and nonlinear relationships between variables and training the students in applications oriented.<br>2. To teach Linear Regression models, its assumptions and its properties.<br>3. To perform model adequacy check before using Linear Regression models</td></tr>
<tr><td colspan="2" rowspan="4">Course Outline</td><td colspan="6">Unit I<br>Simple linear regression-Assumptions, estimation of model parameters, standard error of estimators, testing of hypotheses on slopeand intercept ( β‘s), interval estimation of model parameters, Prediction interval of a new observation, coefficient of determination, regression through origin.</td></tr>
<tr><td colspan="6">Unit II<br>Standard Gauss Markov setup, least square estimation of model parameters, variance covariance of least squares estimators, estimation of error variance.</td></tr>
<tr><td colspan="6">Unit III<br>Model adequacy checking - residual plots for checking normality homoscedasticity and detection of outliers. Test for Lack of fit of the model. Durbin – Watson test for autocorrelation. Analytical methods for selecting a transformation generalized and weighted least squares- Detection of influential observations – Cooks statistic, DFFITS, DFBETAS.</td></tr>
<tr><td colspan="6">Unit-IV<br>Multicollinearity – sources, effects, diagnostics, Methods of dealing with multi collinearity (collection of additional data, model respecification, Ridge regression).</td></tr>
</table>

| | |
|---|---|
| | **Unit-V**<br>Nonlinear regression – transformation to a linear model, their use and limitations, initial estimates (starting values), parameter estimation using iterative procedures – Gauss-Newton, steepest Descent, Marquardt's compromise.<br>Count data- Poisson Regression – variables selection- Non –parametric regression. |
| Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour) |
| Skills acquired from this course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| Recommended Text | 1. Montgomery, D. C., Peck, E. A. and Vining, G. G. (2003): Introduction to Linear regression analysis, third edition, John Wiley and Sons, Inc.<br>2. Zar, J.H. (2006): Biostatistical Analysis, fourth edition, Pearson education.<br>3. Douglas C. Montgometry (2012)Introduction to Linear Regression Analysis.<br>4. Iain Pardoe (2012): Applied regression Modeling, second edition, Wiley |
| Reference Books | 1. Draper, N.R. and Smith, H. (2003): Applied Regression Analysis, third edition, John Wiley and Sons, Inc.<br>2. Johnston, J. (1984): Econometric methods, third edition, McGraw Hill International.<br>3. A. Sen, M. Srivastava, Regression Analysis — Theory, Methods, and Applications, Springer-Verlag, Berlin, 2011. |
| Website and e-Learning Source | e-books, tutorials on MOOC/SWAYAM courses on the subject<br>http://home.iitk.ac.in/~shalab/regression/Chapter2-Regression-SimpleLinearRegressionAnalysis.pdf<br>http://www.mit.edu/~6.s085/notes/lecture3.pdf<br>https://ncss-wpengine.netdna-ssl.com/wp-content/themes/ncss/pdf/Procedures/ NCSS/Nonlinear_Regression.pdf<br>https://data.princeton.edu/wws509/notes/c4.pdf<br>http://home.iitk.ac.in/~shalab/regression/Chapter15 Regression- PoissonRegressionModels.pdf |

## Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1** Estimating model parameters and testing it
**CLO-2** understand linear and nonlinear models assumptions
**CLO-3** check model adequacy
**CLO-4** know about variable selection
**CLO-5** know about nonlinear regression models
**CLO-6** choose model if some of the basic assumptions are violated also

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | S | M | S | S | S | S |
| **CLO2** | S | S | S | S | M | S | S | S | S |
| **CLO3** | S | S | S | S | S | M | S | M | S |
| **CLO4** | S | S | S | M | S | S | S | S | M |
| **CLO5** | S | S | S | M | M | S | M | S | M |
| **CLO6** | S | S | M | S | M | S | S | M | M |

## CO-PO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">Operations Research</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">Elective – V</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>3</td><td colspan="2">1</td><td colspan="2">--</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">Linear algebra</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">The main objectives of this course are:<br>1. Optimization techniques<br>2.Transportation problems<br>3. Game theory<br>4. Replacement problems<br>5. Network analysis</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="7">Unit I<br>Formulation of Linear programming models – Graphical solution of LPP in two variables – LPP in standard form – Principles of Simplex method – Algorithm – Need for artificial variables – Charne‘s M-Technique – Concept of degeneracy.<br>Unit II<br>Transportation problem(TP) – TP formulation- North-West Corner, Least cost, Vogel‘s Approximation method – UV-method – Assignment problem and algorithm.<br>Unit III<br>Theory of Games – Basic definition – Maximin and Minimax criterion<br>– Solution of Games with saddle points – Two–by–Two (2x2) Games without saddle point – principle of dominance – problems based on dominance rule – Graphical method for (2xn) and (mx2) games.<br>Unit-IV<br>Replacement problems – Replacement policy for items whose maintenance cost increases with time and the value of money remains constant – Replacement policy for items whose maintenance cost increases with time and the value of money also changes with time – Replacement of items that fail completely – Group replacement policy<br>Unit-V<br>Network analysis by CPM/PERT: Basic Concept – Constraints in Network – Construction of the Network – Time calculations –Concept of slack and float in Network Analysis – Network crashing – Finding optimum project duration and minimum project cost.</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="7">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour)</td></tr>
</table>

| | |
|---|---|
| Skills acquired from this course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| Recommended Text | 1. Kanti Swarup, P.K. Gupta and Manmohan (2007) Operations Research, Sultan Chand Sons, New Delhi.<br>2. S.D. Sharma (2002) : Operations Research: Kedarnath and Ramnath, Meerut.<br>3. J.K. Sharma (2002) : Operations Research: Theory and application , Macmillan, India Ltd. |
| Reference Books | 1. Taha : Operations Research, PHI.<br>2. F.S. Hiller and Liberman (1994): Operations Research, CBS Publishers and Distributions, New Delhi. |
| Website and e-Learning Source | e-books, tutorials on MOOC/SWAYAM courses on the subject |

## Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1** understand optimization techniques and solving set of equations with constraints
**CLO-2** solve problems of linear programming
**CLO-3** understand transportation problems and its applications
**CLO-4** solve problems using games theory
**CLO-5** do replacement problems and solve it
**CLO-6** do network analysis and get problem solving skills

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | S | M | S | S | S | S |
| **CLO2** | S | S | S | S | M | S | S | S | S |
| **CLO3** | S | S | S | S | S | M | S | M | S |
| **CLO4** | S | S | S | M | S | S | S | S | M |
| **CLO5** | S | S | S | M | M | S | M | S | M |
| **CLO6** | S | S | M | S | M | S | S | M | M |

## CO-PO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Title of the Course** | | **Population Studies** | | | | | |
| **Paper Number** | | **Elective – VI** | | | | | |
| **Category** | **Core** | **Year** | **III** | **Credits** | **3** | **Course Code** | |
| | | **Semester** | VI | | | | |
| **Instructional Hours per week** | | **Lecture** | **Tutorial** | **Lab Practice** | **Total** | | |
| | | 3 | 1 | -- | 4 | | |
| **Objectives of the Course** | | 1. To identify appropriate sources of data with basic vital statistics analyses<br>2. To relate the population with standardized death rates<br>3. To utilize the mortality table to find the survival and death rates<br>4. To analyze the birth rate used to describe fertility in the populations | | | | | |
| **Course Outline** | | **Unit I** Introduction<br>Definition, nature and scope of Population Studies, relationship of other social sciences with population studies - Advantages of Population Study. | | | | | |
| | | **UNIT II**<br>Concept of Natural Increase of Population and Growth of Population - Measurement and Indicators of Demographic Determinants: Fertility, Mortality, Migration, Marriage. | | | | | |
| | | **Unit III** Vital Statistics<br>Definition, Nature, Scope and Methods of vital statistics data - Measurement of Population – Development of Population Studies in India. | | | | | |
| | | **Unit IV** Risk Measures<br>Ratios, Proportions, and Rates – its properties, uses and simple problems; Morbidity Rates: Incidence proportions, Incidence rates, Prevalence rates – Definition, properties, uses and simple problems. | | | | | |
| | | **Unit V** Fertility Rates<br>Crude Birth Rate - General Fertility Rate - Age Specific Fertility Rate – Total Fertility Rate - Gross Reproduction Rate (GRR) - Net Reproduction Rate(NRR) - Replacement level Fertility - Birth order statistics - Child Women ratio - Order Specific Fertility Measures – Theory and Problems. | | | | | |

| | |
|---|---|
| Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved<br>(To be discussed during the Tutorial hour) |
| Skills acquired from this course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| Reference Books | 1. Gujarati, D. and Sangeetha, S. (2007): Basic Econometrics, 4th Edition,McGraw Hill Companies.<br>2. Johnston, J. (1972): Econometric Methods, 2nd Edition, McGraw Hill International. |
| | 3. Koutsoyiannis, A. (2004): Theory of Econometrics, 2nd Edition, Palgrave Macmillan Limited, 4. Maddala, G.S. and Lahiri, K. (2009):Introduction to Econometrics, 4th Edition, John Wiley & Sons.<br>4. Gupta S.P. & Kapoor V.K., Fundamentals of Applied Statistics, Sultan Chand& Sons, 2019.<br>5. Peter R Cox, Demography, 5th Edition, Vikas Publishing House,1979.<br>6. Agarwal S.N, India`s Population Problems, Tata McGraw Hill, 1981.<br>7. Srinivasan, K, Basic Demographic Techniques and Applications, SagePublications, New Delhi, 1998. |
| Website | https://www.cdc.gov/csels/dsepd/ss1978/lesson3/section1.html |

## Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1** Distinguish between proper and improper fractions. Express an algebraic fraction as the sum of its partial fractions.

**CLO-2** Demonstrate the knowledge to determine the sums, expansion and approximation of series including binomial, exponential, logarithmic and fourier.

**CLO-3** Solve problems about polynomials with real coefficients, imaginary and irrational roots. Explain the relationship between the derivative of a function as a function and the notion of the derivative.

**CLO-4** Calculate limits of a function.

**CLO-5** Obtain the nth derivative in successive differentiation. Apply Euler‘s theorem on homogenous function

**CLO-6** Obtain the mathematical knowledge and skills for the better understanding of statistics as a mathematical science

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | M | M | S | M | S | M |
| **CLO2** | S | S | S | S | M | S | M | S | M |
| **CLO3** | S | S | S | M | S | S | M | S | S |
| **CLO4** | S | S | S | M | S | S | S | S | M |
| **CLO5** | S | S | M | M | M | S | S | S | M |
| **CLO6** | S | S | S | S | M | S | S | M | M |

**CLO-PSO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Title of the Course** | | **Core XI - Practical – IV (Core – IX & X)** | | | | | |
| **Paper Number** | | **Core XI** | | | | | |
| **Category** | Core | **Year** | III | **Credits** | 4 | **Course Code** | |
| | | **Semester** | V | | | | |
| **Instructional Hours per week** | | **Lecture** | | **Tutorial** | **Lab Practice** | **Total** | |
| | | 4 | | | -- | 4 | |
| **Objectives of the Course** | | The main objectives of this course are:<br>1. To enable the students to gain practical knowledge stochastic processes problems.<br>2. Demonstrate the fitting of linear regression models for real time data.<br>3. Infer model adequacy through various model selection process. | | | | | |
| **Course Outline** | | **UNIT I**<br>Transition probability Matrix – Stationarity of Markov Chain and graphical representation of Markov Chain. | | | | | |
| | | **Unit II**<br>Poisson Process – probabilities of birth and death Process – Yule – Furry Process. | | | | | |
| | | **Unit III**<br>Queuing Systems – Single server exponential queuing system – Single server exponential queuing system having finite capacity. | | | | | |
| | | **Unit-IV**<br>Simple linear regression – Confidence interval estimation of simple linear regression | | | | | |
| | | **Unit –V**<br>Normality of residuals – Multicollinearity in simple and multiple linear regression – Heteroscedasticity and auto correlation in simple and multiple Regression. | | | | | |

## Note:

**Question Paper Setting:**

5 questions are to be set without omitting any unit. All questions carry equal marks.
Any 3 questions are to be answered in 3 hours duration.

## Examinations Distribution of Marks

| | |
|---|---|
| University Examinations (Written Practical) | 60 Marks |
| CIA (Including Practical Record) | 40 Marks |
| Total | 100 Marks |

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Design of Experiments</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">Core XIII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>5</td><td colspan="2">1</td><td colspan="2">--</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Linear models</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">The main objectives of this course are:<br>1. To get theoretical knowledge in Statistical Design of Experiments and analysis of variance<br>2. To build strong theoretical foundation in Orthogonal Latin squares, Hyper Graeco Latin squares, factorial and fractional factorial experiments, PIBD, inter and intra blocks, split plot, analysis covariance, Response surface methodology<br>3. To develop analytical thinking in problem solving skills</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">Unit I<br>Fundamental Principles of Experiments – Replication, Randomization and Local Control techniques – Size of experimental unit – Methods of determination of experimental units – (Maximum curvature method – Fairfield Smith‘s variance law).</td></tr>
<tr><td colspan="6">Unit II<br>Analysis of variance – One way, Two way, classification (without interaction) – Multiple range test; Newman-Keul‘s test – Duncan‘s multiple range test – Tukey‘s test – Transformation – Square root, angular and log transformations.</td></tr>
<tr><td colspan="6">Unit III<br>Completely Randomized Design (CRD) and its analysis – Randomized block design (RBD) – RBD – More than one but equal number of observations per cell – Latin Square Design (LSD) and its analysis.</td></tr>
<tr><td colspan="6">Unit-IV<br>Missing plot techniques – Meaning – Least Square method of estimating one missing observation – RBD and LSD – Two observations missing in RBD and LSD – Analysis of covariance technique in CRD and RBD (without derivation).</td></tr>
<tr><td colspan="6">Unit-V<br>Factorial experiment – Definition – $2^2$, $2^3$ and $3^2$ factorial experiments and their analysis – Principles of confounding – Partial and complete confounding in $2^3$ – Split plot design and its analysis.</td></tr>
</table>

| | |
|---|---|
| Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour) |
| Skills acquired from this Course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| Recommended Text | 1. Das, M.N. and Giri N.C (1979) : Design and Analysis of Experiments, Wiley Eastern, New Delhi.<br>2. Gupta S.C. and Kapoor V.K (2007) : Fundamentals of Applied Statistics, Sultan Chand and Sons, New Delhi. |
| Reference Books | 1. Kempthorne, (1956): Design and Analysis of Experiments, John Wiley, New York.<br>2. Montgomery . D. (1985): Design of Experiments, John Wiley and Sons. |
| Website and e-Learning Source | e-books, tutorials on MOOC/SWAYAM courses on the subject |

## Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1** To understand analysis of variance and experimental designs

**CLO-2** To have strong theoretical knowledge in Orthogonal latin squares, Hyper Graeco Latin squares

**CLO-3** Know factorial and fractional factorial experiments, PIBD, inter and intrablocks, split plot, analysis co-variance

**CLO-4** To understand clinical trial concepts and Response surface methodology

**CLO-5**To do numerical problems and able to get critical thinking to solve problems

**CLO-6** To choose suitable experiment and do it for real life problems

| | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** | **PSO6** | **PSO7** | **PSO8** | **PSO9** |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | S | S | S | S | S | S |
| **CLO2** | S | S | S | S | M | S | S | S | S |
| **CLO3** | S | S | S | S | S | M | S | S | S |
| **CLO4** | S | S | S | M | S | S | S | S | M |
| **CLO5** | S | S | M | M | M | S | M | S | M |
| **CLO6** | S | S | M | S | M | S | S | M | M |

## CO-PO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">Demography</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">Core – XIV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2">1</td><td colspan="2">--</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">The main objectives of this course are:<br>1. Learn population and demographic registration<br>2. To learn fertility and mortality measurements<br>3. To understand Life table uses<br>4. To learn migration effect</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">Unit I<br>Sources of demographic data – civil registration – population census registers – errors in demographic data – methods of improvements.</td></tr>
<tr><td colspan="8">Unit II<br>Fertility and mortality measurements – general and specific rates – standardized rates – age pyramid of sex composition gross and net reproduction rates.</td></tr>
<tr><td colspan="8">Unit III<br>Life table – structure – construction – relationship between the function of a life table – abridged life table – population estimation – growth rates – gross and net reproduction rates component method of population projection – forces of mortality – Gompertz and Makeham's law – logistic curve fitting and its use.</td></tr>
<tr><td colspan="8">Unit-IV Spatial distribution of population –migration – kinds of migration – factors important in migration analysis – migration defining period and boundary – migration data by vital statistics and survival ratio and National Growth rate methods</td></tr>
<tr><td colspan="8">Unit-V<br>Components of population growth and change – Demographic transition theory – Methods of population projection – component method of projection, Leslie matrix, Logistic curve and its graduation</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="8">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="8">1. Berclay, G.W.(1959) : Techniques of Population Analysis<br>2. Benjamin, B (1968) : Health and Vital Statistics, Allen & Unwin</td></tr>
</table>

| | |
|---|---|
| | Srivastava,<br>3. O.S.(1983) : A text book of Demography , Vikas Publishing.<br>4. Bogue , Donald J: Principles of Demography (1976) John Willey, New York |
| Reference Books | 1. Pathak. K.B. and Ram. F (1992): Techniques of Demography, Wiley Eastern.<br>2. Ram Kumar R (1986): Technical Demography, Wiley Eastern |
| Website and e-Learning Source | e-books, tutorials on MOOC/SWAYAM courses on the subject |

## Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1** to understand need of population study and its registration system
**CLO-2** to understand fertility and mortality effect on population
**CLO-3** to understand life table and its usage to real problems
**CLO-4** to get effect of migration in population
**CLO-5** to understand population growth and its effect
**CLO-6**: to understand the need of population study for a government

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | S | S | S | S | S | S | S |
| **CLO2** | S | S | S | S | M | S | S | S | S |
| **CLO3** | S | S | S | S | S | M | S | S | S |
| **CLO4** | S | S | S | S | S | S | S | S | M |
| **CLO5** | S | S | M | M | M | S | M | M | M |
| **CLO6** | S | S | M | S | M | S | S | M | M |

## CO-PO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Statistical Quality Control</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">Elective VII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>5</td><td colspan="2">1</td><td colspan="2">--</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Estimation theory and Distribution theory</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">The main objectives of this course are:<br>1. To impart basic theoretical knowledge about terminologies, need of control charts for quality control, construct control limits of variables and attributes.<br>2. To educate the learner to be able to construct control charts for defects, number of defects (c-chart); and control chart for number of defects per unit (u-chart).<br>3. To educate acceptance sampling plan and discuss the procedure of its implementation, compute the probability of accepting or rejecting a lot.<br>4. To define acceptance quality level (AQL) and lot tolerance percent defective (LTPD) of the lot; and compute the producer‘s risk and consumer‘s risk for an acceptance sampling plan.<br>5. To facilitate the learner to understand the difference between attributes and variables sampling plans, the advantages and disadvantages of variables sampling.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">Unit I<br>Importance and need for Statistical Quality Control techniques in Industry – Causes of variations in Quality – Uses of Shewart‘s Control charts –Terminologies: Specification limits, Tolerance limits, 3σ limits. Advantages and Limitations of SQC - Control charts variables Control Chart for Mean (Xbar- Chart) ,Range Chart (R- Chart) Standard Deviation Chart (S-Chart)<br><br>Unit II<br>Control Charts for Attributes: Control Chart for Fraction Defective (p-Chart) ,p-Chart for Variable Sample Size , Control Chart for Numberof Defectives (np-Chart). Control Charts for Defects: Control Chartfor Number Of Defects (C-Chart)and Control Chart for Number Of Defects Per Unit (U-Chart).<br><br>Unit III<br>Acceptance sampling plans for attributes –Types of Acceptance Sampling plans, Methods of Inspection: 100% Inspection and Sampling Inspection, Advantages and Limitations of Acceptance Sampling. Terms used in acceptance sampling plans: Lot, Lot Size,</td></tr>
</table>

| | |
|---|---|
| | Sample Size, Lot Quality, Acceptance Number , Probability of accepting a lot (Pa) ,Acceptance Quality Level (AQL), Lot Tolerance Percent Defective (LTPD), Producer's Risk, Consumer's Risk, AOQ, AOQL, ATI and ASN. |
| | **Unit-IV**<br>Rectifying Sampling Plans. Single and Double sampling plans. OC, AOQ, ATI and ASN curves for Single and Double sampling plans. |
| | **Unit-V**<br>Acceptance sampling for variables known and unknown sampling plans (one sided specification only) -Determination of n and k for one sided specification of OC curve |
| Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper) | Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour) |
| Skills acquired from this Course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| Recommended Text | 1. Douglas C. Montgomery (2005) : Introduction to Statistical Quality Control, John Wiley & Sons, New York.<br>( Unit V: Chapter 16 ( pages 670 to 680)<br>2. Gupta S.C and V.K.Kapoor (2007): Fundamentals of Applied Statistics, Sultan Chand Sons, New Delhi<br>3. Mahajan, M (1998) : Statistical Quality Control, DhanpatRao& Co, New Delhi. |
| Reference Books | 1. Gupta, R.C.(1974): Statistical Quality Control.<br>2.Ekambaram, S K. (1963): Statistical basis of Acceptance sampling, Asia Publishing House.<br>Grant, E,L. and Laven Worth, R.S.: Statistical Quality Control, McGraw Hill. |
| Website and e-Learning Source | e-books, tutorials on MOOC/SWAYAM courses on the subject |

## Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1** understand Industrial applications of Statistics
**CLO-2** understand statistical process control and methods for it
**CLO-3** understand attribute and variable control chart and interpret process based on it
**CLO-4** understand the situations using special purpose control charts
**CLO-5** know various product control techniques
**CLO-6** To do numerical problems and able to get critical thinking to solve problems
To explore real life problems

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | S | S | S | S | S | S | S |
| **CLO2** | S | S | S | S | M | S | S | S | S |
| **CLO3** | S | S | S | S | S | M | S | S | S |
| **CLO4** | S | S | S | S | S | S | S | S | M |
| **CLO5** | S | S | M | M | M | S | M | M | M |
| **CLO6** | S | S | M | S | M | S | S | M | M |

## CO-PO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Time Series</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">Elective – VIII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">4</td><td colspan="2">1</td><td colspan="2">--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. On successful completion of this course, students will be able to acquire the knowledge of time series data and its applications.<br>2. Outline the growth curves and their fitting.<br>3. To calculate the seasonal indices by various methods.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">Unit I Time Series<br>Definition, uses, Additive Model, Multiplicative Models, Components - Secular Trend, Seasonal variation – Simple problems.</td></tr>
<tr><td colspan="6">UNIT II Measurement of Trend:<br>Graphical method, Method of Semi - Averages, Method of Moving Averages and Method of Least Squares.</td></tr>
<tr><td colspan="6">Unit III Measurement of Seasonal Variations<br>Method of Simple Averages, Ratio to Moving Average method, Ratio to Trend Method and Link Relative Method - Cyclic Variationand Irregular fluctuations.</td></tr>
<tr><td colspan="6">Unit IV Growth Curves<br>Modified Exponential Curve and its Fitting – Method of Three Selected Points – Method of Partial Sums – Fitting of Gompertz Curve – Logistic Curve.</td></tr>
<tr><td colspan="6">Unit V<br>De-Seasonalisation of data – Cyclic components : Harmonic analysis. Random component – Variate difference method. Weak Stationarity, autocorrelation function and the correlogram.</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour)</td></tr>
</table>

| | |
|---|---|
| External Examination question paper) | |
| Skills acquired from this Course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Books.** | Gupta, S.C. and Kapoor, V.K.: Fundamentals of Applied Statistics, Sultan Chand & Co., 4 th Revised Edition, 2019. |
| **References Books** | 1. Garret, H.E., Education and Psychological Statistics, Paragan International Publications, 2005.<br>2. Pillai RSN and Bagavathi V, Statistics, S. Chand & Co., 2010.<br>3. Box, G.E.P., Jenkins, G.M., Reinsel, G.C. and Ljung, G.M. Time Series Analysis: Forecasting and Control, 5th Edition, John Wiley & sons, Inc., 2015.<br>4. Brockwell, P.J. and Davis, R.A., Introduction to Time Series Analysis. Springer, 2003. |

## Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1** Understand the time series concept

**CLO-2** estimate the trend values using various methods

**CLO-3** concept and purposes of index numbers

**CLO-4** understand the notation and formulae concerning the use.

**CLO-5** understand time series data its components and its application in various fields.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | M | M | S | M | S | M |
| **CLO2** | S | S | S | S | M | S | M | S | M |
| **CLO3** | S | S | S | M | S | S | M | S | S |
| **CLO4** | S | S | S | M | S | S | S | S | M |
| **CLO5** | S | S | M | M | M | S | S | S | M |

## CLO-PSO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Index Numbers</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">Elective – VIII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>5</td><td colspan="2">-</td><td>--</td><td colspan="2">5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. On successful completion of this course, students will be able to acquire the knowledge of index number and its applications.<br>2. To compute the different index numbers in real life problems.<br>3. To analyse the importance of a good index number.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">Unit I Index Numbers<br>Definition, Uses, Types, Problems involved in the construction of Index Numbers – Construction of Index Numbers.</td></tr>
<tr><td colspan="6">UNIT II<br>Simple aggregate method and Simple average of Price relatives method. Weighted Index Numbers – Laspeyre‘s, Paasche‘s, Dorbish Bowley‘s, Marshall Edge worth‘s Index Numbers and Fisher‘s Ideal Index Number.</td></tr>
<tr><td colspan="6">Unit III<br>Tests for adequacy<br>Time Reversal Test, Factor Reversal Test, Unit test and Cyclic test. Definition of Deflation, Splicing, Inflation, and Real wages.</td></tr>
<tr><td colspan="6">Unit IV<br>Construction of Weighted Average of Price relatives Index Numbers using A.M & G.M. Fixed Base Index Numbers and Chain Base Index Numbers.</td></tr>
<tr><td colspan="6">Unit V Price and Quantity index numbers – Consumer Price index(CPI) – Producer Price Index (PPI) – Wholesale Price Index – Retail Price Index (RPI) – Production index – Sales index – Export and import index – Employability index.</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour)</td></tr>
</table>

| | |
|---|---|
| External Examination question paper) | |
| Skills acquired from this Course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Books.** | Gupta, S.C. and Kapoor, V.K.: Fundamentals of Applied Statistics, Sultan Chand & Co., 4 th Revised Edition, 2019. |
| **References Books** | 13. Garret, H.E., Education and Psychological Statistics, ParaganInternational Publications, 2005.<br>14. Pillai RSN and Bagavathi V, Statistics, S. Chand & Co., 2010. |

## Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1** Understand the time series concept

**CLO-2** estimate the trend values using various methods

**CLO-3** concept and purposes of index numbers

**CLO-4** Understand the notation and formulae concerning the use.

**CLO-5** understand time series data its components and its application in various fields.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | M | M | S | M | S | M |
| **CLO2** | S | S | S | S | M | S | M | S | M |
| **CLO3** | S | S | S | M | S | S | M | S | S |
| **CLO4** | S | S | S | M | S | S | S | S | M |
| **CLO5** | S | S | M | M | M | S | S | S | M |

## CLO-PSO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

| Title of the Course | | Practical – V | | | | | |
|---|---|---|---|---|---|---|---|
| Paper Number | | Core XIII & XIV | | | | | |
| Category | Core | Year | III | Credits | 4 | Course Code | |
| | | Semester | VI | | | | |
| Instructional Hours per week | | Lecture | | Tutorial | Lab Practice | Total | |
| | | 1 | | | 4 | 5 | |

## Objectives:

The main objectives of this course are:

1. Apply the theoretical concepts and solve the problems based on one missing observation and two missing observations in RBD and LSD.
2. Analyse and interpret data for $2^2$, $2^3$ and factorial experiments by using Yates Algorithm.
3. Apply the methods of estimating net migration rates.
4. Execute the various fertility measures sources of demographic data.

## Programming Exercises :

1. One Way ANOVA
2. Two Way ANOVA
3. Missing plot techniques – Estimating One missing observation, Two missing observations in LSD.
4. Estimating One missing observation, Two missing observations in RBD.
5. Factorial Experiments - Analysis of $2^2$ factorial experiments using Yates algorithm.
6. Analysis of $2^3$ factorial experiments using Yates algorithm.
7. Analysis of $3^2$ factorial experiments.
8. Measures of Population size, growth and composition.
9. Age – sex distribution analysis
10. Fertility and mortality analysis
11. Demographic Modeling Using Life tables, Modeling fertility and mortality rates.

## Note:

**Question Paper Setting:**

5 questions are to be set without omitting any unit. All questions carry equal marks.
Any 3 questions are to be answered in 3 hours duration.

## Examinations Distribution of Marks

| | |
|---|---|
| University Examinations (Written Practical) | 60 Marks |
| CIA (Including Practical Record) | 40 Marks |
| Total | 100 Marks |

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Introduction to R language</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">Professional Competency Skill</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>2</td><td colspan="2">-</td><td>--</td><td colspan="2">2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Knowledge of R/Python</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">Upon completing this course, students will be able to:<br><br>1. Develop a regular workflow to execute reproducible research and analysis using R and R Studio and communicate the results and implications to others.<br>2. Install and use R packages for specific applications<br>3. Import data from a variety of external sources<br>4. Write basic R functions using control and data structures<br>5. Employ R functions to conduct statistical analysis and inference<br>6. Generate research or analytical reports and presentations using R Markdown<br>7. Deliver an oral presentation describing your data science analysis to an audience.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">Unit – I<br>Installation of R - Features of R -Variables in R-Constants in R-Operators in R. Creating data frame-Operations on data frames - Accessing data frames-Creating data frames from various sources Creating lists-Manipulating list elements-Merging lists</td></tr>
<tr><td colspan="6">Unit – II<br>Data types and R Objects-Accepting Input from keyboard-Important Built-in functions. Creating Vectors-Accessing elements of a Vector-Operations on Vectors-Vector Arithmetic-Converting lists to vectors Creating arrays-Accessing array elements-Calculations across array elements.</td></tr>
<tr><td colspan="6">Unit – III<br>Creating matrices-Accessing elements of a Matrix-Operations on Matrices-Matrix transpose .R Programming Structures, Control Statements, Loops, - Looping Over Nonvector Sets- if…else statement-if else() function-switch() function-repeat loop-while loop-for loop-break statement-next statement</td></tr>
<tr><td colspan="6">Unit – IV<br>Need for data visualization-Bar plot-Plotting categorical data-Stacked bar plot-Histogram-plot() function and line plot-pie chart / 3D pie chart-Scatter plot-Box plot- Customizing Graphs, Saving Graphs to Files.</td></tr>
<tr><td colspan="6">Unit – V<br>Probability Distributions, Binomial Distribution- Poisson Distributions, Normal Distribution- Other Distribution. Correlation-Regression. Chi –Square test. t-Test - Analysis of Variance -Non-Parametric Tests.</td></tr>
</table>

| | |
|---|---|
| Skills acquired from this Course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **References Books** | 1.Hadley Wickham : ―R Packages ― Latest Edition – Shroff /O'Reilly Publisher<br>2. William N. Venables and David M. Smith, An Introduction to R. 2nd Edition. Network Theory Limited. 2009.<br>3. Norman Matloff, The Art of R Programming -A Tour of Statistical Software Design, No Starch Press. 2011.<br>4. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, ISBN 0-07-120413-X, 6th edition (chapter 3 only) |

## Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1** Students will able to install, code and use basic R programming & Python

**CLO-2** Describe key terminologies, concepts and techniques employed in statistical analysis

**CLO-3** Understand how to write simple coding

**CLO-4** Compile and run the program

**CLO-5** Interpret the result

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | M | M | S | M | S | M |
| **CLO2** | S | S | S | S | M | S | M | S | M |
| **CLO3** | S | S | S | M | S | S | M | S | S |
| **CLO4** | S | S | S | M | S | S | S | S | M |
| **CLO5** | S | S | M | M | M | S | S | S | M |

## CLO-PSO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

# ALLIED PAPERS FOR OTHER MAJORS

| S. No. | Paper code | Title of the Course | Page No. |
|---|---|---|---|
| 1. | | Allied Statistical Methods I | |
| 2. | | Allied Statistical Methods II | |
| 3. | | Allied Statistics Practical | |
| 4. | | Allied Biostatistics | |
| 5. | | Allied Statistics Practical | |
| 6. | | Statistical methods &their applications I | |
| 7. | | Statistical methods &their applications II | |
| 8. | | Allied Statistics Practical | |
| 9. | | Statistical methods for economics | |
| 10. | | Applied Statistics for Economics | |

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Allied-Statistical Methods-I<br>(For B.Sc., Mathematics/B.Sc., Mathematics(CA))</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6"></td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Allied</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td>LabPractice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td colspan="2">-</td><td>--</td><td colspan="2">4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basis of Statistics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. To introduce the basic concepts of probability theory, random variables, probability distribution.<br>2. To introduce the statistical concepts and develop analytical skills.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">Unit I Probability, Random Variable and Mathematical Expectation<br>Definitions – Addition and Multiplication Theorem of Probability – Conditional probability – Random variable ( discrete and continuous) – Distribution functions – Marginal and Conditional Distributions – Mathematical Expectation – Moment generating function - Characteristic function(concept only)– Tchebychev‘s inequality-Simple Problems.</td></tr>
<tr><td colspan="6">Unit II Discrete and Continuous Distributions<br>Binomial and Poisson Distributions – Derivations – Properties and Applications - Simple Problems – Normal distribution – Derivations – Properties and Applications - Simple Problems.</td></tr>
<tr><td colspan="6">Unit III Measures of Central Tendency, Measures of Dispersion and Skewness<br>Definitions – Mean , Median , Mode , Geometric mean , Harmonic mean – Merits and demerits – Range , Quartile deviation , Mean deviation and their coefficients - Standard deviation – Co-efficient of Variation - Merits and demerits – Measure of Skewness – Karl Pearson‘s and Bowley‘s Coefficient of Skewness.</td></tr>
<tr><td colspan="6">Unit IV Curve Fitting<br>Method of least square–Fitting of a straight line and second degree Parabola, Fitting of Power Curve and Exponential Curves–Simple Problems.</td></tr>
<tr><td colspan="6">Unit V Correlation and Regression<br>Definition – Types and methods of measuring correlation – Scatter diagram ,Karl Pearson‘s correlation coefficient and Spearman‘s rank correlation coefficient - Regression lines -Regression coefficients – Properties – Regression equations.</td></tr>
<tr><td colspan="2">Skills acquired from this Course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">References Books</td><td colspan="6">1. Gupta S. C and Kapoor V. K (2004), Fundamentals of Mathematical Statistics, (11th edition), Sultan Chand & Sons, New Delhi.<br>2. Gupta.S.P.(2001),StatisticalMethods,SultanChand&Sons,NewDelhi.</td></tr>
</table>

| | |
|---|---|
| | 3. Sancheti D. C and Kapoor V. K (2005), Statistics (7th Edition), Sultan Chand & Sons, New Delhi.<br>4. Robert V. Hogg, Allen T. Craig, JosephW.McKean , Introduction to mathematical statistics, Pearson Education.<br>5. AgarwalB.L,BasicStatistics,WileyEasternLtd.,Publishers,NewDelhi.<br>6. Marek Fisz, Probabilitytheoryand Mathematical Statistics, John Wileyand Sons.<br>7. Rohatgi V. K, An Introduction to Probabilitytheoryand Mathematical Statistics, Wiley Eastern Ltd., Publishers, New Delhi.<br>8. Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi.<br>9. VittalP.R,MathematicalStatistics,MarghamPublications,Chennai.<br>10. HoelP. G, Introduction to Mathematical Statistics, Asia PublishingHouse, New Delhi. |
| ***Web links*** | https://seeing-theory.brown.edu/probability-distributions/index.htmlhttps://www.kullabs.com/classes/subjects/units/lessons/notes/note-detail/9557https://www.stat.berkeley.edu/~stark/SticiGui/Text/location.html<br>https://www.originlab.com/index.aspx?go=Products/Origin/DataAnalysis/CurveFitting<br>https://www.bmj.com/about-bmj/resources-readers/publications/statistics-square-one/11-correlation-and-regression |

**Course Learning Outcome(for Mapping with POs andPSOs)**

Students will be able to

**CLO-1**Understandthe random experiments in real life situations

**CLO-2** Understand the axioms of probability in real life situations.

**CLO-3** Compute Bernoulli trials and understand the rare case population

**CLO-4** Learn the usage of central tendencies, dispersion and skewness.

**CLO-5** Obtain the relationship between two random variables.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| CLO1 | S | S | M | M | M | S | M | S | M |
| CLO2 | S | S | S | S | M | S | M | S | M |
| CLO3 | S | S | S | M | S | S | M | S | S |
| CLO4 | S | S | S | M | S | S | S | S | M |
| CLO5 | S | S | M | M | M | S | S | S | M |

**CLO-PSO Mapping(Course Articulation Matrix)S-Strong, M-Medium-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">Allied–Statistical Methods-II<br>(For B.Sc., Mathematics/B.Sc. ,Mathematics(CA))</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7"></td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Allied</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>4</td><td colspan="2">-</td><td colspan="2">--</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">Basis of Statistics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">1. To equip students with theoretical knowledge for estimating unknown parameters.<br>2. To introduce the concepts of testing the hypothesis, significance and chi-square test..</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="7">UNIT–I Point Estimation<br>Population and Sample – Parameter and Statistic – Point Estimation – Consistency– Unbiasedness– Efficiency(Cramer – Rao inequality) and Sufficiency (Rao – Blackwell Theorem).</td></tr>
<tr><td colspan="7">UNIT–II Methods of Estimation and Interval Estimation<br>Maximum likelihood Estimator (MLE) and Methods of Moments – Properties of these estimators – Interval estimation (concept only).</td></tr>
<tr><td colspan="7">UNIT– III Test of Significance<br>Concept of Statistical Hypothesis – Simple and Composite Hypothesis – Null and Alternative Hypothesis – Critical region – Type I and Type II Errors – Power of a test–Neyman-Pearson Lemma.</td></tr>
<tr><td colspan="7">UNIT–IV Test of Significance (Large Sample Tests)<br>Sampling distribution – Standard error – Large sample tests with regard to Mean, Difference of Means, Proportions and Difference of Proportions – Simple Problems.</td></tr>
<tr><td colspan="7">UNIT– V Test of Significance (Small Sample Tests)<br>Exact sample test based on ‗t‘ and F Distributions with regard to Means Variance and Correlation coefficient – Chi-square test , Goodness of fit and independence of attributes.</td></tr>
<tr><td colspan="2">Skills acquired from this Course</td><td colspan="7">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">References Books</td><td colspan="7">1. Gupta. S. C. and Kapoor. V. K. (2004) – Fundamentals of Mathematical Statistics – (11th Edition), Sultan Chand & Sons, New Delhi.<br>2. Saxena H.C, Statistical Inference, S. Chand & Company Private Ltd, New Delhi.<br>3. Goon A M, Gupta M K, Das Gupta B: Fundamentals of Statistics (Vol-I), The World Press Pvt. Ltd., Kolkata.<br>4. Mood A.M, Graybill F. A and Boes D. C (1983), Introduction to the theory of Statistics, McGraw Hill, New Delhi.</td></tr>
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|---|---|
| | 5. Sancheti. D. C. and Kapoor. V. K. Statistics (7th Edition), Sultan Chand & Sons, New Delhi.<br>6. SnedecorG.Wand Cochran W.G., Statistical Methods, Oxford Press and IBH.<br>7. AgarwalB.L,BasicStatistics,WileyEasternLtd.,Publishers,NewDelhi.<br>8. Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi.<br>9. VittalP.R,MathematicalStatistics,MarghamPublications,Chennai.<br>10. Robert V. Hogg, Elliot A. Tanis, Probabilityand statistical inference, Macmillan. |
| ***Web links*** | http://www.sjsu.edu/faculty/gerstman/StatPrimer/estimation.pdf<br>https://www.tutorialspoint.com/statistics/<br>https://www.statisticshowto.datasciencecentral.com/<br>https://www.investopedia.com/terms/c/chi-square-statistic.asp<br>http://onlinestatbook.com/2/introduction/inferential.html |

**Course Learning Outcome(for Mapping with POs and PSOs)**

Students will be able to

**CLO-1**Knowtheimportance of good estimators.

**CLO-2** understand the importance of maximum likelihood estimator

**CLO-3** know the difference types of estimators Cramer Rao inequality.

**CLO-4** Learn the importance of statistical hypothesis for large samples.

**CLO-5** Learn the importance of statistical hypothesis for small samples.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| CLO1 | S | S | M | M | M | S | M | S | M |
| CLO2 | S | S | S | S | M | S | M | S | M |
| CLO3 | S | S | S | M | S | S | M | S | S |
| CLO4 | S | S | S | M | S | S | S | S | M |
| CLO5 | S | S | M | M | M | S | S | S | M |

**CLO-PSO Mapping(Course Articulation Matrix)S-Strong, M- Medium, W-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 |
| Weightage | 15 | 15 | 15 | 15 | 15 |
| Weighted percentage of Course Contribution to Pos | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO'sand CO's**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">Allied–Statistics Practical<br>(For B.Sc., Mathematics/B.Sc., Mathematics(CA))</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7"></td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Allied</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>2</td><td colspan="2">-</td><td colspan="2">--</td><td>2</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">To impart knowledge about the basis of data analysis related to various activities like production, consumption, distribution, bank transactions, insurance and transportation.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="7">UNIT–I Measures of Central Tendency and Dispersion Computation of Measures of Central Tendency – Measures of Dispersion (absolute and relative measures) -Coefficient of Skewness.</td></tr>
<tr><td colspan="7">UNIT–II Theoretical Distributions<br>Distributions–Fitting of Binomial distribution, Poisson distributions and Normal distribution– Testing the Goodness of fit.</td></tr>
<tr><td colspan="7">UNIT– III Method of Least Square<br>Curve fitting - Method of least square – Fitting of a straight line (y=a+bx), Second degree parabola($y=a+bx+cx^2$),Fitting of Power Curve and ($y=ax^b$), Exponential Curve($y= ae^{bx}$ and $y= ab^x$)–Simple Problems.</td></tr>
<tr><td colspan="7">UNIT–IV Correlation and Regression<br>Computation of Karl Pearson‘s co-efficient of correlation–Spearman‘s Rank correlation coefficient–Regression equations.</td></tr>
<tr><td colspan="7">UNIT–V Large and Small Sample Tests<br>Large sample tests with regard to Mean, Difference between Means, Proportions and Difference of Proportions.<br>Small sample tests with regard to Mean, Difference between Means and Paired_ t‘ test, F–test, Chi-square test for independence of attributes.</td></tr>
</table>

**Note:**

**Question Paper Setting:**

**5 questions are to be set without omitting any unit. All questions carry equal marks.**

**Any 3 questions are to be answered in 3 hours duration.**

**Examinations Distribution of Marks**

| | |
|---|---|
| University Examinations (Written Practical) | 60Marks |
| CIA (Including Practical Record) | 40Marks |
| Total | 100Marks |

<table>
<tr><td colspan="2">Title ofthe Course</td><td colspan="6">Allied– Bio–Statistics<br>(For B.Sc., Biotechnology and Bio–Chemistry)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6"></td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Allied</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>4</td><td colspan="2">-</td><td colspan="2">--</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basis of Statistics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. The students will be able to understand and apply the statistical methods like measures of location, dispersion and the relationship between two variables in bio- statistics.<br>2. To understand large and small samples in laboratory study to apply it in real life problems.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">Unit I Collection and Presentation of Statistical Data<br>Biostatistics Definition –Types of data – Primary and secondary data – Method of Collection of data – Sources of data in life science – Limitations and Uses o Statistics–Classification and Tabulation of data–Diagrammatic and Graphical Representation of data.</td></tr>
<tr><td colspan="6">Unit II Measures of Central Tendency<br>Definitions – Mean – Median – Mode – Geometric mean – Harmonic mean – Characteristics of a good average – Merits and demerits.</td></tr>
<tr><td colspan="6">Unit III Measures of Dispersion Range<br>Quartile deviation –Mean deviation and their co-efficient –Standard deviation – Co-efficient of variation – Merits and demerits.</td></tr>
<tr><td colspan="6">Unit IV Correlation and Regression<br>Definitions – Types and Methods of Correlation –Karl Pearson‘s coefficient of correlation – Spearman‘s Rank correlation coefficient<br>Regression: Simple regression equations (two variables)–Simple Problems.</td></tr>
<tr><td colspan="6">Unit V Test of Significance Sampling distribution<br>Standarderror–TestofHypothesis:Simplehypothesis,Nullhypothesisand AlternativeHypothesis–Testofsignificance:Largesampletestsbasedon Mean, Differences of Means, Proportion and Difference of Proportions - Small sample test based on Mean, Difference of Means ,Paired t‘test -F-test-Chi square test.</td></tr>
<tr><td colspan="2">Skills acquired from this Course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">References Books</td><td colspan="6">1. GuptaS.P.(2001),Statistical Methods,Sultan Chand& Sons, New Delhi.<br>2. Pillai R. S. N. And Bagavathi. V. (2005), Statistics, S. Chand & Company Ltd., New Delhi.<br>3. P.S.S. Sunder Rao, J. Richard (2012). Introduction to Bio-Statistics and Research methods, Prentice Hall of India Pvt Ltd, New Delhi.<br>4. Gurumani.N(2005),AnintroductiontoBio-Statistics,2ndRevisedEdition, MJP Publishers.</td></tr>
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|---|---|
| | 5. Daniel .W.W,(1987),Bio- Statistics, John Wiley and Sons, New York.<br>6. Beth Dawson, Robert G Trapp (2004), Basic and Clinical Biostatistics, McGraw Hill, New Delhi.<br>7. ZarJ, Bio Statistical Analysis ,Prentice Hall, India.<br>8. Bernard Rosner, Fundamentals of Biostatistics, (8th edition), Cengage Learning, USA.<br>9. Rossi R.J (2010), Applied Biostatistics for Health Science ,John Wiley, New York.<br>10. Rao C.R ,Advanced Statistical Methods in Biometric Research ,John Wiley, New York. |
| ***Weblinks*** | https://faculty.franklin.uga.edu/dhall/sites/faculty.franklin.uga.edu.dhall/files/lec1.pdf<br>https://www.tutorialspoint.com/statistics/<br>http://www.stat.yale.edu/Courses/1997-98/101/sigtest.htmhttp://biostat.jhsph.edu/~jleek/teaching/2011/754/lecture1.pdfhttp://homepage.divms.uiowa.edu/~dzimmer/applied-multivariate/lecturenotesold.pdf |

**Course Learning Outcome (for Mapping with POs and PSOs)**

Students will be able to

**CLO-1** Understand the statistical methods measures of location

**CLO-2** Understand the statistical methods measures of dispersion

**CLO-3** Apply the statistical methods of dispersion and location

**CLO-4** Understand the relationship between two variables in biostatistics

**CLO-5** Understand large and small samples in laboratory study to apply it in real life problems.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| CLO1 | S | S | M | M | M | S | M | S | M |
| CLO2 | S | S | S | S | M | S | M | S | M |
| CLO3 | S | S | S | M | S | S | M | S | S |
| CLO4 | S | S | S | M | S | S | S | S | M |
| CLO5 | S | S | M | M | M | S | S | S | M |

**CLO-PSO Mapping(Course Articulation Matrix)S-Strong, M-Medium-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 |
| Weightage | 15 | 15 | 15 | 15 | 15 |
| Weighted percentage of Course Contribution to PSOs | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">Allied–Statistics Practical<br>(For B.Sc., Biotechnology/B.Sc., Biochemistry)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7"></td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Allied</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>2</td><td colspan="2">-</td><td colspan="2">--</td><td>2</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">➢ To impart knowledge about the basis of data analysis related to various activities like production, consumption, distribution, bank transactions, insurance and transportation.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="7">UNIT–I Collection and Presentation of Statistical Data<br>Diagrammatic and Graphical Representation of Statistical Data (Histogram, Frequency Polygon, Frequency curves and O give).</td></tr>
<tr><td colspan="7">UNIT–II Measures of Central Tendency and Dispersion Computation of Measures of Central Tendency (Mean, Median, Mode, Geometric Mean & Harmonic Mean)</td></tr>
<tr><td colspan="7">UNIT–III Measures of Dispersion<br>Computation of Measures of Dispersion (absolute and relative measures) - Coefficient of Variation.</td></tr>
<tr><td colspan="7">UNIT–IV Correlation and Regression<br>Computation of Karl Pearson‘s Coefficient of Correlation and Spearman‘s Rank Correlation Coefficient–Regression equations(two variables only).</td></tr>
<tr><td colspan="7">UNIT–V Large and Small Sample Tests<br>Large sample tests with regard to Mean(s) and Proportion(s) – Small sample tests with regard to Mean(s)<br>Variance-Chi-square test for independence of attributes.</td></tr>
</table>

**Note:**

**Question Paper Setting:**

**5 questions are to be set without omitting any unit. All questions carry equal marks. Any 3 questions are answered in 3 hours duration.**

**Examinations Distribution of Marks**

| | |
|---|---|
| University Examinations (Written Practical) | 60Marks |
| CIA (Including Practical Record) | 40Marks |
| Total | 100Marks |

<table>
<tr><td colspan="2">Title ofthe Course</td><td colspan="6">Allied – For B.Sc. Computer Science<br>Common for B.Sc. (Information Science) and B.C.A<br>STATISTICALMETHODSANDTHEIRAPPLICATIONS–I</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Allied</td><td>Year</td><td>I/II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I/III</td></tr>
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<tr><td>4</td><td colspan="2">-</td><td colspan="2">--</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basis of Statistics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. Analyse the sample data and its usage in different ways such as locations, dispersion.<br>2. Understand the relationship between variables and forecasting the future values.<br>3. Understand the concept of sampling , sampling errors, and types of sampling.</td></tr>
<tr><td colspan="2" rowspan="5"></td><td colspan="6">Unit I<br>Collection and Presentation of Statistical Data<br>Nature and Scope of Statistics – Limitations – Types of data – Classification and Tabulation of Data – Construction of Frequency Distribution – Diagrammatic and Graphical Representation of Data.</td></tr>
<tr><td colspan="6">UNITII Measures of Central Tendency<br>Mean, Median, Mode, Geometric mean, Harmonic mean – Characteristics of a good average – Merits and demerits.</td></tr>
<tr><td colspan="6">Unit III Measures of Dispersion<br>Range – Quartile deviation – Mean deviation and their coefficients – Standard deviation – Coefficient of variation – Merits and demerits.</td></tr>
<tr><td colspan="6">Unit IV Correlation and Regression<br>Types and Methods for Measuring Correlation - Scatter diagram – Karl Pearson‘s co-efficient of correlation – Spearman‘s rank correlation coefficient – Regression equations of two variables – Simple Problems.</td></tr>
<tr><td colspan="6">Unit V Probability<br>Definition of Probability-Addition and Multiplication Theorems – Conditional probability – Simple Problems.</td></tr>
<tr><td colspan="2">Skills acquired from this Course</td><td colspan="6">Knowledge ,Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">References Books</td><td colspan="6">1. Gupta S.P.(2001),Statistical Methods ,Sultan Chand&Sons ,New Delhi.<br>2. Gupta. S. C. and Kapoor. V. K. Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi<br>3. Pillai R. S. N. And Bagavathi. V. (2005), Statistics, S. Chand & Company Ltd., New Delhi.<br>4. Sancheti D. C. And Kapoor. V. K (2005), Statistics (7th Edition), Sultan Chand & Sons, New Delhi.<br>5. Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi.<br>6. Murthy M.N(1978),Sampling Theory and Methods, Statistical Publishing</td></tr>
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| | Society, Kolkata.<br>7. Pillai R. S. N. And Bagavathi. V. (1987), Practical Statistics, S. Chand & Company Ltd., New Delhi.<br>8. AgarwalB.L,BasicStatistics,WileyEasternLtd., Publishers,New Delhi.<br>9. Gupta C. B(1978), An Introduction toStatistical Methods, Vikas Publishing House, New Delhi.<br>10. Snedecor G.W and Cochran W.G., Statistical Methods, Oxford Press and IBH. |
| ***Weblinks*** | ➢ https://www.tutorialspoint.com/statistics/data_collection.htm<br>➢ https://www.surveysystem.com/correlation.htm<br>➢ https://www.investopedia.com/terms/r/regression.asp<br>➢ https://www.bmj.com/about-bmj/resources-readers/publications/statistics-square-one/11-correlation-and-regression<br>➢ https://course-notes.org/statistics/sampling_theory |

**Course Learning Outcome (for Mapping with POs and PSOs)**

Students will be able to

**CLO-1** Understand the statistical methods measures of location

**CLO-2** Understand the statistical methods measures of dispersion

**CLO-3** Apply the statistical methods of dispersion and location

**CLO-4**Understand the relationship between variables and fore casting the future values.

**CLO-5**Understand the concept of sampling, sampling errors and types of sampling.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | M | M | S | M | S | M |
| **CLO2** | S | S | S | S | M | S | M | S | M |
| **CLO3** | S | S | S | M | S | S | M | S | S |
| **CLO4** | S | S | S | M | S | S | S | S | M |
| **CLO5** | S | S | M | M | M | S | S | S | M |

**CLO-PSO Mapping(Course Articulation Matrix)S-Strong, M-Medium, W-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td colspan="2">Title ofthe Course</td><td colspan="6">Allied–For B.Sc. Computer Science<br>Common for B.Sc.(Information Science) and B.C.A</td></tr>
<tr><td colspan="2"></td><td colspan="6">STATISTICALMETHODSANDTHEIRAPPLICATIONS–II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Allied</td><td>Year</td><td>I/II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>II/IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>4</td><td colspan="2">-</td><td colspan="2">-</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basis of Statistics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. To impart statistical concepts with rigorous mathematical treatment.<br>2. To introduce concepts of statistical hypothesis.</td></tr>
<tr><td colspan="2" rowspan="5"></td><td colspan="6">Unit I Discrete Probability Distribution<br>Binomial and Poisson Distributions – Mean and Variance of Distributions – Recurrence formula – Fitting of Binomial and Poisson Distributions -Simple Problems.</td></tr>
<tr><td colspan="6">Unit II Continuous Probability Distribution and Curve Fitting<br>Definition of Normal distribution – Characteristics of Normal distribution (Simple Problems) – Curve fitting– Fitting of Straight line and Second degree Parabola-Simple Problems.</td></tr>
<tr><td colspan="6">Unit III Test of Significance (Large Samples Tests)<br>Concept of Statistical Hypothesis – Simple and Composite Hypothesis – Null and Alternative Hypothesis – Critical region – Type I and Type II Errors – Sampling distribution and Standard Error – Test of Significance: Large Sample Tests for Proportion, Difference of Proportions, Mean and Difference of Means - Simple Problems.</td></tr>
<tr><td colspan="6">Unit IV Test of Significance (Small Samples Tests)<br>Small sample tests with regard to Mean, Difference between Means and Paired _t‘ test , F-test - Definition of Chi-square test – Assumptions – Characteristics– Chi-square tests for Goodness of fit and Independence of attributes – Simple Problems.</td></tr>
<tr><td colspan="6">Unit V Analysis of variance- One and Two way Classifications – Basic Principle of design of Experiments – Randomization ,Replication and Local control-C.R.D.,R.B.D and L.S.D</td></tr>
<tr><td colspan="2">Skills acquired from this Course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability ,Professional Competency, Professional Communication and Transferrable Skill</td></tr>
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| | |
|---|---|
| ***References Books*** | 1. Gupta S.P.(2001),Statistical Methods, Sultan Chand & Sons ,New Delhi.<br>2. Gupta.S. C. and Kapoor. V. K. Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi<br>3. Pillai R. S. N. And Bagavathi. V. (2005), Statistics, S. Chand & Company Ltd., New Delhi.<br>4. Sancheti D. C. And Kapoor. V. K (2005), Statistics (7th Edition), Sultan Chand & Sons, New Delhi.<br>5. Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi. |

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**Course Learning Outcome (for Mapping with POs and PSOs)**

Students will be able to

**CLO-1** Understand the concept of random variables and expected average

**CLO-2**Compute Bernoulli trials and understand the rare case population.

**CLO-3** Learn the usage of normal curve and curve fitting by using the method of least squares.

**CLO-4**Learn about the large samples

**CLO-5**Learn the basic concepts of theory of attributes.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | M | M | S | M | S | M |
| **CLO2** | S | S | S | S | M | S | M | S | M |
| **CLO3** | S | S | S | M | S | S | M | S | S |
| **CLO4** | S | S | S | M | S | S | S | S | M |
| **CLO5** | S | S | M | M | M | S | S | S | M |

**CLO-PSO Mapping(Course Articulation Matrix)S-Strong ,M- Medium, W-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Allied–Statistics Practical<br>For B.Sc. Computer Science (Common for B.Sc. (Information Science) and B.C.A</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6"></td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Allied</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>2</td><td colspan="2">-</td><td colspan="2">--</td><td>2</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To impart knowledge about the basis of data analysis related to various activities like production, consumption, distribution, bank transactions, insurance and transportation.</td></tr>
<tr><td colspan="2" rowspan="5">CourseOutline</td><td colspan="6">UNIT – I Collection and Presentation of Statistical Data<br>Construction of Uni-variate frequency distribution – Diagrammatic and Graphical Representation of Statistical Data.</td></tr>
<tr><td colspan="6">UNIT–II Measures of Central Tendency and Dispersion<br>Computation of Measures of Central Tendency – Computation of Measures of Dispersion (absolute and relative measures) – Coefficient of Variation.</td></tr>
<tr><td colspan="6">UNIT–III Correlation and Regression<br>Computation of Karl Pearson‘s Coefficient of Correlation and Spearman‘s Rank Correlation Coefficient–Regression equations(two variables only).</td></tr>
<tr><td colspan="6">UNIT – IV Theoretical Distributions and Methods of Least Squares<br>Fitting of Binomial and Poisson Distributions – Test for Goodness of fit – Fitting of a Straight line (y=a+bx) , Second degree Parabola (y=a+bx+cx$^2$) by the method of least square.</td></tr>
<tr><td colspan="6">UNIT–V Large and Small Sample Tests<br>Large sample tests with regard to Mean(s) and Proportion(s) – Small sample tests with regard to Mean(s)<br>Variance-Chi- square test for in dependence of attributes.</td></tr>
</table>

**Note:**

**Question Paper Setting:**

**5 questions are to be set without omitting any unit. All questions carry equal marks. Any 3 questions are answered in 3 hours duration.**

**Examinations Distribution of Marks**

| | |
|---|---|
| University Examinations (Written Practical) | 60Marks |
| CIA (Including Practical Record) | 40Marks |
| Total | 100Marks |

<table>
<tr><td colspan="2">Titleof the Course</td><td colspan="6">For B.A.(Economics)</td></tr>
<tr><td colspan="2"></td><td colspan="6">STATISTICAL METHODS FOR ECONOMICS</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Allied</td><td>Year</td><td>I/II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23USTA06</td></tr>
<tr><td>Semester</td><td>I/III</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>4</td><td colspan="2">-</td><td colspan="2">--</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basis of Statistics</td></tr>
<tr><td colspan="2">Objectivesof the Course</td><td colspan="6">To introduce statistical concepts and develop analytical skills through economic barometers.</td></tr>
<tr><td colspan="2" rowspan="5"></td><td colspan="6">UNIT–I Collection, Classification and Tabulation of Data<br>Nature and scope of statistics - Limitations – Types of data – Primary data and secondary data – Methods of collection of data – Classification and tabulation of data.</td></tr>
<tr><td colspan="6">UNIT– II Diagrammatic Representation of Data<br>Formation of frequency distribution – Diagrammatic representation – Simple bar diagram – Multiple bar diagram – Subdivided bar diagram – Percentage bar diagram – Pie diagram.</td></tr>
<tr><td colspan="6">UNIT–III Graphical representation of Data<br>Graphical representation – Histogram – Frequency polygon – Frequency curve – O gives curve and Lorenz curve.</td></tr>
<tr><td colspan="6">UNIT–IV Measures of Central Tendency<br>Definitions – Arithmetic Mean, Median, Mode, Geometric mean, Harmonic mean, weighted arithmetic mean and their uses in Economics – Simple Problems.</td></tr>
<tr><td colspan="6">UNIT – V Measures of Dispersion<br>Definitions - Absolute and Relative Measures of Dispersion – Range , Quartile deviation , Mean deviation and their coefficients – Standard deviation and co-efficient of variation.</td></tr>
<tr><td colspan="2">Skills acquired from this Course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">References Books</td><td colspan="6">1. Gupta S.P.(2001),Statistical Methods, Sultan Chand&Sons,New Delhi.<br>2. Gupta.S. C. and Kapoor. V. K. Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi<br>3. Pillai R. S. N. And Bagavathi. V. (2005), Statistics, S. Chand & Company Ltd., New Delhi.<br>4. Sancheti D. C. And Kapoor. V. K (2005), Statistics (7th Edition), Sultan Chand & Sons, New Delhi.<br>5. Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi.<br>6. MurthyM. N (1978), SamplingTheoryand Methods, Statistical Publishing Society, Kolkata.<br>7. PillaiR.S.N.AndBagavathi.V.(1987),PracticalStatistics,S.Chand &</td></tr>
</table>

| | |
|---|---|
| | Company Ltd.,NewDelhi.<br>8. Agarwal B.L,Basic Statistics, Wiley Eastern Ltd.,P ublishers, New Delhi.<br>9. Gupta C. B(1978), An Introduction toStatistical Methods, Vikas Publishing House, New Delhi.<br>10. P.A.Navanithan(2007), Business Statistics, JaiPublishers, Trichy. |
| ***Weblinks*** | ➢ https://www.tutorialspoint.com/statistics/<br>➢ http://pages.intnet.mu/cueboy/education/notes/statistics/presentationofdata.pdf<br>➢ https://www3.nd.edu/~dgalvin1/10120/10120_S17/Topic15_8p2_Galvin_2017_short.pdf<br>➢ https://www3.nd.edu/~dgalvin1/10120/10120_S16/Topic16_8p3_Galvin.pdf<br>➢ https://www.toppr.com/guides/economics/statistics-for-economics/statistics-in-economics/ |

**Note:Thequestionpaper20%theoryand80%problemstobeconsidered.**

**Course Learning Outcome (for Mapping with POs and PSOs)**

Students will be able to

**CLO-1**Understandthescope and functions of statistics

**CLO-2**Emphasis the necessity of data collection

**CLO-3** Understand the various types of diagrams and graphs.

**CLO-4** Understand the relationship between variables and forecasting the future values.

**CLO-5** Compute mathematical averages, positional averages and dispersion.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| CLO1 | S | S | M | M | M | S | M | S | M |
| CLO2 | S | S | S | S | M | S | M | S | M |
| CLO3 | S | S | S | M | S | S | M | S | S |
| CLO4 | S | S | S | M | S | S | S | S | M |
| CLO5 | S | S | M | M | M | S | S | S | M |

**CLO-PSO Mapping (Course Articulation Matrix)S-Strong, M-Medium, W-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">B.A. (Economics)</td></tr>
<tr><td colspan="2"></td><td colspan="6">APPLIED STATISTICS FOR ECONOMICS</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Allied</td><td>Year</td><td>I/II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23USTA07</td></tr>
<tr><td>Semester</td><td>I/III</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>4</td><td colspan="2">-</td><td colspan="2">--</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basis of Statistics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To enable the students to understand the elementary concepts in statistical analysis</td></tr>
<tr><td colspan="2" rowspan="5"></td><td colspan="6">UNIT– I Correlation<br>Definition of Correlation – Types of Correlation – Measures of Correlation – Scatter diagram – Karl Pearson‘s correlation coefficient – Spearman‘s rank correlation coefficient and their interpretation.</td></tr>
<tr><td colspan="6">UNIT– II Regression<br>Meaning of Regression – Fitting of Regression lines – Regression Equations – Uses in Economics.</td></tr>
<tr><td colspan="6">UNIT– III Time Series<br>Time series analysis – Definition – Uses – Components of Time series – Measures of Trend – Graphic method – Semi-average method – Moving average method – Least square method – Measure of Seasonal variation - Simple average method.</td></tr>
<tr><td colspan="6">UNIT–IV Index Number<br>Definition – Uses of Index Number – Types of Index Number – Methods of construction – Simple index number - Weighted index number –Time Reversal and Factor Reversal Test – Cost of living index number.</td></tr>
<tr><td colspan="6">UNIT–V Sampling Methods<br>Basic sampling methods – Probability sampling - Simple Random Sampling – Systematic Sampling – Stratified Random Sampling – Non Probabilitysampling-QuotaSampling–PurposiveSampling-Errors–Difference between probability and non-probability sampling.</td></tr>
<tr><td colspan="2">Skills acquired from this Course</td><td colspan="6">Knowledge ,Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
</table>

| | |
|---|---|
| ***References Books*** | 1. Gupta S.P.(2001),StatisticalMethods,SultanChand&Sons,New Delhi.<br>2. Gupta.S. C. and Kapoor. V. K. Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi<br>3. Pillai R. S. N. And Bagavathi. V. (2005), Statistics, S. Chand & Company Ltd., New Delhi.<br>4. Sancheti D. C. And Kapoor. V. K (2005), Statistics (7th Edition), Sultan Chand & Sons, New Delhi.<br>5. Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi.<br>6. MurthyM.N(1978),SamplingTheoryandMethods,StatisticalPublishing |

| | |
|---|---|
| | Society, Kolkata.<br>7. Pillai R. S. N. And Bagavathi. V. (1987), Practical Statistics, S. Chand & Company Ltd., New Delhi.<br>8. Agarwal B.L,Basic Statistics, Wiley EasternLtd., Publishers, New Delhi.<br>9. Gupta C. B(1978), An Introduction toStatistical Methods, Vikas Publishing House, New Delhi.<br>10. P.A. Navanithan (2007), Business Statistics, JaiPublishers, Trichy. |
| ***Weblinks*** | ➢ https://www.surveysystem.com/correlation.htm<br>➢ https://www.investopedia.com/terms/r/regression.asp<br>➢ https://www.academia.edu/2191454/Chapter5_Index_number<br>➢ https://www.itl.nist.gov/div898/handbook/pmc/section4/pmc4.htm |

**Note: The question paper20%theoryand80%problems to be considered.**

**Course Learning Outcome(for Mapping with POs and PSOs)**

Students will be able to

**CLO-1** Understand the correlation coefficient from different methods of measurements.

**CLO-2** Concept of regression lines

**CLO-3** Understand the concept of time series and estimate the trend values using various methods.

**CLO-4** Understand the concept, purpose and its types of index numbers.

**CLO-5** Understand the concept of sampling, sampling errors and types of sampling.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| CLO1 | S | S | M | M | M | S | M | S | M |
| CLO2 | S | S | S | S | M | S | M | S | M |
| CLO3 | S | S | S | M | S | S | M | S | S |
| CLO4 | S | S | S | M | S | S | S | S | M |
| CLO5 | S | S | M | M | M | S | S | S | M |

**CLO-PSO Mapping(Course Articulation Matrix)S-Strong, M-Medium, W-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 |
| Weightage | 15 | 15 | 15 | 15 | 15 |
| Weighted percentage of Course Contribution to Pos | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td>Title of the Course</td><td colspan="6">B.Sc Geography</td></tr>
<tr><td></td><td colspan="6">STATISTICS-I</td></tr>
<tr><td rowspan="2">Category Allied</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>3</td><td colspan="2">-</td><td colspan="2">--</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td colspan="6">Basics of Statistics</td></tr>
<tr><td>Objectives of the Course</td><td colspan="6">1. To enable the Students to understand the basic Concepts of Statistics, Collection of data, Presentation of data and analysis of data.<br>2. To enable the students understand the concepts of Sampling and types of Sampling.<br>3. To enable the students understand and compute the Descriptive Measures.<br>4. Understand the concepts of Time series and its components.<br>5. Understand the concepts of Population studies.</td></tr>
<tr><td rowspan="3"></td><td colspan="6">UNIT – I Collection, Classification and Tabulation of Data<br>Nature and scope of statistics - Limitations – Types of data – Primary data and secondary data – Methods of collection of data – Classification and tabulation of data-Methods of Sampling-Probability Sampling –Non Probability Sampling(Only Concepts).</td></tr>
<tr><td colspan="6">UNIT – II Diagrammatic Representation of Data<br>Formation of frequency distribution – Diagrammatic representation – Simple bar diagram – Multiple bar diagram – Subdivided bar diagram – Percentage bar diagram – Pie diagram.<br>Graphical Representation of Data<br>Graphical representation – Histogram – Frequency polygon – Frequency curve</td></tr>
<tr><td colspan="6">UNIT – III<br>Descriptive Measures<br>Definitions – Arithmetic Mean, Median, Mode, Standard deviation, Skewness and kurtosis– Simple Problems.</td></tr>
</table>

| | |
|---|---|
| | **UNIT – IV**<br>**Time Series** -Definition-Utility of Time Series Analysis-Components of Time Series-Measurement of Trend-Method of Semi-Averages-Method of Moving Averages. Measures of Seasonal Variations-Simple Average Method. |
| | **UNIT – V Population Studies**<br>Definition, Nature and Scope of Population studies, Relationship of other Social Sciences with Population Studies-Advantages of Population Study. Measures of Mortality. |
| Skills acquired from this Course | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill. |
| ***References Books*** | 1. Gupta S. P. (2001), Statistical Methods, Sultan Chand & Sons, New Delhi.<br>2. Gupta. S. C. and Kapoor. V. K. Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi<br>3. Pillai R. S. N. And Bagavathi. V. (2005), Statistics, S. Chand & Company Ltd., New Delhi.<br>4. Sancheti D. C. And Kapoor. V. K (2005), Statistics (7th Edition), Sultan Chand & Sons, New Delhi.<br>5. Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi.<br>6. Murthy M. N (1978), Sampling Theory and Methods, Statistical Publishing Society, Kolkata.<br>7. Pillai R. S. N. And Bagavathi. V. (1987), Practical Statistics, S. Chand & |
| | Company Ltd., New Delhi.<br>8. Agarwal B. L, Basic Statistics, Wiley Eastern Ltd., Publishers, New Delhi.<br>9. Gupta C. B (1978), An Introduction to Statistical Methods, Vikas Publishing House, New Delhi.<br>10. P.A. Navanithan (2007), Business Statistics, Jai Publishers, Trichy.<br>11. Agarwal S.N India's Population Problem,Tata McGraw Hill,1981. |
| ***Weblinks*** | ➢ https://www.tutorialspoint.com/statistics/<br>➢ http://pages.intnet.mu/cueboy/education/notes/statistics/presentationofdata.pdf<br>➢ https://www3.nd.edu/~dgalvin1/10120/10120_S17/Topic15_8p2_Galvin_2017_short.pdf<br>➢ https://www3.nd.edu/~dgalvin1/10120/10120_S16/Topic16_8p3_Galvin.pdf<br>➢ https://www.toppr.com/guides/economics/statistics-for-economics/statistics-in-economics/ |

**Note: The question paper 20% theory and 80% problems to be considered.**

## Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

**CLO-1** Understand the scope and functions of statistics and necessity of data collection

**CLO-2** Understand the various types of diagrams and graphs

**CLO-3** Understand the various types of Descriptive Measures

**CLO-4** Understand the concepts of Time series and its components

**CLO-5** Understand the concepts of Population studies.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | M | M | S | M | S | M |
| **CLO2** | S | S | S | S | M | S | M | S | M |
| **CLO3** | S | S | S | M | S | S | M | S | S |
| **CLO4** | S | S | S | M | S | S | S | S | M |
| **CLO5** | S | S | M | M | M | S | S | S | M |

## CLO-PSO Mapping (Course Articulation Matrix) S-Strong, M-Medium, W-Weak

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

# NME FOR OTHER MAJOR

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">(NME) Basic of Statistics–I</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">NME-I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">NME</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>2</td><td colspan="2">-</td><td colspan="2">--</td><td>2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Uses and its basics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. To enable the students to understand the basic concepts of statistics, collection of data, presentation of data and analysis of data.<br>2. To acquire knowledge of statistics and its scope and importance in various areas such as Medical, Engineering, Agricultural and Social Sciences etc.,</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">Unit II introduction Meaning and Scope<br>Statistics – Definition – Scope – Limitations – Population and Sample – Concepts of Random sampling and Non-random sampling – Basic concepts only.</td></tr>
<tr><td colspan="6">Unit II Collection of Data<br>Primary and Secondary data – Methods of collecting primary and secondary data -sources of data – Preparation of Questionnaire and Schedule.</td></tr>
<tr><td colspan="6">Unit III Presentation of Data<br>Classification of data–Types–Frequency distributions for discrete and continuous data – Construction of tables with one, two factors of classification.</td></tr>
<tr><td colspan="6">Unit IV Diagrammatic Representation of Data<br>Bar Diagrams: Types of one dimensional and two dimensional bar diagrams -Pie-diagrams – Uses.</td></tr>
<tr><td colspan="6">Unit–V Graphical Representation of Statistical Data<br>Histogram–Frequency Polygon–Frequency curve and Cumulative frequency curve–O give curves– Lorenz curve–Uses.</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this Course</td><td colspan="6">Knowledge, Problem Solving ,Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="6">1. Gupta. S. P. (2001), Statistical methods, Sultan Chand & Company Ltd., New Delhi.<br>2. Pillai. R. S. N. And Bagavathi. V. (2005), Statistics, S. Chand & Company Ltd., New Delhi.<br>3. Sancheti.D.C.andKapoor.V.K,Statistics(7thEdition),Sultan Chand&Sons,NewDelhi.</td></tr>
</table>

| | |
|---|---|
| | 4. Arora P. N, Comprehensive Statistical Methods, Sultan Chand & Sons, New Delhi.<br>5. Agarwal B. L, Basic Statistics, Wiley Eastern Ltd., Publishers, New Delhi.<br>6. Vittal P. R,Business Statistics,Margham Publications,Chennai.<br>7. Shukla M. C and Gulshan S. S, Statistics, Sultan Chand & Sons, New Delhi.<br>8. Simpson Gand Kafka F, Basic Statistics, Oxford and IBH, Calcutta.<br>9. Freud J. E, Modern Elementary Statistics, Prentice Hall of India, New Delhi.<br>10. Saxena H. C (1983), Elementary Statistics, Sultan Chand & Sons, New Delhi. |
| **Website and e-Learning Source** | ❖ https://www.tutorialspoint.com/statistics/<br>❖ https://www.emathzone.com/tutorials/basic-statistics/collection-of-statistical-data.html<br>❖ https://byjus.com/commerce/meaning-and-objectives-of-classification-of-data/<br>❖ https://byjus.com/commerce/diagrammatic-presentation-of-data/<br>❖ https://byjus.com/maths/graphical-representation/ |

**Course Learning Outcome (for Mapping with POs and PSOs)**

Students will be able to

**CLO-1** Distinguish between population and sample.

**CLO-2** Know the concepts of random sampling and non – sampling

**CLO-3** Frame a questionnaire and collect primary and secondary data.

**CLO-4** Easy to understand the basic concepts.

**CLO-5**Analyzestatisticaldataanddrawgraphs, histograms, frequency polygons and O gives.

**CLO-6** Obtain the mathematical knowledge and skills for the better understanding of statistics.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| CLO1 | S | S | M | M | M | S | M | S | M |
| CLO2 | S | S | S | S | M | S | M | S | M |
| CLO3 | S | S | S | M | S | S | M | S | S |
| CLO4 | S | S | S | M | S | S | S | S | M |
| CLO5 | S | S | M | M | M | S | S | S | M |
| CLO6 | S | S | S | S | M | S | S | M | M |

**CLO-PSOMapping(Course Articulation Matrix)S-Strong, M-Medium-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">(NME)Basic of Statistics–II</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">NME-II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">NME</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">23USTSE02</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">2</td><td colspan="2">-</td><td>--</td><td>2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Statistics and its basics</td></tr>
<tr><td colspan="2" rowspan="6">Objectives of the Course Outline</td><td colspan="6">1. To enable the students understand and compute the measures of central tendency and dispersion.<br>2. To learn the concepts of time series, evaluation of trend and measurement of seasonal variations by using various methods.<br>3. Acquire knowledge about index numbers, cost of living index numbers and calculate an indices from real life problems.</td></tr>
<tr><td colspan="6">Unit I Measures of Central Tendency<br>Definitions and concepts of Arithmetic mean Median and Mode – Merits and Demerits – Uses -Simple Problems.</td></tr>
<tr><td colspan="6">Unit II Measures of Dispersion<br>Range,Quartiledeviationandtheirrelativemeasures-Standarddeviationand Coefficient of variation-Simple Problems.</td></tr>
<tr><td colspan="6">Unit III Correlation<br>Karl Pearson‘s coefficient of correlation and Spearman‘s rank correlation coefficient – Simple Problems.</td></tr>
<tr><td colspan="6">Unit IV Time series<br>Measures of trend–Graphic method–Semi average method and Moving average method- Simple Problems.</td></tr>
<tr><td colspan="6">Unit V Index Numbers<br>Un weighted and Weighted Index Numbers: Laspeyre‘s, Paasche‘s and Fisher‘s method – Cost of living index numbers – Simple Problems.</td></tr>
<tr><td colspan="2">Skills acquired from this Course</td><td colspan="6">Knowledge ,Problem Solving, Analytic l ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2"></td><td colspan="6">❖ https://byjus.com/maths/central-tendency/<br>❖ https://byjus.com/maths/dispersion/<br>❖ https://www.bmj.com/about-bmj/resources-readers/publications/statistics-square- one/11-correlation-and-regression<br>❖ http://www.stat.columbia.edu/~rdavis/lectures/Session6.pdf<br>❖ https://www.civilserviceindia.com/subject/Management/notes/index-numbers.html</td></tr>
</table>

**Course Learning Outcome (forMappingwithPOs and PSOs)**

Students will be able to

**CLO-1**Analyze statistical data using measures of central tendency.
**CLO-2**Analyze statistical data using measures of central dispersion.
**CLO-3**Understand and compute various statistical measures of correlation.
**CLO-4**Gain knowledge about the sources of time series
**CLO-5**Gain knowledge about the sources of measures cular trend.
**CLO-6**understandtheconceptsofindex numbers, optimum tests and its construction.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| CLO1 | S | S | M | M | M | S | S | S | M |
| CLO2 | S | S | S | S | M | S | S | S | M |
| CLO3 | S | S | S | M | S | M | S | S | M |
| CLO4 | S | S | S | M | S | S | S | S | M |
| CLO5 | S | S | M | M | M | S | S | S | M |
| CLO6 | S | M | M | S | M | S | S | S | M |

**CLO-PSO Mapping (Course Articulation Matrix)S-Strong, M-Medium-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 |
| Weightage | 15 | 15 | 15 | 15 | 15 |
| Weighted percentage of Course Contribution to Pos | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Genetical Statistics</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">NME</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>2</td><td colspan="2">-</td><td colspan="2">--</td><td>2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basic level on mathematical computation</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">The main objectives of this course are to:<br>1. Know the Elements of Genetics<br>2. UnderstandMandel‘sLawofinheritanceandUseof$\chi$2(chi- square) tests in testing the Mendel‘s segregation law<br>3. Know the Method of maximum likelihood and other methods of estimation</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">Unit – I<br>ElementsofGenetics:Physicalbasisofheredity-cellstructurechromosomesandgenes–Interactionofgenesconceptofgenotypes<br>and phenol types–Linkage and crossing over-Genetic maps.</td></tr>
<tr><td colspan="6">Unit –II<br>Mandel‘s Law of inheritance –Laws of segregation and independent assortment –concept over generation.</td></tr>
<tr><td colspan="6">Unit<br>-III<br>Use of $\chi$2 ( chi-square) tests in testing the Mendel‘s segregation law-Sex linked genes –Concept of gene frequency –concept of random mating detection and estimation of linkage from backcross, F2,& F3 Data.</td></tr>
<tr><td colspan="6">Unit–IV<br>Method of maximum likelihood and other methods of estimation-Planning of experiments.</td></tr>
<tr><td colspan="6">Unit–V<br>Multiple allelic systems-Elementary aspects of the study of human blood group.</td></tr>
<tr><td colspan="2">Skills acquired from this Course</td><td colspan="6">Knowledge ,Problem Solving ,Analytical ability, Professional Competency ,Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">References Books</td><td colspan="6">1. Kempthorne, O. (1957). An Introduction to Genetic Statistics, John Wiley & Sons, New York, US.<br>2. Mackay,T.F.C.,and Falconer,D.S.(1995).Introduction to Quantitative Genetics, Longman(Publisher)</td></tr>
</table>

| | |
|---|---|
| **Website Links** | 1 https://en.wikipedia.org/wiki/Mobile_genetic_elements<br>2 https://byjus.com/biology/mendel-laws- f inheritance/#:~:text=Mendel%27s%20Laws%20of%20Inheritance%20Inheritance%20can%20be%20defined,that%20the%20offsprings%20are%20similar%20to%20the%20parents<br>3 https://www.encyclopedia.com/science-and- |
| | technology/biology-and-genetics/genetics-and genetic-engineering/multiple alleles#:~:text=multiple%20alleles%20Three%20or%20more%20alternative%20forms%20of,present%20in%20an%20individual.%20A%20Dictionary%20of%20Biology |

**Course Learning Outcome (for Mapping with POs and PSOs)**

Students will be able to

**CLO-1**Understand the correlation coefficient from different methods of measurements.

**CLO-2**Concept of regression lines

**CLO-3** Understand the concept of time series and estimate the trend values using various methods.

**CLO-4** Understand the concept, purpose and its types of index numbers.

**CLO-5** Understand the concept of sampling, sampling errors and types of sampling.

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| **CLO1** | S | S | M | M | M | S | M | S | M |
| **CLO2** | S | S | S | S | M | S | M | S | M |
| **CLO3** | S | S | S | M | S | S | M | S | S |
| **CLO4** | S | S | S | M | S | S | S | S | M |
| **CLO5** | S | S | M | M | M | S | S | S | M |

**CLO-PSO Mapping (Course Articulation Matrix) S-Strong, M-Medium,W-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |
| **Weightage** | 15 | 15 | 15 | 15 | 15 |
| **Weighted percentage of Course Contribution to Pos** | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Indian Official Statistics</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">NME</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>VI</td></tr>
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<tr><td>2</td><td colspan="2">-</td><td colspan="2">--</td><td>2</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basic level on statistical computation</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">The main objective of this course are to:<br>1. know the population and agricultural statistics<br>2. understand industrial statistics and price statistics<br>3. know the National sample survey</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT – I Population Statistics: Statistical organization – Population Statistics – Agricultural Statistics – Indices of Agricultural production – Miscellaneous Agricultural Statistics.</td></tr>
<tr><td colspan="6">UNIT –II<br>Industrialstatistics–ASI–IndicesofIndustrialProductionandprofits.</td></tr>
<tr><td colspan="6">UNIT-III<br>Price statistics – Price index numbers – Lab our Bureau; Index number of Retail prices – Indices of security price</td></tr>
<tr><td colspan="6">Unit–IV<br>Wage statistics – trade statistics – Financial statistics – National income statistics.</td></tr>
<tr><td colspan="6">Unit–V<br>National sample surveys – Activities and publications of CSO and the Department of Statistics, Government of Tamil Nadu. National Income compilation.</td></tr>
<tr><td colspan="2">Skills acquired from this Course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency ,Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">References Books</td><td colspan="6">1. Central Statistical Organization, Guide to Official Statistics 1979 Ed<br>Department of Statistics, Ministry of Planning, India</td></tr>
<tr><td colspan="2">Website Links</td><td colspan="6">1 https://agriculture.uk.gov.in/pages/show/221-agriculture-statistics-Data<br>2 http://labourbureau.gov.in/CPIW05%20Methodolgy.html<br>3 https://byjus.com/free-ias-prep/nsso</td></tr>
</table>

**Course Learning Outcome (for Mapping with POs and PSOs)**

Students will be able to

**CLO-1** Understand the correlation coefficient from different methods of measurements.

**CLO-2**Concept of regression lines

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| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 | PSO8 | PSO9 |
|---|---|---|---|---|---|---|---|---|---|
| CLO1 | S | S | M | M | M | S | M | S | M |
| CLO2 | S | S | S | S | M | S | M | S | M |
| CLO3 | S | S | S | M | S | S | M | S | S |
| CLO4 | S | S | S | M | S | S | S | S | M |
| CLO5 | S | S | M | M | M | S | S | S | M |

**CLO-PSO Mapping (Course Articulation Matrix)S-Strong, M-Medium-Weak**

| CO /PO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 |
| Weightage | 15 | 15 | 15 | 15 | 15 |
| Weighted percentage of Course Contribution to Pos | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

**Level of Correlation between PSO's and CO's**