

P.R. GOVERNMENT COLLEGE, KAKINADA

(An Autonomous, NAAC accredited with 'A' Grade (3.17 CGPA) & ISO certified Institution)



**BOARD OF STUDIES
2021-2022**

STATISTICS

**DEPARTMENT
OF
STATISTICS**

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P.R.GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA, E.G.DT
Department of Statistics

The Board of Studies meeting for **Statistics** subject during the academic year 2021-2022 is conducted at Mathematics & Statistics Department on **12-11-2021** at **2.00** pm under the chairmanship of Sri. G. Moses Lecturer –In-Charge along with the following members

Name, Designation and Address **Signature**

1. Chairperson :

Sri. G. Moses M.Sc M.Ed Chairperson
Lecturer in Statistics & I/C Dept. of Mathematics & Statistics
P.R.G.C. (A), Kakinada

2. University Nominee:

Dr. D.V. Ramana Murthy University Nominee
Head, Dept. of Statistics, SKVT College , Rajahmundry

3. Members nominated by Academic council of the College:

a. Dr. N. Madhavi Subject Expert
HOD of Statistics, Govt. College (A),
Rajamahendravaram

b. Sri. M. Simhadi, HOD of Statistics, Subject Expert
Aditya Degree College for Women , Kakinada

c. Sri Ch. Tata Rao, A. O Industrialist
LIC, Kakinada.

4. Members from the College:

a. Smt. C. Chinnamamba, Member
Guest Faculty in Statistics

b. Smt. S. Annapurna Member
Guest Faculty in Statistics

c. Sri V. Syam Prasad Member
Guest Faculty in Statistics

Student members:

a. P. Murali III MSCS Student Nominee

b. Md. Jafreen III MSCS Student Nominee

(DR. B.V TIRUPANYAM)

P.R. Government College (Autonomous), Kakinada
Department of Statistics
Board of Studies Meeting in Statistics on 12.11.2021 at 2.00pm

Agenda:

1. Revamping Of Syllabus For I,III &V Semesters.
2. Model Question Papers And Blue Print
3. Panel Of Question Paper Setters And Examiners
4. Pass Minimum In Internal Assessment
5. Choice Based Credit System For I,II &III Year Students
6. Introducing Of New Courses Of Study And The Possibilities .
7. Admission Criteria For Programmes Offered By The Departments .
8. Proposals For Community Service /Extension Activities/ Projects For The Benefit Of The Society.
9. Any Other Proposal /Item With The Permission Of The Chair

Resolutions taken :

The following resolutions are approved by university nominee and all the members of BOS

1. It is resolved to revamping of syllabus for I,III and V semesters
2. It is resolved to follow the existing model question papers and blue print of papers.
3. It is resolved to follow the modified panel of question paper, setters and examiners.
4. It is resolved to follow pass minimum in internal assessment as per norms
5. It is resolved to follow Choice Based Credit System for I,II & III year students .
6. It is resolved to introduce new courses of study whenever necessary.
7. It is resolved to follow the admission criteria for the programmes offered by the department
8. It is resolved to conduct extension lectures from LIC and NSSO resource persons.
9. It is resolved to
Student Project / Assignment - 10 marks (**Assignment**) / Final year V SEM
(**Project** all students)

P.R.GOVERNMENT COLLEGE (A), KAKINADA

DEPARTMENT OF STATISTICS

Objectives of Department of Statistics:

- To inspire knowledge across different areas in Statistics and Actuarial Science.
 - To impart knowledge on Statistical concepts like Data Collection, Measures of Central Tendency and Dispersion, Probability and Distributions, Statistical Methods, Inference, Sampling methods, Experimental Designs, Economical and Vital Statistics, SQC, reliability and Operations Research.
 - To impart knowledge on Actuarial Science concepts like basics of Economics, Financial Accounting and Mathematics, Surviving models, life contingences, Business communication, Actuarial Statistics , Mortality and Insurance,
 - To equip our students with good quality to appear for competitive examinations.
 - To make the students to understand the needs of Statistics and Actuarial Science in Science, Technology and various industries like manufacturing, construction, insurance, IT, Pharmacy, etc.
 - To inculcate research atmosphere among students by assigning projects.
 - To provide learning environment by organizing industrial/field visits.
 - To conduct remedial classes to slow learners and assign research work to advance learners in collaboration with industries.
 - To organize guest lectures by inviting the resource persons from in and outside of universities for improving quality in education
 - To celebrate significant days like, National/World Statistics Day, Mathematics Day, Science Day, etc
 - To upgrade the students with latest Technology and Statistical softwares.
 - To make the students to join in Post Gradation in the domain of Statistics/Actuarial Science/related subjects in top universities after completion of their UG course
 - To make the students to get placements in Govt. and Private sectors in various positions viz, Assistant Statistical Officer, AD, Statistician, Data Analyst, Data Scientist, Business Analyst, Actuarial Analyst, Actuary, Risk Analyst, Bank PO, etc.
- The Department of Statistics is offering two **B.Sc.** courses **MSCs** and **MSAs**,

PROGRAMME OUTCOMES

For every degree program expectations are listed out by the institution under the Program Outcomes.

PO1. Knowledge and Understanding of:

1. All concepts at under graduate level.
2. Real life applications of these concepts and relationship between them.

PO2. Intellectual skills – be able to:

1. Think logically and arrange real life situations to mathematical form.
2. Assimilate knowledge and ideas based on wide reading and through the internet.
3. Transfer of appropriate knowledge and methods from one topic to another within the subject.
4. Understand the evolving state of knowledge in a rapidly developing field.

PO3. Transferable skills:

1. Use of IT (word-processing, use of internet for doing project).
2. Ability to work as part of a team.
3. Ability to use library resources/Equipment.
4. Time management.

PO4. Problem analysis:

1. Conversion of real life problem to Mathematical model and analyze with suitable Statistical tools.
2. Conduct investigations of complex problems: Use research-based knowledge.

PO5. Ethics:

1. Apply ethical principles, commit environment and responsibilities among students.

PO6. Individual and team work:

1. Function effectively as an individual and as a member in diverse teams, and in multidisciplinary settings.

PO7. Communication:

1. Communicate effectively on complex group activities and with society at large. Speak, read, write and listen clearly in person and through electronic media .

PO8.Critical Thinking:

1. Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO9. Effective Citizenship:

1. Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO10. Life-long learning:

1. Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes (PSO)

S.No.	Programme	PSO
1	B.Sc. (Mathematics, Statistics, Computer Science) (Code: BS 11)	PSO1: To understand nature, scope, basic concepts and terminology of the three courses of the programme.
		PSO2: To identify and understand the applications of the three courses in different areas like, physical sciences, life sciences, arts and humanities, Business, various industries, etc
		PSO3: To solve various real life problems by developing mathematical model and applying various statistical tools with the help of computer programming knowledge.
		PSO4: To develop research thinking to solve critical problems.
2	B.Sc. (Mathematics, Statistics, Actuarial Science) (Code: BS 14)	PSO1: To understand nature, scope, basic concepts and terminology of the three courses of the programme.
		PSO2: To identify and understand the applications of the three courses in different areas like, physical sciences, life sciences, arts and humanities, Business, Insurance, various industries, etc
		PSO3: To solve various real life problems by developing mathematical model and applying various statistical tools with the help of suitable economic, finance and risk policies.
		PSO4: To develop research thinking to solve critical problems.

P.R.Government College(Autonomous), Kakinada, A.P.
STRUCTURE OF C.B.C.S. MODEL CURRICULUM IN STATISTICS

Yr.	Sem&Course (Th / Lab)	Course Title	Workload Hrs./week	Credits	Max. Marks		
					Intrnl.	Extrnl	Tot.
I	I Sem. Course-I Theory	Descriptive Statistics& Probability	4 Hrs	4	50	50	100
	I Sem Course-I Lab	Practical – I	2 Hrs	1	–	–	50
	II sem Course-II Theory	Probability Distributions& Statistical Methods	4 Hrs	4	50	50	100
	II sem Course-II Lab	Practical –II	2 Hrs	1	–	–	50
II	III Sem Course-III Theory	Statistical Inference	4 Hrs	4	40	60	100
	III Sem Course-III Lab	Practical-III	2 Hrs	1	–	–	50
	IV Sem Course IV Theory	Sampling Techniques & Design of Experiments	4 Hrs	4	40	60	100
	IV Sem Course IV Lab	Practical-IV	2 Hrs	1	–	–	50
	IV Sem Course V Theory	Applied Statistics	4 Hrs	4	40	60	100
	IV Sem Course V Lab	Practical-V	2 Hrs	1	–	–	50
III	V Sem Course V Theory	Sampling & Design of Experiments	3 Hrs	3	40	60	100
	V Sem Course V Lab.	Practical-V	3 Hrs	2	–	–	50

	V sem Course VI Theory	Applied Statistics	3 Hrs	3	40	60	100
	V sem Course VI Lab	Practical-VI	3Hrs	2	-	-	50
	VI sem Course VII Theory	Elective 1: SQC & Optimization Techniques (or) Elective2: Actuarial Statistics	3 Hrs	3	40	60	100
	VI sem Course VII Lab	Practical-VII(EI) (or) Practical-VII(EII)	3 Hrs	2			50
	VI Sem Course VIII Theory	Cluster A					
		1:Operations Research	3 Hrs	3	40	60	100
		2:Advanced Designs of Experiment	3 Hrs	3	40	60	100
		3. Econometrics	3 Hrs	3	40	60	100
		Project work (or)	2Hrs	2			50
		Cluster B					
		1. Operations Research -I	3 Hrs	3	40	60	100
		2. Operations Research-II	3 Hrs	3	40	60	100
		3. Econometrics	3 Hrs	3	40	60	100
		Project work	2 Hrs	2			50
	VI Sem. Course VIII Lab I & II	Practical-VIII-A1 & A2 (or)	3 Hrs	2			50
		Practical-VIII-B1 & B2	3 Hrs	2			50
Life Skill Course	II Sem	Elementary Statistics	2 Hrs	2		50	50
Opento all	Certificate Course 01	SPSS	40 Hrs				50
Open to all	Certificate Course 02	Descriptive Statistics with R	40 Hrs				50

OBJECTIVE OF THE COURSE

Statistics is a key to success in the field of science and technology. Today, the students need a thorough knowledge of fundamental basic principles, methods, results and a clear perception of the power of statistical ideas and tools to use them effectively in modeling, interpreting and solving the real life problems. Statistics plays an important role in the context of globalization of Indian economy, modern technology, computer science and information technology.

The main objectives of the course are

- To build the basis for promoting theoretical and application aspects of statistics.
- To underline the statistics as a science of decision making in the real life problems with the description of uncertainty.
- To emphasize the relevance of statistical tools and techniques of analysis in the study of interdisciplinary sciences.
- To acquaint students with various statistical methods and their applications in different fields.
- To cultivate statistical thinking among students.
- To develop skills in handling complex problems in data analysis and research design.
- To prepare students for future courses having quantitative components.

This course 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.

Course Outcomes (CO's) of Statistics

S.No	Year & Sem	Course No. & Title of the Course	Course Outcomes
1	I Year & I Sem	Course-I: Descriptive Statistics & Probability	<p>After completion of this course, the students will acquire</p> <p>CO 01: knowledge of various types of data, their organization and evaluation of summary measures such as measures of central tendency, dispersion, etc.</p> <p>CO 02: ability to distinguish between random and non-random experiments and conceptualize the probabilities of events including frequentic and axiomatic approach</p> <p>CO 03: knowledge to apply the theory of probability and also conditional probability including Bayes' law</p> <p>CO 04: knowledge related to concept of discrete and continuous random variables and their probability distributions</p> <p>CO.05: knowledge related to concept of mathematical expectation, moments and generating functions and application of inequalities</p>
2	I Year & II Sem	Course-II: Probability Distributions & Statistical Methods	<p>After completion of this course, the students will acquire</p> <p>CO 01: knowledge of important discrete distributions such as Binomial, Poisson, Geometric, Negative Binomial and Hyper-geometric distributions and to apply in relevant situations</p> <p>CO 02: knowledge of important continuous distributions such as normal, uniform, exponential, beta and gamma distributions and to apply in relevant situations</p>

			CO 03: Knowledge of correlation, regression analysis, regression diagnostics, partial and multiple correlations
			CO 04: knowledge to fit suitable curve for observed data to study its past behavior and forecasting for future.
			CO 05: knowledge of other types of data reflecting quality characteristics including concepts of independence and association between two attributes
3	II Year & III Sem	Course-III: Statistical Inference	<p>After completion of this course, The students will acquire</p> <p>CO 01: concept of random sample from a distribution, sampling distribution of a statistic, standard error of important estimates such as mean and proportions</p>
			CO 02: Concept of law of large numbers and their uses and central limit theorem and its uses in statistics
			CO 03: knowledge about important inferential aspects such as point estimation, test of hypotheses and associated concepts
			CO 04: knowledge about inferences from Binomial, Poisson and Normal distributions as illustrations
			CO 05: concept about non-parametric method and some important non-parametric tests.
4	II Year & IV Sem	Course-IV: Sampling Techniques & Design of Experiments	<p>After completion of this course, The students shall get</p> <p>CO 01: Introduced to various statistical sampling schemes such as simple, stratified and systematic sampling</p>
			CO 02: an idea of conducting the sample surveys and selecting appropriate sampling techniques
			CO 03: Knowledge about comparing various sampling techniques.
			CO 04: carry out one way and two way Analysis of Variance

			CO 05: use appropriate experimental designs to analyze the experimental data
		Course-IV: Sampling Techniques & Design of Experiments	After completion of this course, the students will know about CO 01: time series data, its applications to various fields and components of time series
			CO 02: measuring trend and seasonal variation by various methods
			CO 03: fitting of growth curves.
			CO 04: Interpret and use a range of index numbers commonly used in the business sector
			CO 05: Construction and implementation of life tables, measurement of mortality, fertility and growth rates
5	III Year & V Sem	Course-V: Sampling & Design of Experiments	After completion of this course, the students are able to CO 01: understand the different types of sampling and adopt suitable method and also learn and apply the simple random sampling to estimate the parameters and error in estimates.
			CO 02: understand and apply stratified and systematic sampling methods for estimating parameters with relevant error.
			CO 03: analyze one-way and two-way classifications by the technique of ANOVA with assumptions
			CO 04: understand the principles of experimental designs and design and test various hypothetical problems as CRD, RBD and LSD
6	III Year & V Sem	Course-VI: Applied Statistics	After completion of this course, the students are able to CO 01: study a times series for estimating the effect of its components trend and seasonal variations by different methods
			CO 02: understand various types of index numbers and apply an appropriate formula to find index of various items and also study the cost of living of a group of people and calculate their deflated figures.

			CO 03: understand elasticity of demand and supply and learn various methods to find the elasticity and income distribution
			CO 04: apply various mortality, fertility and reproduction rates to study and compare various places regarding death and birth and also construct life tables
7	III Year & VI Sem	Course-VII(E-I): SQC and Optimization Techniques	After completion of this course, the students are able to CO 01: understand the concept of quality control in industry and apply the techniques of process and product control for checking and diagnosis of lack of quality
			CO 02: understand the reliability of successful running of an item and learn hazard function-exponential distribution as a special case and also calculate the reliability of various systems with series, parallel and k out of n configurations.
			CO 03: understand the origin, scope and applications of operations research and apply graphical and simplex methods to solve LPP.
			CO 04: apply various artificial techniques (Big-M and Two-phase) to solve the LPP's for which artificial variables are required and understand the concept of duality and application.
8	III Year & VI Sem	Paper-VII(E-II): Actuarial Statistics	After completion of this course, the students are able to CO 01: understand utility theory, insurance and prepare and study life tables with reference to mortality
			CO 02: understand multiple life functions and annuities and calculate the single and multiple decrement rates.
			CO 03: understand various life annuities- discrete, continuous, and calculate these with-immediate or due

			CO 04: understand and calculate net premiums-continuous, discrete and monthly .
9	III Year & VI Sem	Course- VIII(A1): Operations Research	After completion of this course, the students are able to CO 01: understand the objective of transportation problem and apply various methods(NWC, LCM, VAM.MODI) to solve this problem(balanced and unbalanced) for optimum solution
			CO 02: understand the objective of the assignment problem and apply assignment algorithm to solve the problem(balanced and unbalanced) and study the travelling salesman problem
			CO 03: understand the objective and assumptions of sequencing problem and apply the algorithm to solve the problem with n jobs on 2 and 3 machines
			CO 04: understand the decision making under conflict-game theory and apply various techniques (maximin-minimax, dominance, algebraic, graphical) to solve the games with and without saddle points.
10	III Year & VI Sem	Course- VIII(A2): Advanced Design of Experiments	After completion of this course, the students are able to CO 01: understand the analysis of CRD, RBD and LSD and apply these in relevant areas
			CO 02: deal the analysis of RBD and LSD with one and two missing values
			CO 03: understand the ANCOVA and analyze CRD and RBD with one covariate.
			CO 04:understand the factorial designs, $2^2, 2^3, 3^2$ and find the main and interaction effects
11	III Year & VI Sem	Course- VIII(B1): Operations Research-I	After completion of this course, the students are able to CO 01: understand and apply revised simplex method to solve a LPP and also apply the technique bounded variables to solve LPP

			CO 02: understand the objective of transportation problem and apply various methods(NWC, LCM, VAM.MODI) to solve this problem(balanced and unbalanced) for optimum solution
			CO 03: understand the objective of the assignment problem and apply assignment algorithm to solve the problem(balanced and unbalanced) and study the travelling salesman problem
			CO 04: understand the objective and assumptions of sequencing problem and apply the algorithm to solve the problem with n jobs on 2 and 3 machines
12	III Year & VI Sem	Course-VIII(B2): Operations Research-II	After completion of this course, the students are able to CO 01: understand the decision making under conflict-game theory and apply various techniques (maximin-minimax, dominance, algebraic, graphical) to solve the games with and without saddle points.
			CO 02: understand the concept of inventory and its control and apply various EOQ models to solve real life problems under different physical conditions.
			CO 03: understand the concept of price breaks and apply the methodology to solve such problems and also deal with problems with uncertain demand.
			CO 04: understand the rules to draw a network for a project and apply CPM and PERT to prepare and analyze network schedules of various projects.
13	III Year & VI Sem	Course-VIII(A3,B3): Econometrics	After completion of this course, the students are able to CO 01: understand the scope and objectives of econometrics
			CO 02: construct and study an econometric model (regression model) and estimate and test the parameters
			CO 03: understand the general linear model and its assumptions and also estimate and test the parameters by least square method

			CO 04: understand the concept of multi co-linearity and its effects and detect the multi co-linearity and its remedies. And have idea about auto correlation
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Model Blue Print for Statistics Question paper and choice for I years
(Duration; 2½ Hrs)

S.No.	Type of Questions	To be given in the Question paper			To be answered		
		No. of Questions	Marks allotted to each question	Total marks	No. of Questions	Marks allotted to each question	Total marks
1	<u>SECTION –A</u> Short Answer Questions	7	5	35	4	5	20
2	<u>SECTION-B</u> Essay Questions	6	10	60	3	10	30
TOTAL		13	15	95	7	15	50

Weighted for Internal Assessment is 50 marks.

For **Mid** semester Examinations - 25 marks

For Continuous assessment - 25 marks

Two Mid semester Examinations will be conducted for 50 marks (Duration: 1 Hr) in the following

QUESTION PAPER PATTERN

S.No	Type of question	No. Of questions given	No. Of questions to be answered	Marks allotted to each question	Total Marks
1	Part-I short questions	5	3	5	15
2	Part-II Essay Questions	2	1	10	10
Total					25
Average of Two Internal Assessments is taken for 25 marks					

Continuous Assessment: 25 Marks distributed in the following way:

1. Student Project /Assignment : 10 M (Assignment)/ Final year V SEM (Project all students)
2. Viva : 10 M
3. Group discussion/Seminar : 5 M

Practical Exam Question paper pattern: (Duration: 2 Hrs)

Practical: Five Questions will be given.

The Student has to answer three questions.

3x12=36M

Record:

10M

Viva:

4M

TOTAL:

50M

Note: External evaluation for practical exam is only in even semester

Model Blue Print for Actuarial Science Question paper and choice for II & III years (Duration: 2 1/2 Hrs)

S.No.	Type of Questions	To be given in the Question paper			To be answered		
		No. of Questions	Marks allotted to each question	Total marks	No. of Questions	Marks allotted to each question	Total marks
1	<u>SECTION – A</u> Short Answer Questions	6	5	30	4	5	20
2	<u>SECTION-B</u> Essay Questions	4	10	40	2	10	20
3	<u>SECTION-C</u> Essay Questions	4	10	40	2	10	20
TOTAL		14		110	8		60

Inernal Assessment : 20 marks

QUESTION PAPER PATTERN FOR 40 MARKS (Duration: 1:15 Hrs)

S.No	Type of question	No. Of questions given	No. Of questions to be answered	Marks allotted to each question	Total Marks
1	Part-I short questions	5	5	2	10
2	Part-II Essay Questions	6	3	10	30
Total					40

Average of Two Internal Assessments is taken for 20 marks	
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P.R.GOVERNMENT COLLEGE(A), KAKINADA

I B.Sc. – Statistics / Semester- I (w.e.f 2020-21) 2021-22

Course-I

Course Title: DESCRIPTIVE STATISTICS& PROBABILITY

Theory

Total Hrs. of Teaching: 60 @ 4 h / Week

Credits: 04

Objectives:

- This course gives the students to review good practice in presentation and format that most applicable to their own data.
 - The measures of central tendency or averages reduce the data to a single value which is highly useful for making comparative studies.
 - The measures of dispersion throw light on reliability of average and control of variability
 - This paper deals with the situation where there is uncertainty and how to measure that uncertainty by defining the probability, random variable and mathematical expectation which are essential in all research areas.
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Module-I (10 Hrs)

Introduction to Statistics: Concepts of primary and secondary data. Diagrammatic and graphical representation of data: Histogram, frequency polygon, Ogives, Pie. **Measures of Central Tendency:** Mean, Median, Mode, Geometric Mean and Harmonic Mean. Median and Mode through graph.

Module-II (10 Hrs)

Measures of Dispersion: Range, Quartile Deviation, Mean Deviation and Standard Deviation, Variance. Central and Non-Central moments and their inter-relations. Sheppard's correction for moments. Skewness and kurtosis.

Module-III (12 Hrs)

Introduction to Probability: Basic Concepts of Probability, random experiments, trial, outcome, sample space, event, mutually exclusive and exhaustive events, equally likely and favourable outcomes. Mathematical, Statistical, axiomatic definitions of probability. Conditional Probability and independence of events, Addition and multiplication theorems of probability for 2 and for n events. Boole's inequality and Baye's theorem and its applications in real life problems.

Module-IV (8 Hrs)

Random variable: Definition of random variable, discrete and continuous random variables, functions of random variable. Probability mass function. Probability density function, Distribution function and its properties. Simple Problems. Bi-variate random variable - meaning, joint, marginal and conditional Distributions, independence of random variables and simple problems.

Module-V (10 Hrs)

Mathematical Expectation : Mathematical expectation of a random variable and its Properties. Moments and covariance using mathematical expectation with examples. Addition and Multiplication theorems on expectation. Definitions of M.G.F, C.G.F, P.G.F, C.F and their properties. Chebyshev and Cauchy - Schwartz inequalities.

Co-Curricular Activities(10 Hours):

Problem Solving / Seminars / Assignments /Quiz /Group Discussions /Open Text Book Test /Oral test /Brain Storming

Text Books:

1. V. K.Kapoor and S.C.Gupta: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, NewDelhi.
2. BA/BSc I year statistics - descriptive statistics, probability distribution - Telugu Academy- Dr M.Jaganmohan Rao, Dr.N.Srinivasa Rao, Dr P.Tirupathi Rao, Smt.D.Vijayalakshmi
3. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI

Reference books:

1. Willam Feller: Introduction to Probability theory and its applications. Volume –I,Wiley
2. Goon AM, Gupta MK, Das Gupta B : Fundamentals of Statistics , Vol-I, the World Press Pvt.Ltd.,Kolakota.
3. Hoel P.G: Introduction to mathematical statistics, Asia Publishinghouse.
4. M. JaganMohan Rao and Papa Rao: A Text book of StatisticsPaper-I.
5. Sanjay Arora and Bansi Lal: New Mathematical Statistics: Satya Prakashan , NewDelhi

Practicals-Course-I

Total Hrs. of Teaching: 30 @ 2 h / Week

Credits: 01

Conduct any SIX (MS-Excel mandatory):

1. Graphical presentation of data (Histogram, frequency polygon).
2. Construction of Ogive curves
3. Computation of measures of central tendency(Mean, Median and Mode)
4. Computation of measures of dispersion(Q.D, M.D and S.D)
5. Computation of non-central, central moments, β_1 and β_2 for ungrouped data.
6. Computation of non-central, central moments, β_1 and β_2 and Sheppard's corrections for grouped data.
7. Computation of Karl Pearson's coefficient of Skewness and Bowley's coefficient of Skewness.
8. Practicals 1, 2, 3, 4, 6, 7 using MS-Excel.

Note: Training shall be on establishing formulae in Excel cells and derive the results. The excel output shall be exported to MS word for writing inference.

SEMESTER-I:DISCRIPTIVE STATISTICS& PROBABILITY

Model blue print for the Question Paper setter

Max. Marks: 50

Time: 2 ½ Hrs.

Module	Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
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I	2	1	20
II	1	2	25
III	1	1	15
IV	1	1	15
V	2	1	20
Total including choice	7	6	95

**Statistics Course–I: DESCRIPTIVE STATISTICS& PROBABILITY
Question Bank**

Short answer Questions:

1. Explain the construction of Ogives.
2. Write the merits and demerits of mode.
3. Show that the sum of absolute deviation from median is minimum.
4. State and Prove properties of arithmetic mean
5. Explain an ideal measure of dispersion
6. Write about Sheppard's corrections.
7. Define Kurtosis and explain.
8. State and prove addition theorem of probability for two events.
9. State and prove multiplication theorem for two events.
10. Define Probability density function.
11. Define Probability mass function.
12. Define distribution function and state its properties.
13. Define Marginal and conditional distributions.
14. What is the chance that leap year selected at random will contain 53 Sundays.
15. A problem in statistics is given to the three students A,B and C whose chances of solving it are $1/2$, $3/4$ and $1/4$ respectively. What is the probability that the problem will be solved if all of them solve independently.
16. For a continuous random variable X with p.d.f. $f(x)=3x^2, 0 \leq x \leq 1$. Find a and b such that i) $p(X \leq a) = p(X > a)$ and ii) $p(X > b) = 0.05$
17. Define Mathematical Expectation of a random variable. State its properties?
18. State and prove addition theorem of expectation for 2 variables.
19. Define Characteristic function and state its properties.
20. Explain Cumulative generating function

ESSAY QUESTIONS:

21. Explain the various methods to collect primary data and the sources of secondary data.
22. Explain measures of central tendency.
23. Explain measures of dispersion.
24. Define central and non central moments and establish the relation between them.
25. Explain Karl Pearson's and Bowley's coefficient of Skewness.
26. State and prove addition theorem for n events.
27. State and prove multiplication theorem for n events.
28. State and prove Bayes's theorem.
29. State and prove Boole's inequality.
30. The first four moments about a point 4 are respectively 1, 4, 10 and 45. Find mean, variance, μ_3 and μ_4 .
31. A random variable X has the following probability distributions

X:	0	1	2	3	4	5	6	7	8
P(X):	a	3a	5a	7a	9a	11a	13a	15a	17a

 Find the values of

a) a	b) $p(X < 3)$	c) $p(X \geq 3)$	d) $p(0 < X < 5)$	e) $p(X \leq 7)$
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32. Suppose that the random variables X takes the values 3,4 and 5 with probabilities $\frac{1}{2}$, $\frac{1}{6}$ and $\frac{1}{3}$ respectively. Obtain distribution function of the random variable X.
33. State and prove Cauchy's Schwartz inequality.
34. State and prove Chebyshev's inequality.
35. Define Moment generating function and derive its properties.
36. Define Probability generating function and derive its properties.

P.R. Government College (Autonomous), Kakinada
I year B.Sc., Degree Examinations – Semester-I
Statistics Course–I: DESCRIPTIVE STATISTICS& PROBABILITY
Model Paper

Time: 2 ½ Hrs.

Max. Marks: 50

Section – A

Answer any FOUR of the following questions.

4x5 = 20 M

1. Explain the construction of Ogives.
2. Show that the sum of absolute deviation from median is minimum
3. Write the merits and demerits of mode.
4. State and Prove properties of arithmetic mean
5. Explain an ideal measure of dispersion
6. A problem in statistics is given to the three students A,B and C whose chances of solving it are $1/2$, $3/4$ and $1/4$ respectively. What is the probability that the problem will be solved if all of them solve independently.
7. For a continuous random variable X with p.d.f. $f(x)=3x^2, 0 \leq x \leq 1$. Find a and b such that i) $p(X \leq a) = p(X > a)$ and ii) $p(X > b) = 0.05$

Section – B

Answer any THREE questions

3x10 = 30 M

8. Explain the various methods of collecting primary data.
9. Explain measures of central tendency with their relative merits and demerits?
10. Define raw and central moments and establish relationship between them
11. State and prove Baye's theorem probability.
12. A random variable X lies the following probability distributions

X:	0	1	2	3	4	5	6	7	8
P(X):	a	3a	5a	7a	9a	11a	13a	15a	17a

Find the values of a) a b) $p(X < 3)$ c) $p(X \geq 3)$ d) $p(0 < X < 5)$ e) $p(X \leq 7)$
13. Define M.G.F state and prove its properties.

P.R.GOVERNMENT COLLEGE(A), KAKINADA
I B.Sc. – Statistics / Semester- II (w.e.f 2020-21) 2021-22
Course- II

Course Title: PROBABILITY DISTRIBUTIONS & STATISTICAL METHODS

Theory

Total Hrs. of Teaching: 60 @ 4 h / Week

Credits: 03

Objectives:

- This course gives an idea of using various standard theoretical distributions, their chief characteristics and applications in analyzing any data.
- The concept of Correlation and Linear Regression deals with studying the linear relationship between two or more variables, which is needed to analyze the real life problems.
- The attributes gives an idea that how to deal with qualitative data.

Module-I (10 Hrs)

Discrete Distributions: Binomial, Poisson, Negative Binomial, Geometric distributions: Definitions, means, variances, M.G.F, C.F, C.G.F, P.G.F, additive property if exists. Poisson approximation to Binomial distribution. Hyper-geometric distribution: Definition, mean and variance.

Module- II (12 Hrs)

Continuous Distributions: Rectangular, Exponential, Gamma, Beta Distributions: mean , variance, M.G.F, C.F. Normal Distribution: Definition, Importance, Properties, M.G.F, , additive property.

Module-III (12 Hrs)

Correlation: Meaning, Types of Correlation, Measures of Correlation: Scatter diagram, Karl Pearson's Coefficient of Correlation, Rank Correlation Coefficient (with and without ties), Bi-variate frequency distribution, correlation coefficient for bi-variate data and simple problems.

Regression: Concept of Regression, Linear Regression: Regression lines, Regression coefficients and it's properties, Regressions lines for bi-variate data and simple problems. Correlation vs Regression.

Module- IV (8 Hrs)

Curve fitting: Bi- variate data, Principle of least squares, fitting of degree polynomial. Fitting of straight line, Fitting of Second degree polynomial or parabola, Fitting of power curve and exponential curves.

Module-V (8 Hrs)

Attributes : Notations, Class, Order of class frequencies, Ultimate class frequencies, Consistency of data, Conditions for consistency of data for 2 and 3 attributes only , Independence of attributes , Association of attributes and its measures, Relationship between association and colligation of attributes, Contingency table: Square contingency, Mean square contingency, Coefficient of mean square contingency, Tschuprow's coefficient of contingency.

Co-Curricular Activities(10 Hours):

Problem Solving / Seminars / Assignments /Quiz /Group Discussions /Open Text Book Test /Oral test /Brain Storming

Text Books:

1. V.K.Kapoor and S.C.Gupta: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. BA/BSc I year statistics - descriptive statistics, probability distribution - Telugu Academy- Dr M.Jaganmohan Rao, Dr N.Srinivasa Rao, Dr P.Tirupathi Rao, Smt.D.Vijayalakshmi.
3. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI

Reference books:

1. Willam Feller: Introduction to Probability theory and its applications. Volume –I, Wiley
2. Goon AM, Gupta MK, Das Gupta B : Fundamentals of Statistics , Vol-I, the World Press Pvt.Ltd., Kolkata.
3. Hoel P.G: Introduction to mathematical statistics, Asia Publishinghouse.
4. M. JaganMohan Rao and Papa Rao: A Text book of Statistics Paper-I.
5. Sanjay Arora and Bansilal: New Mathematical Statistics: Satya Prakashan , New Delhi
6. Hogg Tanis Rao: Probability and Statistical Inference. 7th edition. Pearson.

Practicals –Course-II

Total Hrs. of Teaching: 30 @ 2 h / Week

Credits: 01

Conduct any TEN (MS-Excel mandatory):

1. Fitting of Binomial distribution – Direct Method.
2. Fitting of Binomial distribution – Recurrence Relation Method.
3. Fitting of Poisson distribution – Direct Method.
4. Fitting of Poisson distribution - Recurrence Relation Method.
5. Fitting of Negative Binomial distribution.
6. Fitting of Geometric distribution.
7. Fitting of Normal distribution – Areas Method.
8. Fitting of Normal distribution – Ordinates Method.
9. Fitting of Exponential distribution.
10. Fitting of straight line and parabola by the method of least squares
11. Fitting of exponential and power curves by the method of least squares.
12. Computation of correlation coefficient and regression lines for ungrouped data
13. Computation of correlation coefficient, forming regression lines for grouped data
14. Practicals 1, 3, 7, 9, 10, 11, 12 using MS-Excel

Note: Training shall be on establishing formulae in Excel cells and derive the results. The excel output shall be exported to MS word for writing inference.

SEMESTER-II PROBABILITY DISTRIBUTIONS & STATISTICAL METHODS
Model blue print for the Question Paper setter

Max. marks: 50

Time : 2 ½ Hrs.

Module	Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
I	2	1	20
II	1	2	25
III	2	1	20
IV	1	1	15
V	1	1	15
Total including choice	7	6	95

Statistics-Course-II:PROBABILITY DISTRIBUTIONS& STATISTICAL METHODS

Question Bank

SHORT QUESTIONS:

1. Find m.g.f. of Binomial distribution.

2. Explain the memory less property of geometric distribution.
3. Obtain mean and variance of binomial distribution.
4. Obtain mean and variance of Poisson distribution.
5. Obtain mean and variance of rectangular distribution.
6. Obtain mean and variance of exponential distribution.
7. Obtain mean and variance of geometric distribution.
8. Define Normal Distribution and find MGF
9. Define correlation and write types of correlation.
10. Write the difference between correlation and regression.
11. Write the properties of regression coefficients.
12. Define rank correlation coefficient
13. Define principle of least squares and write the procedure to fit a straight line.
14. Define attribute and explain association of attributes.
15. Explain the criteria of independence of attributes

ESSAY QUESTIONS:

16. Define Hyper Geometric distribution, find its mean and variance.
17. Derive the recurrence relation for the moments of Binomial distribution.
18. Show that Poisson distribution is limiting case of binomial distribution.
19. In Normal distribution, show that mean = median = mode.
20. In Normal distribution, show that Q.D:MD:SD is approximately 10:12:15.
21. Define Gamma distribution, state and prove additive property of gamma distribution.
22. State and prove memory less property of exponential distribution.
23. Derive mean and variance of Beta distribution of first kind.
24. Derive mean and variance of Beta distribution of second kind.
25. It is found that the average calls received by a lady at a particular helpline centre is 4 per hour. What is the probability that she will receive during a random hour i) no call ii) exactly 4 calls iii) at least one call.
26. In a normal distribution, 7% of items are under 35 and 89% of items are under 63. Find mean and variance of the distribution.
27. Show that the correlation coefficient is independent of change of origin and scale
28. Derive the two regression lines.
29. Obtain rank correlation for the following data.

X	45	55	52	71	84	66	74	42	49	58
Y	48	52	74	65	71	44	85	78	54	65
30. Explain fitting of exponential curve and power curve.
31. Fit a second degree parabola for the following data.

X	5	4	6	2	7	9	4
Y	6	7	4	8	4	1	8
32. Show that $Q = \frac{2Y}{1+Y^2}$?

P.R. Government College (Autonomous), Kakinada
I year B.Sc., Degree Examinations - II Semester
Statistics Course-II:PROBABILITY DISTRIBUTIONS& STATISTICAL METHODS
Model Paper

Section – A**Answer any FOUR of the following questions.****4x5 = 20 M**

1. Find m.g.f. of Binomial distribution.
2. Derive variance of Poission distribution
3. Explain the memory less property of geometric distribution.
4. Write the differences between correlation and regression
5. Define rank correlation coefficient
6. Explain the fitting of straight line
7. Explain the independence of attributes

Section – B**Answer any THREE questions****3x10 = 30 M**

8. Define Hyper Geometric distribution, find its mean and variance.
9. Define Normal Distribution and find MGF & hence deduce it's mean and variance.
10. Define Gamma distribution, state and prove additive property of gamma distribution.
11. Show that Correlation coefficient is independent of change of origin and scale.
12. Explain the fitting of second degree parabola.
13. Show that $Q = \frac{2Y}{1+Y^2}$?

Objective:

To provide basic understanding of general statistical tools and their elementary applications and to create awareness on Indian Statistical System.

Course outcomes:

CO 1: To understand the concept of Statistics and its merits and demerits. Distinguishing primary and secondary data. Classification, Tabulation and Pictorial representation of data.

CO 2: To understand the basic nature of data and how a single value describes the entire data set. Measuring the degree of departure of a distribution from symmetry and reveals the direction of scatteredness of the items.

CO 3: To understand the spread of the data and to draw conclusions from the comparison of averages. To understand the concept of correlation and regression and to learn the degree of association between two variables and establishing relationship between the variables.

Syllabus

Unit I: Meaning, scope and limitations of Statistics

Collection of data: Primary and Secondary, Classification and Tabulation, Construction of frequency distribution. Graphical Representation: Histogram, Bar, Pie and Frequency polygon. (8 Hrs)

Unit II: Measures of Central Tendency: Features of good average, Arithmetic Mean, Median, Mode. Empirical relationship between Mean Median and Mode and skewness based on central values. (8 Hrs)

Unit III: Measures of Dispersion: Range, Quartile Deviation(QD), Mean Deviation(MD), Variance, Standard Deviation(SD), relationship between QD, MD and SD. Familiarization of the concepts relating to Correlation and Linear Regression line. (8 Hrs)

Books for Study:

1. Statistics (Theory, Methods, Application) D C Sancheti, V K Kapoor, Sultan Chand and Sons, New Delhi

2. Statistical Methods, S.P. Gupta, Sultan Chand and Sons, New Delhi

3. Statistics (Theory and Practice) B.N Gupta, Sahitya Bhavan, Agra
Web sites for free download books for Statistics

[https://www.pdfdrive.com/introduction-to-statistics-](https://www.pdfdrive.com/introduction-to-statistics-books.html)

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http://onlinestatbook.com/Online_Statistics_Education.pdf

Co-curricular activities: (6 Hrs)

Objective is to apply the theoretical concept to real life data which enhances the learning and interpretation ability to the current environment.

CoCA I: (i) Collect primary or secondary data and establish frequency distribution.

(ii) Suitable pictorial/ Graphical representation to the established frequency distribution

CoCA II: (i) Select the data and then calculate AM,Median and Mode and interpret the result.

(ii) Calculate the skewness based on central values and interpret the degree of departure of a distribution from symmetry and the direction of scatteredness of the items.

CoCA III: (i) Calculate the dispersion values of a data for a single or double data sets and to draw conclusions from the comparison of averages.

(ii) Select the bi-variate data (for example, select marks of any two subjects of your course) and calculate the degree of association and establish the linear relationship and find the forecasting value.

CoCA IV: If there is an internet facility at your college/home, go through the Ministry of Statistics and Program Implementationsite www.mospi.gov.in to know about the Indian Statistical System and <https://desap.cgg.gov.in> or www.apdes.in to know about the Andhra Pradesh Directorate of Economics and Statistics(APDES) and its activities.

Life Skill Course/Semester-II

Elementary Statistics

Time: 2 Hrs

Model Paper

Max. Marks: 50

Answer any 5 of the following.

5 x 10 = 50

1. Question from Unit-I
2. Question from Unit-I
3. Question from Unit-I
4. Question from Unit-II
5. Question from Unit-II
6. Question from Unit-III
7. Question from Unit-III
8. Question from Unit-III

P.R.GOVERNMENT COLLEGE(A), KAKINADA

II B.Sc. – Statistics/Semester- III(w.e.f 2021-22) for 2020-21 Batch

Course -III

Course Title: STATISTICAL INFERENCE

Theory

Total Hrs. of Teaching: 60@ 4 h / Week

Total Credits: 04

Objective:

- To provide basic knowledge on sampling distributions and applications of chi-square, t, and F
 - To enhance the knowledge to find the estimators of parameters keeping in view the properties of estimators
 - To give an central idea to apply parametric and non-parametric methods to test hypotheses
-

UNIT-I (10 Hrs)

Concepts: Population, Sample, Parameter, statistic, Sampling distribution, Standard error. convergence in probability and convergence in distribution, law of large numbers, central limit theorem (statements only). Student's t- distribution, F – Distribution, χ^2 -Distribution: Definitions, properties and their applications.

UNIT-II (10 Hrs)

Theory of estimation: Estimation of a parameter, criteria of a good estimator – unbiasedness, consistency, efficiency, & sufficiency and. Statement of Neyman's factorization theorem. Estimation of parameters by the method of moments and maximum likelihood (M.L), properties of MLE's. Estimation of Binomial, Poisson & Normal Population parameters by MLE method. Confidence Intervals for mean and variance in Normal Distribution.

Additional Inputs: Method of least square, confidence limits, Method of estimation

UNIT-III (8 Hrs)

Testing of Hypothesis: Concepts of statistical hypotheses, null and alternative hypothesis, critical region, two types of errors, level of significance and power of a test. One and two tailed tests. Neyman-Pearson's lemma. Examples in case of Binomial, Poisson, Exponential and Normal distributions.

Additional Inputs: likelihood Ratio test

UNIT – IV (12 Hrs)

Large sample Tests: Large sample test for single mean and difference of two means, confidence intervals for mean(s). Large sample test for single proportion, difference of proportions. standard deviation(s) and correlation coefficient(s).

Small Sample tests: t-test for single mean, difference of means and paired t-test, test for correlation. χ^2 -test for goodness of fit and independence of attributes. F-test for equality of variances.

UNIT – V (10 Hrs)

Non-parametric tests- advantages and disadvantages, comparison with parametric tests. Measurement scale- nominal, ordinal, interval and ratio. One sample runs test, sign test and Wilcoxon-signed rank tests (single and paired samples). Two independent sample tests: Median test, Wilcoxon –Mann-Whitney U test, Wald Wolfowitz's runs test.

Additional Inputs: Sequential analysis introduction.

Co-Curricular Activities(10 Hours):

Problem Solving / Seminars / Assignments /Quiz /Group Discussions /Open Text Book Test /Oral test /Brain Storming

Text Books:

1. V.K.Kapoor and S.C.Gupta: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, NewDelhi.
2. BA/BSc II year statistics - descriptive statistics, probability distribution - Telugu Academy- Dr M.JaganmohanRao,DrN.Srinivasa Rao, Dr P.Tirupathi Rao, Smt.D.Vijayalakshmi.
3. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI

Reference books:

4. Willam Feller: Introduction to Probability theory and its applications. Volume –I,Wiley
5. Goon AM, Gupta MK, Das Gupta B : Fundamentals of Statistics , Vol-I, the World Press Pvt.Ltd.,Kolkata.
6. Hoel P.G: Introduction to mathematical statistics, Asia Publishinghouse.
7. M. JaganMohan Rao and Papa Rao: A Text book of StatisticsPaper-II.
8. Sanjay Arora and Bansi Lal: New Mathematical Statistics: Satya Prakashan , NewDelhi
9. Hogg Tanis Rao: Probability and Statistical Inference. 7thedition.Pearson.

Practicals – Course-III

Total Hrs. of Teaching: 30 @ 2 h / Week

Credits: 01

Conduct any TEN (MS-Excel mandatory):

1. Large sample test for single mean and difference of means
2. Large sample test for single proportion and difference of proportions
3. Large sample test for difference of standard deviations
4. Large sample test for correlation coefficients
5. Small sample test for single mean and difference of means
6. Small sample test for correlation coefficient
7. Paired t-test.
8. Small sample test for single variance(χ^2 - test)
9. Small sample test for difference of variances(F-test)
10. χ^2 - test for goodness of fit and independence of attributes
11. Nonparametric tests for single sample(run test, sign test and Wilcoxon signed rank test)
12. Nonparametric tests for related samples (sign test and Wilcoxon signed rank test)
13. Nonparametric tests for two independent samples (Median test, Wilcoxon –Mann-Whitney - U test, Wald - Wolfowitz' s run test)
14. Practical 5, 6, 7, 8, 9, 10 using MS-Excel

Note: Training shall be on establishing formulae in Excel cells and derive the results. The excel output shall be exported to MS word for writing inference.

Model blue print for the Question Paper setter

Course-III: STATISTICAL INFERENCE

Max. Marks: 60

Time : 2 ½ Hrs.

Module	Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
I	1	2	25
II	1	2	25
III	1	1	15
IV	1	2	25
V	2	1	20
Total including choice	6	8	110

Statistics Course–III: Statistical Inference

Question Bank

SHORT QUESTIONS:

1. Define i) Population ii) Parameter iii) Sample iv) Statistic v) Sampling distribution vi) Standard error.
2. Write the applications of t-distribution.
3. Explain method of moments
4. Explain the concept of Interval estimation.
5. Define null hypothesis and alternate hypothesis.
6. Explain one tailed tests and two tailed tests.
7. Explain two types of errors.
8. Define critical region, level of significance and power of test.
9. Write the procedure for testing of hypothesis.
10. Write the procedure for test for single mean.
11. Explain the procedure for single proportion.
12. Explain randomized tests and non randomized tests.
13. Write the procedure for t- test for sample correlation coefficient.
14. Explain the procedure for t-test for single mean.
15. Explain paired t-test for difference of means.
16. Write the advantages and disadvantages of NP tests over parametric tests.
17. Explain the test for randomness.
18. Write the procedure for one sample sign test.

ESSAY QUESTIONS:

19. Define chi square test and write it's properties.
20. Define t-test and write it's properties.
21. Define F-test and write it's properties.
22. Explain criteria of good estimator.
23. Explain MLE and write it's properties.
24. Prove that the sample mean is consistent estimator of population mean for normal population
25. Find MLE for the parameter of a Poisson distribution on the basis of random sample of size n.
26. Find MLE for the parameters of a Normal distribution on the basis of random sample of size n.
27. State and prove Neyman Pearson's Lemma.
28. Obtain the most powerful critical region for testing $H_0: \mu = \mu_0$ against $H_1: \mu = \mu_1$, in case of Normal population with known variance, using N-P lemma.
29. Explain large sample test for testing equality of two means and two standard deviation of two normal populations.
30. Random samples drawn from two countries gave the following data relating two heights of men.

Mean heights in inches	67.42	67.25
Standard deviation	2.58	2.5
Sizes of samples	1000	2000

 - i) Is the difference between means significant at 1% los.
 - ii) Is the difference between standard deviations significant at 1% los.
31. Explain t-test for difference of means.
32. Explain F-test for equality of variances of two populations.

33. Explain run test for equality of two populations.
34. Explain the chi-square test for i) goodness of fit ii) Independence of attributes.
35. Explain one and paired sample signed rank test.
36. Explain U test for equality of two populations.
37. Explain the procedure for two sample sign test.

P.R. Government College (Autonomous), Kakinada
II year B.Sc., Degree Examinations - III Semester (w.e.f 2021-22)
For 2020-21 batch
Statistics Course–III: Statistical Inference
Model Paper

Section – A**Answer Any Four of the following questions.****4x5 = 20 M**

1. Define 1) standard error 2) Parameter 3) Sampling distribution
2. Write the concept of Interval estimation
3. Define null hypotheses, alternative hypotheses ,simple and composite hypotheses
4. Write procedure of test for single mean for large sample.
5. Advantages and disadvantages of non-parametric methods over parametric methods.
6. Explain run test for randomness?

Section – B**2x10 = 20 M****Answer Any Two of the following questions.**

7. Define chi square distribution and write its properties.
8. Define F-Statistic. Derive its PDF and state its properties..
9. Explain the criteria of a good estimator
10. Explain the Method of Maximum Likelihood Estimation. And state the properties of MLE

Section – C**2x10 = 20 M****Answer Any Two of the following questions.**

11. State and prove Neyman- Pearson Lemma.
12. Explain the large sample test for testing the difference of two means. Random samples drawn from two countries gave the following data relating to the heights of adult males.

	Country A	Country B
Mean Height (in inches)	67.42	67.25
S.D(in inches)	2.58	2.50
No.of samples	1000	1200

Is the difference between means significant at 1% los. [$Z_{0.5\%} = 2.58$]

13. Explain the small sample test for testing the difference of two means
14. Explain Mann Whitney Wilcoxon U test.

Note: Provide Statistical table values wherever necessary.

P.R.GOVERNMENT COLLEGE (A), KAKINADA
II B.Sc. –Statistics / Semester- IV (w.e.f 2021-22) for 2020-21 Batch
Course- IV
Course Title: Sampling Techniques & Designs of Experiments

Theory

Total Hrs. of Teaching: 60 @ 4 h / Week

Total Credits: 04

UNIT I (10 hours)

Simple Random Sampling (with and without replacement): Notations and terminology, various probabilities of selection. Random numbers tables. Methods of selecting simple random sample, lottery method, method based on random numbers. Estimates of population total, mean and their variances and standard errors, determination of sample size.

UNIT II (12 hours)

Stratified random sampling: Stratified random sampling, Advantages and Disadvantages of Stratified Random sampling, Estimation of population mean, and its variance. Stratified random sampling with proportional and optimum allocations. Comparison between proportional and optimum allocations with SRSWOR.

Additional Inputs: $\text{var}(\bar{y}_{st})$ is minimum for fixed total sample size n if $n_i \propto N_i s_i$

Systematic sampling: Systematic sampling definition when $N = nk$ and merits and demerits of systematic sampling - estimate of mean and its variance. Comparison of systematic sampling with Stratified and SRSWOR.

Additional Inputs: variance of systematic sample mean where intra class correlation coefficient ρ involved.

UNIT III (10 hours)

Analysis of variance: Analysis of variance(ANOVA) –Definition and assumptions. One-way with equal and unequal classification, Two- way classification.

Design of Experiments: Definition, Principles of design of experiments, CRD: Layout, advantages and disadvantages and Statistical analysis of Completely Randomized Design(C.R.D).

Additional Inputs: Cochran's theorem, fixed effect & random effect model.

UNIT IV (10 hours)

Randomized Block Design (R.B.D) and Latin Square Design (L.S.D) with their layouts and Analysis, Missing plot technique in RBD and LSD. Efficiency of RBD over CRD, Efficiency of LSD over RBD and CRD.

UNIT V (8 hours)

Factorial experiments – Main effects and interaction effects of 2^2 and 2^3 factorial experiments and their Statistical analysis.

Additional Inputs: Advantages of factorial experiment.

Co-Curricular Activities(10 Hours):

Problem Solving / Seminars / Assignments /Quiz /Group Discussions /Open Text Book Test /Oral test /Brain Storming

Text Books:

1. Fundamentals of applied statistics: VK Kapoor and SCGupta.
2. Telugu Academy BA/BSc III year paper - III Statistics - applied statistics - Telugu academy by Prof. K. Srinivasa Rao, Dr D. Giri. Dr A. Anand, Dr V. Papaiah Sastry.
3. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC.PHI.

Reference Books:

1. Anuvarthita SankyakaSastram – TeluguAcademy.
3. Parimal Mukhopadhyay : Applied Statistics .New Central Book agency.B.L.Agarwal: Basic Statistics.New Age publications.
4. S.C.Gupta : Statistical Methods. Sultan Chand and Sons.
5. .Pratirupa Sidhanthamulu – Telugu Academy.
6. PrayogaRachana and Visleshana – TeluguAcademy.

Practicals – Course-IV

Total Hrs. of Teaching: 30 @ 2 h / Week

Credits: 01

Conduct any EIGHT (MS-Excel Mandatory)

Sampling Techniques:

Estimation of population mean and its variance by

1. Simple random sampling with and without replacement. Comparison between SRSWRand SRSWOR.
2. Stratified random sampling with proportional and optimum allocations. Comparison between proportional and optimum allocations withSRSWOR.
3. Systematic sampling with $N=nk$. Comparison of systematic sampling with Stratified andSRSWOR.

Design of Experiments:

4. ANOVA - one - way classification with equal and unequal number of observations
5. ANOVA - Two-way classification with one observation per cell.
6. Analysis ofCRD.
7. Analysis of RBD Comparison of relative efficiency of CRD withRBD
8. Estimation of single missing observation in RBD and itsanalysis
9. Analysis of LSD and efficiency of LSD over CRD andRBD
10. Estimation of single missing observation in LSD and itsanalysis
11. Analysis of 2^2 with RBD layout
12. Analysis of 2^3 with RBDlayout
13. Practicals 4, 5, 6 and 7 using MS-Excel

Note: Training shall be on establishing formulae in Excel cells and deriving the results. The excel output shall be exported to MS Word for writing inferences.

Model blue print for the Question Paper setter

Course-IV: Sampling Techniques & Designs of Experiments

Max. Marks: 60

Time : 2 ½ Hrs.

Module	Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
I	1	2	25
II	1	2	25
III	1	2	25
IV	2	1	20
V	1	1	15
Total including choice	6	8	110

**Statistics Course-IV: Sampling Techniques & Design of Experiments
Question Bank**

SHORT QUESTIONS:

1. Write the difference between sampling versus census.
2. Explain stratified random sampling.
3. Explain systematic sampling.
4. Write a short note on cost function.
5. Explain ANOVA and its basic assumptions.
6. Write a short note on local control.
7. Write a short note on randomization and replication.
8. Write advantages and disadvantages of CRD.
9. Write advantages and disadvantages of RBD.
10. Write the main and interaction effects of 2^2 experimental design

ESSAY QUESTIONS:

11. Explain SRSWR and SRSWOR.
12. Explain stratified random sampling with proportional and optimum allocation.
13. Show that $E(s^2)=S^2$
14. Explain one way classification.
15. Explain two way classification.
16. Explain principles of design of experiments.
17. Define CRD and explain the analysis of CRD.
18. Define RBD and explain the layout and analysis of RBD.
19. Define LSD and explain the layout and analysis of LSD.
20. Discuss the efficiency of RBD over CRD and that of LSD over RBD and CRD.
21. Show that $V(\bar{y}_{opt}) \leq V(\bar{y}_{prop}) \leq V(\bar{y}_{srswor})$
22. Explain the statistical analysis of 2^3 experimental design

P.R.Government College (Autonomous), Kakinada
II year B.Sc., Degree Examinations- IV Semester (w.e.f 2021-22)
for 2020-21 Batch
Statistics Course IV: Sampling Techniques & Design of Experiments

Section – A

4x5 = 20 M

Answer any four of the following questions. Each question carries five marks.

1. Write the advantages of sampling over complete enumeration.
2. Define stratified random sampling.
3. List out the basic assumptions involved in ANOVA technique.
4. Explain missing plot technique in LSD
5. Write the advantages of C.R.D.
6. Write the main and interaction effects of 2^2 experimental design.

Section – B

Answer any two questions.

2X10=20M

7. Distinguish SRSWR and SRSWOR.
8. In simple random sampling without replacement prove that sample mean square is an unbiased estimation of population mean square i.e. $E(S^2) = S^2$
9. Explain the method of systematic sampling. Discuss the merits and demerits of systematic sampling.
10. Explain the proportional and optimum allocations. Show that $V(\bar{y}_{opt}) \leq V(\bar{y}_{prop})$

Section – C

Answer any two questions.

2X10=20M

11. Explain the ANOVA for two-way classification.
12. Explain the principles of experimental designs.
13. Give a layout of RDB. Write its statistical analysis.
14. Explain the statistical analysis of 2^3 experimental design

Course Title: Applied Statistics

Theory

Total Hrs. of Teaching: 60 @ 4 h / Week

Total Credits: 04

UNIT I (10 hours)

Time Series: Time Series and its components with illustrations, additive, multiplicative models. Trend: Estimation of trend by free hand curve method, method of semi averages. Determination of trend by least squares (Linear trend, parabolic trend only), moving averages method.

UNIT II (10 hours)

Seasonal Component: Determination of seasonal indices by simple averages method, ratio to moving average, Ratio to trend and Link relative methods, Deseasonalization.

UNIT III (10 hours)

Growth curves: Modified exponential curve, Logistic curve and Gompertz curve, fitting of growth curves by the method of three selected points and partial sums. Detrending- Effect of elimination of trend on other components of the time series

UNIT IV (10 hours)

Index numbers: Concept, construction, problems involved in the construction of index numbers, uses and limitations. Simple and weighted index numbers. Laspeyres's, Paasche's and Fisher's index numbers, Criterion of a good index number, Fisher's ideal index numbers. Cost of living index number and wholesale price index number.

Additional Inputs: Chain Indices.

UNIT V (10 hours)

Vital Statistics: Introduction, definition and uses of vital statistics, sources of vital statistics.

Measures of different Mortality and Fertility rates, Measurement of population growth. Life tables: construction and uses of life tables.

Additional Inputs: Abridged life tables.

Co-Curricular Activities(10 Hours):

Problem Solving / Seminars / Assignments / Quiz / Group Discussions / Open Text Book Test / Oral test / Brain Storming

Text Books:

1. Fundamentals of applied statistics : VK Kapoor and SC Gupta.
2. BA/BSc III year paper - III Statistics - applied statistics - Telugu academy by Prof.K.Srinivasa Rao, Dr D.Giri. Dr A.Anand, Dr V.Papaiah Sastry.

Reference Books:

3. Anuvarthita Sankhyaka Sastram - Telugu Academy.
4. Mukopadhyay, P (2011). Applied Statistics, 2nd ed. Revised reprint, Books and Allied Pvt.

Ltd.

5. Brockwell, P.J. and Devis, R.A. (2003). Introduction to Time Series Analysis. Springer.
 6. Chatfield, C. (2001). Time Series Forecasting., Chapman & Hall.
 7. Srinivasan, K. (1998). Demographic Techniques and Applications. Sage Publications
 8. Srivastava O.S. (1983). A Text Book of Demography. Vikas Publishing House
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Practicals – Course-V

Total Hrs. of Teaching: 30 @ 2 h / Week

Credits: 01

Conduct any EIGHT (MS-Excel Mandatory)

Time Series:

1. Measurement of trend by method of moving averages(odd and evenperiod)
2. Measurement of trend by method of Least squares(linear andparabola)
3. Determination of seasonal indices by method simpleaverages
4. Determination of seasonal indices by method of Ratio to movingaverages
5. Determination of seasonal indices by method of Ratio totrend
6. Determination of seasonal indices by method of Linkrelatives

Index Numbers:

7. Computation of simple index numbers.
8. Computation of all weighted index numbers.
9. Computation of reversal tests.

Vital Statistics:

10. Computation of various Mortality rates
11. Computation of various Fertility rates
12. Computation of various Reproduction rates.
13. Construction of Life Tables
14. Practical 1, 2, 3, 5, 6, 13 using MS-Excel

Note: Training shall be on establishing formulae in Excel cells and deriving the results.

The excel output shall be exported to MS Word for writing inferences.

Model blue print for the Question Paper setter

Course-V: Applied Statistics

Max. Marks: 60

Time : 2 ½ Hrs.

Module	Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
I	2	2	30
II	1	1	15
III	1	1	15
IV	1	2	25
V	1	2	25
Total including choice	6	8	110

Statistics Course V:Applied Statistics Question Bank

SHORT QUESTIONS:

1. Define Time series. Write its uses.
2. Explain the models in time series.
3. Explain irregular variations in Time series.
4. Write a brief note on growth curves.
5. Explain about logistic curve.
6. Explain base shifting.
7. Explain splicing & deflating.
8. Write the uses of index numbers.
9. Explain NRR.
10. Explain GRR.
11. Write the uses of life table.
12. Explain the terms-registration method & survey method.

ESSAY QUESTIONS:

13. Explain components of time series.
14. Explain trend in time series and explain different methods to measure trend..
15. Explain link relative method to measure seasonal variations..
16. Explain the method of ratio to moving averages to measure seasonal variations.
17. Explain the methods of fitting modified exponential curve.
18. Explain the method of selecting three points to fit Gompertz' curve.
19. Explain the steps involved in construction of index numbers.
20. Explain weighted price index numbers.
21. Explain criteria of good index number.
22. Explain various components of life table.
23. Explain measures of mortality rate.
24. Explain measures of fertility rate.

**P.R. Government College (Autonomous), Kakinada
II year B.Sc., Degree Examinations IV Semester (w.e.f 2021-22)
for 2020-21 Batch
Statistics Course V:Applied Statistics**

Section – A

4x5 = 20 M

Answer any four of the following questions. Each question carries five marks.

1. Explain the method of moving averages to measure trend.
2. Explain the mathematical models in time series.
3. Explain the method of link relatives.
4. Write a brief note on growth curves.
5. What is meant by base shifting.
6. Explain about Net Reproduction Rate.

Section – B

2x10 = 20 M

Answer any two questions

7. Define Time series. Explain the components of time series.
8. Explain the least square method to measure Trend.
9. Explain the method of ratio to trend to measure seasonal variations.
10. Explain the method of three selected points to fit modified exponential curve.

Section – C

2x10 = 20 M

Answer any two questions

11. What are the Problems or steps involved in the construction of Index Numbers?
 12. Explain about the Criteria for Good Index Number
 13. Explain (i) General Fertility Rate. (ii) Specific Fertility Rate. (iii) Total Fertility Rate.
14. State the meanings of various columns of a life table and mention the construction of a life table. Explain the relationship between different columns.

Course: sampling & design of experiments

Total Hrs. of Teaching: 45 @ 3 h / Week

Total Credits: 03

Objective: In the design of experiments, the experimenter is often interested in the effect of some process or intervention (the "treatment") on some objects (the "experimental units"), which may be people, parts of people, groups of people, plants, animals, etc. Design of experiments is thus a discipline that has very broad application across all the natural and social sciences and engineering.

Module -1

Sampling

(12h)

- a. Concepts of sampling
- b. Principal steps(main steps) in a sample survey
- c. Sampling errors and Non-sampling errors
- d. Principles of sampling
- e. Types of sampling ,Simple random sampling with replacement(SRSWR)
- f. Simple random sampling without replacement(SRSWOR), expected value for population mean, sample variance, variance of sample mean in SRSWR and SRSWOR

Module - 2

Stratified and Systematic Sampling

(11h)

- a. Stratified random sampling, Proportional and Optimum Allocation, variance of sample mean in both allocations
- b. Systematic random sampling
- c. Advantages & disadvantages of systematic & stratified random sampling

Module - 3

Analysis of Variance

(11h)

- a. One way classification. (mathematical model, statistical model & ANOVA table)
- b. Two way classification (mathematical model, statistical model & ANOVA table)
- c. Principles of design of experiments- randomization, replication and local control

Module - 4

Design of Experiments:

(11h)

- a. Completely randomized design(mathematical model, statistical model & ANOVA table)
- b. Randomized block design(mathematical model, statistical model & ANOVA table)
- c. Latin square design(mathematical model, statistical model & ANOVA table)
- d. Advantages & disadvantages of CRD, RBD & LSD

Additional Input: Missing plot Technique in RBD and LSD with one missing value
(not included in examination)

List of text books:

4. V.K.Kapoor and S.C.Gupta : Fundamentals of Applied Statistics. Sultan Chand

List of reference books

1. Parimal Mukhopadhyay : Applied Statistics .New Central Book agency.
5. B.L.Agarwal: Basic Statistics.New Age publications.
3. S.C.Gupta : Statistical Methods. Sultan Chand and Sons.
4. Pratihara Sidhanthamulu – Telugu Academy.
5. Prayoga Rachana and Visleshana – Telugu Academy.

List of Practicals:(3 hrs/week credits:2)

Conduct any SIX (MS-Excel mandatory)

Estimation of population mean, population total and variance of these estimates by

1. Simple random sampling with and without replacement. Comparison between SRSWR and SRSWOR.
2. Stratified random sampling with proportional and optimum allocations. Comparison between proportional and optimum allocations with SRSWOR.
3. Systematic sampling with $N=nk$. Comparison of systematic sampling with Stratified and SRSWOR.
4. ANOVA – one – way classification with equal number of observations
5. ANOVA Two-way classification with equal number of observations.
6. Analysis of CRD.
7. Analysis of RBD and Comparison of relative efficiency of RBD with CRD
8. Analysis of LSD and comparison of relative efficiencies of LSD with RBD and CRD.
9. Practicals 4, 5, 6, 7 using MS-Excel

Model blue print for the Question Paper setter

V Semester Paper-V Sampling & Design of Experiments

Max. Marks: 60

Time : 2 1/2 Hrs.

Unit / Chapter name	Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
Unit - 1			
Sampling	2	2	30
Unit - 2			
Stratified and Systematic sampling	1	2	25
Unit - 3			
Analysis of Variance	2	2	30
Unit - 4			
Design of Experiments	1	2	25
-			
Total No. of Questions including choice (14)	6	8	--
Total marks allotted to all questions including choice =			110

Statistics Paper V: Sampling & Design of Experiments Question Bank

SHORT QUESTIONS:

1. Explain the principles of sampling.
2. Write the difference between sampling versus census.
3. Explain the types in sampling.
4. Explain stratified random sampling.
5. Explain systematic sampling.
6. Write a short note on cost function.
7. Explain ANOVA and its basic assumptions.
8. Write a short note on local control.
9. Write a short note on randomization and replication.
10. Write advantages and disadvantages of CRD.
11. Write advantages and disadvantages of RBD.

ESSAY QUESTIONS:

12. Explain the principal steps involved in conducting of sample survey.
13. Explain sampling errors and non sampling errors.
14. Explain SRSWR and SRSWOR.
15. Explain stratified random sampling with proportional and optimum allocation.
16. Show that $E(s^2)=S^2$
17. Explain one way classification.
18. Explain two way classification.
19. Explain principles of design of experiments.
20. Define CRD and explain the analysis of CRD.
21. Define RBD and explain the layout and analysis of RBD.
22. Define LSD and explain the layout and analysis of LSD.
23. Discuss the efficiency of RBD over CRD and that of LSD over RBD and CRD.
24. Show that $V(\bar{y}_{opt}) \leq V(\bar{y}_{prop}) \leq V(\bar{y}_{srswor})$

Section – A

4x5 = 20 M

Answer any **four** of the following questions. Each question carries **five** marks.

15. What are the errors involved in sample surveys.
16. State briefly the advantages of sampling over complete enumeration.
17. Explain the method of stratified random sampling.
18. List out the basic assumptions involved in ANOVA technique.
19. Write a note on principle of “Randomization”.
20. Write the advantages of C.R.D.

Section – B

Answer any two questions.

2X10=20M

21. What are the main steps involved in a sample survey. Discuss them briefly.
22. Explain SRSWR and SRSWOR.
23. In simple random sampling without replacement prove that sample mean square is an unbiased estimation of population mean square i.e. $E(S^2) = S^2$
24. Explain the method of systematic sampling. Discuss the merits and demerits of systematic sampling.

Section – C

Answer any two questions.

2X10=20M

25. What is meant by two way classification? Give layout and analysis for a two way classification.
26. Explain about ANOVA Technique. Give layout and analysis for a one way classification.
27. What is meant by Randomized Block Design? Give the layout and analysis of a Randomized Block Design. Discuss the advantages and disadvantages of Randomized Block Design.
28. What is Latin Square Design? Give the layout and analysis of a Latin Square Design. Discuss the advantages and disadvantages of Latin Square Design.

PAPER-VI

Course: Applied Statistics

Total Hrs. of Teaching: 45 @ 3 h / Week

Total Credits: 03

Objectives: Statistics is an inductive science in which information is extracted from sample data in order to draw inferences. This most often involves planning experiments to ensure that valid answers to questions are obtained from the sample. Statistics is a subject that deals with the collection and analysis of data and affects most aspects of modern life.

Module-1

(12h)

Time Series

- a. Components of Time Series
- b. Importance of Time Series
- c. Measures of Trend
- d. Measures of seasonal trend
- e. Uses of Time Series
- f. Models of Time Series

Module -2

(11h)

IndexNumbers

- a. Steps involved in the construction of index numbers.
- b. Quantity index number
- c. Weighted & Un Weighted index numbers
- d. Criteria of good index number
- e. Cost of living index number
- f. Base Shifting, Splicing, Deflating of index numbers
- g. Uses, importance of index numbers

Module - 3

(11h)

Vital Statistics

- a. Collection of Vital Statistics
- b. Measures of Mortality
- c. Measures of Fertility.
- d. Measures of Population Growth.
- e. Construction & Uses of life Table.

Module –4

(11h)

Demand Analysis

- a. Demand & Supply-Laws of demand & supply-Price Elasticity's of Demand & Supply.
- b. Time Series data
- c. Family budget data
- d. Leonitef's Method for demand & Supply
- e. Pareto's law of income distribution

Additional Input: Official Statistics – NSSO & CSO(not included in examination)

List of Text Books:

1. V.K.Kapoor and S.C.Gupta : Fundamentals of Applied Statistics. Sultan Chand

List of reference books:

1. Parimal Mukhopadhyay : Applied Statistics . New Central Book agency.
2. M.R.Saluja : Indian Official Statistics. ISI publications.
3. B.L.Agarwal: Basic Statistics.New Age publications.
4. S.P.Gupta : Statistical Methods. Sultan Chand and Sons.

List of Practicals:(3 hrs/week credits:2)**Conduct any EIGHT (MS-Excel mandatory)**

1. Measurement of trend by methods of Least squares and moving averages
2. Determination of seasonal indices by methods of Ratio to moving averages, Ratio to trend and Link relatives
3. Computation of simple and all weighted index numbers.
4. Computation of reversal tests.
5. Construction of cost of living index number and wholesale index number.
6. Construction of fixed base and chain base index numbers.
7. Base shifting, Splicing and Deflation.
8. Computation of various Mortality rates, Fertility rates and Reproduction rates.
9. Construction of Life Tables and Abridged life tables.
10. Construction of Lorenz curve.
11. Fitting of Pareto law to an income data.
12. Practicals 1, 2, 3, 5, 7, 9, 10 using MS Excel.

V Semester Paper –VI-: Applied Statistics

Model blue print for the Question Paper setter

Max. marks: 60

Time : 2 1/2 Hrs.

Unit / Chapter name	Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
Unit - 1			
Time Series	2	2	30
Unit - 2			
Index Numbers	1	2	25
Unit - 3			
Vital Statistics	2	2	30
Unit - 4			
Demand Analysis	1	2	25
Total No. of Questions including choice (14)	6	8	-
Total marks allotted to all questions including choice =			110

Statistics Paper VI: Applied Statistics

Question Bank

SHORT QUESTIONS:

25. Define Time series. Write its uses.
26. Explain the models in time series.
27. Explain irregular variations in Time series.
28. Explain base shifting.
29. Explain splicing & deflating.
30. Write the uses of index numbers.
31. Explain NRR.
32. Explain GRR.
33. Write the uses of life table.
34. Explain the terms-registration method & survey method.
35. Explain laws of demand & supply.
36. Explain price elasticity's of demand & supply.

ESSAY QUESTIONS:

37. Explain components of time series.
38. Explain trend in time series and explain different methods to measure trend..
39. Explain link relative method to measure seasonal variations..
40. Explain the method of ratio to moving averages to measure seasonal variations.
41. Explain the steps involved in construction of index numbers.
42. Explain weighted price index numbers.
43. Explain criteria of good index number.
44. Explain various components of life table.
45. Explain measures of mortality rate.
46. Explain measures of fertility rate.
47. Explain Leinote if's method.
48. Explain family budget data in demand analysis.
49. Explain Pareto's law of income distribution.

Statistics Paper VI: Applied Statistics
(Model paper)

Time: 2 1/2 Hrs.

Max. Marks: 60

Section – A

4x5 = 20 M

Answer any four of the following questions. Each question carries five marks.

1. Explain the method of moving averages in time series data.
2. Explain cyclical component of a time series.
3. What is meant by base shifting.
4. Write the uses of life table.
5. Explain about Net Reproduction Rate.
6. Write about price elasticity of demand.

Section – B

2x10 = 20 M

Answer any two questions

7. What are the measurement of seasonal variation. Discuss briefly about the difference types of measurement of seasonal variation.
 8. Describe the methods of Trend. Discuss briefly about the measures different types of Trend.
 9. What are the Problems or steps involved in the construction of Index Numbers?
10. Explain about the Criteria for Good Index Number?

Section – C

2x10 = 20 M

Answer any two questions

11. Explain (i) General Fertility Rate. (ii) Specific Fertility Rate. (iii) Total Fertility Rate.

12. State the meanings of various columns of a life table and mention the construction of a life table. Explain the relationship between different columns.

13. Describe demand and supply curves and the uses of these curves.

14. Explain Pareto's law of income distribution.

Paper Title: SQC & OPTIMIZATION TECHNIQUES

Total Hrs. of Teaching: 45 @ 3 h / Week

Total Credits: 03

Objective: The main objective of SQC is to achieve quality in production and service organizations, through the use of adequate statistical techniques.

Operational Research –I: In British usage, is a discipline that deals with the application of advanced analytical methods to help make better decisions. It is often considered to be a sub-field of mathematics. Employing techniques from other mathematical sciences, such as mathematical modeling, statistical analysis, and mathematical optimization, operations research arrives at optimal or near-optimal solutions to complex decision-making problems. Operations research is often concerned with determining the maximum (of profit, performance, or yield) or minimum (of loss, risk, or cost) of some real-world objective. Originating in military efforts before World War II, its techniques have grown to concern problems in a variety of industries

Module-1 Statistical Quality Control (12h)

1. Importance of SQC in industry. Process and Product control, Shewart control charts. Construction of control charts for variables (mean, range and standard deviation) and attributes (p, np and c - charts with fixed and varying sample sizes). Interpretation of control charts.
2. Acceptance sampling plans: Producers risk and consumer's risk. Concept of AQL and LTPD. Single and Double sampling plans for attributes and derivation of their OC and ASN functions. Design of single and double sampling plans for attributes using Binomial.

Module – 2 Reliability: (10h)

1. Introduction. Hazard function, Exponential distribution as life model, its memory-less property. Reliability function and its estimation. System reliability - series, parallel and k out of N systems and their reliabilities.

Module -3 Introduction of OR and LPP: (12h)

1. Linear Programming: Meaning and scope of OR, applications of OR, Convex sets and their properties. Definition of general form of LPP. Formulation of LPP, Fundamental theorem of LPP. Solution of LPP by graphical method.
2. Linear Programming: slack and surplus variable, simplex algorithm.

Module – 4 Artificial variable technique and duality: (11h)

1. Concept of artificial variables. Big –M/Penalty method and two-phase simplex methods. Concept of degeneracy and resolving it, Concept of duality, duality as LPP. Dual and Primal relationship. Fundamental theorem of duality.

Additional Input: Specification limits (not included in examination)

List of Text Books:

1. V.K.Kapoor and S.C.Gupta : Fundamentals of Applied Statistics. Sultan Chand
2. Kranthi Swaroop, Manmohan and Gupta: Operations Research-Sultan Chand

List of reference books:

1. Parimal Mukhopadhyay : Applied Statistics . New Central Book agency.
2. B.L. Agarwal: Basic Statistics. New Age publications.
3. S.P. Gupta : Statistical Methods. Sultan Chand and Sons.
4. S.D Sharma: Operations Research

List of Practicals:(3 hrs/week credits:2)

Conduct any SIX (MS-Excel mandatory)

1. Construction of mean, range and standard deviation charts.
2. Construction of \bar{p} , \bar{np} and c - charts with fixed and varying sample sizes.
3. Designing of Single sampling plan and Double sampling plan for attributes and construction of their OC and ASN curves
4. Computation of reliability for series, parallel and k out of n systems.
5. Formulation and graphical solutions of LPP (using different inequality type constraints)
6. Solution of LPP by simplex method.
7. Solution of an LPP using Big-M and two phase simplex methods
8. Solution of an LPP using principal of duality
9. Practicals 1, 2, 3, 4 using MS-Excel

Paper –VII(E-I): SQC & OPTIMIZATION TECHNIQUES

Model blue print for the Question Paper setter

Max. marks:60

Time : 2 1/2 Hrs.

Unit / Chapter name	Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
Unit - 1			
Statistical Quality Control	2	2	30
Unit - 2			
Reliability	1	2	25
Unit - 3			
Introduction to OR and LPP	2	2	30
Unit - 4			
Artificial variable technique and duality	1	2	25
-			
Total No. of Questions including choice (14)	6	8	-
Total marks allotted to all questions including choice =			110

Statistics paper-VII(E-I): SQC & OPTIMIZATION TECHNIQUES

Question Bank

SHORT QUESTIONS:

1. Explain process control and product control.
2. Explain assignable causes and chance causes.
3. Explain in brief Shewart control charts.
4. Write the difference between attributes and variables.
5. What is meant by Quality and explain 4m's in quality.
6. Explain the terms AQL & LTPD.
7. Explain producer's risk & consumer's risk.
8. Explain Hazard function and estimate it.
9. Explain the concepts of censoring and truncation.
10. Define reliability function.
11. State and prove fundamental theorem of duality.
12. Explain the concept of artificial variables.
13. Explain general LPP.
14. Show that dual of a dual is primal.

ESSAY QUESTIONS:

15. Give the importance of SQC in industry. Explain the construction of X & R charts.
16. Explain the construction of np- charts.
17. Explain construction of C-chart.
18. Explain the role and importance of six sigma.
19. Explain single sampling plan.
20. Explain double sampling plan.
21. Explain exponential distribution as a life model and give memory less property.
22. Explain system reliability with K out of N systems and their reliabilities.
23. Explain about series and parallel system reliability.
24. Explain the procedure for graphical method.
25. Explain scope and models of OR.
26. Explain the concept of degeneracy and how do you solve it.
27. Solve the following LPP by using graphical method.

$$\text{Max. } z = 3x_1 + 2x_2$$

Stc

$$x_1 - x_2 < 1$$

$$x_1 + x_2 > 3$$

$$\text{with } x_1, x_2 > 0$$

28. Solve the following LPP by simplex method.

$$\text{Max. } z = 5x_1 + 10x_2 + 8x_3$$

Stc

$$3x_1+5x_2+2x_3<60$$

$$4x_1+4x_2+4x_3<72$$

$$2x_1+4x_2+5x_3<100$$

With $x_1, x_2, x_3 > 0$

29. Use penalty method to solve the following LPP

$$\text{Min. } z = 12x_1 + 20x_2$$

Stc

$$6x_1 + 8x_2 > 100$$

$$7x_1 + 12x_2 > 120$$

With $x_1, x_2 > 0$

30. Describe two phase simplex method of solving a LPP.

Statistics-VII(E-I): SQC & OPTIMIZATION TECHNIQUES

(Model paper)

Time: 2 1/2 Hrs.

Max. Marks: 60

Section – A

4x5 = 20 M

Answer any four of the following questions. Each question carries five marks.

1. Explain the terms of assignable and chance causes.
2. Explain AQL and LTPD.
3. Explain reliability function and its estimation.
4. Write canonical and standard form of LPP.
5. State and prove fundamental theorem of LPP.
6. Explain Big-M method.

Section – B

2x10 = 20 M

Answer any two questions.

7. What are control charts. How do you construct \bar{x} and R- charts.
8. Explain the control charts for attributes. How are they useful.
9. What are the uses of statistical quality control. Explain the statistical basis of control chart analysis.
10. Explain importance of exponential distribution as a failure model. State and prove memory less property of exponential distribution.

Section – C

2x10 = 20 M

Answer any two questions.

11. solve the following LPP by simplex method.

$$\text{Max. } Z = 5x_1 + 10x_2 + 8x_3$$

Sub. To constraints

$$3x_1 + 5x_2 + 2x_3 < 60$$

$$4x_1 + 4x_2 + 4x_3 < 72$$

$$2x_1 + 4x_2 + 5x_3 < 100$$

$$x_1, x_2, x_3 > 0$$

12. Explain the concept of duality. Show that dual of a dual is primal.
13. Write algorithm for two phase simplex method?
14. Explain the scope and applications of OR.

P.R. Government College (Autonomous), Kakinada
III year B.Sc. Statistics /Semester VI- Paper VII(Elective-II)(2021-22)

Title: Actuarial Statistics

Total Hrs. of Teaching: 45 @ 3 h / Week

Total Credits: 03

Module -1

(12h)

Utility theory, insurance and utility theory, models for individuals claims and their sums, survival function, curate future lifetime, force of mortality.

Life table and it's relation with survival function examples, assumptions of fractional ages, some analytical laws of mortality select and ultimate tables.

Module - 2

(11h)

Multiple life functions, joint life and last survivor status, insurance and annuity benefits through multiple life functions, evaluation for special mortality laws.

Multiple decrement models, deterministic and random survivorship groups, associated single decrement tables, central rates of multiple decrement, net single premiums and their numerical evaluations.

Module - 3

(11h)

Elements of compound interest (nominal and effective rate of interest)

Life annuities: Single payment, continuous life annuities, discrete life annuities, life annuities with monthly payments, communication functions, varying annuities-due recursions and complete annuities-immediate and apportionable annuities-due.

Module - 4

(11h)

Net premiums: Continuous and discrete premiums, true monthly payment premiums, apportionate premiums, communication functions, and accumulation type benefits.

Net premium reserves: continuous and discrete net premium reserve, reserves on a semi continuous basis, reserves based on true monthly premiums, reserves on an apportionable or accounted continuous basis reserves at fractional durations.

Text Books

1. Bowers, N. L., Gerber, H.U., Hickman, J.C., Jones, D.A., Nesbitt, C.L.(1986), Actuarial Mathematics, The society of actuaries.

References

1. UK Institute of Actuaries core reading for subject CT5-Contingences.
2. Robin Cunningham, Thomas N. Herzog, Richard L. Models for Quantifying Risk, 4th Edition, ACTEX Publications, 2011.
3. Dickson, David C. M., Hardy, Mary R. and Waters, Howard R., Actuarial Mathematics for life contingent risks, International series on actuarial science, Cambridge 2009.
4. Deshmukh S. R., An Introduction to Actuarial Statistics, University Press, 2009

Paper Title-ACTUARIAL STATISTICS VII (E-II)

Model blue print for the Question Paper setter

Max. marks : 60

Time : 2 1/2 Hrs.

Unit / Chapter name	Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
Unit – 1			
Module-I	2	2	30
Unit – 2			
Module-II	1	2	25
Unit – 3			
Module-III	2	2	30
Unit – 4			
Module-IV	1	2	25
Total No. of Questions including choice (14)	6	8	-
Total marks allotted to all questions including choice =			110

P.R. Government College (Autonomous), Kakinada

Paper Title: Actuarial Statistics
Semester VI paper VII (E-II)
MODEL PAPER

Time : 2 1/2 Hrs.

Max. Marks: 60M

SECTION – A

4x5 = 20 M

Answer any four of the following questions. Each question carries five marks.

1. Explain insurance and utility theory.
2. Write force of mortality.
3. Write about central rates of multiple decrement.
4. Write elements of compound interest.
5. Explain life annuities with monthly payments.
6. What is accumulation type benefits.

SECTION – B

2x10 = 20 M

Answer any two questions.

7. Explain models for individual claims and their sums, survival function.
8. Explain life table and it's relation with survival function examples.
9. Describe multiple decrement models, deterministic and random survivorship group
10. Explain distribution of aggregate claims, compound Poisson distribution.

SECTION – C

2x10 = 20 M

Answer any two questions.

11. Describe single payment, continuous life annuities, discrete life annuities.
12. Explain recursions and complete annuities-immediate and apportionable annuities-due.
13. Explain continuous and discrete premiums, true monthly payment premiums.
14. Explain continuous and discrete net premium reserve, reserves on a semi continuous basis.

P.R.Government College (Autonomous), Kakinada
III year B.Sc., Degree Examinations- VI Semester (2021-22)

Cluster A

Statistics Paper VIIIA: Operations Research

Total Hrs. of Teaching: 45 @ 3 h / Week

Total Credits: 03

Objective: The central objective of operations research is optimization, i.e., "to do things best under the given circumstances." This general concept has great many applications, for instance, in agricultural planning, biotechnology, data analysis, distribution of goods and resources, emergency and rescue operations, engineering systems design, environmental management, financial planning, health care management, inventory control, manpower and resource allocation, manufacturing of goods, military operations, production process control, risk management, sequencing and scheduling of tasks, telecommunications, and traffic control.

Module -1

Transportation Problem

(12h)

Definition of transportation problem,
TPP as a special case of LPP,
Feasible solutions by NWCR, MM, VAM
Optimal solution through MODI
Unbalanced transportation problem.
Degeneracy in TP and resolving it.

Module-2

(11h)

Assignment Problem

Formulation and description of Balanced Assignment problem.
Unbalanced assignment problem,
Traveling salesman problem.
Optimal solution using Hungarian method.

Module –3

Sequencing

(11h)

Problem of Sequencing.
Optimal sequence of N jobs on two and three machines without passing.

Module –4

Game Theory

(11h)

Two Person Zero Sum Game
Saddle Point
Dominance property
Graphical Solution for $m \times 2, 2 \times n$

Additional Input: Sequencing problem with 2 jobs on k machines (not included in examination)

List of Text books:

1. Operations Research by S.D.Sharma.
2. Operations Research by Kranthi Swaroop, Manmohan and Gupta

List of Practicals:**Conduct any SIX:(3 hrs/week credits:2)**

1. Formulation and solution of transportation problem using North-West corner rule, Matrix Minima methods and VAM and to test their optimality
2. Optimum solution to balanced and unbalanced transportation problems by MODI method (both maximization and minimization cases).
3. Formulation and solution of Assignment problem using Hungarian method (both maximization and minimization cases),
4. Solution of unbalanced Assignment problem.
5. Solution of traveling salesman problem.
6. Solution of sequencing problem—processing of n jobs through two machines and processing of n jobs through three machines.
7. Solution of graphical method in game theory
8. Solution of dominance rule in game theory.

Paper –VIII Cluster A₁:Operations Research

Model blue print for the Question Paper setter

Max. marks:60

Time : 2 ½ Hrs

Unit / Chapter name	Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
Unit - 1			
Transportation	2	2	30
Unit - 2			
Assignment	1	2	25
Unit - 3			
Sequencing	1	2	25
Unit - 4			
Game Theory	2	2	30
-			
Total No. of Questions including choice (14)	6	8	
Total marks allotted to all questions including choice =			110

P.R. Government College (Autonomous), Kakinada

III year B.Sc., Degree Examinations-VI Semester
Statistics VIII Cluster A₁: operations research
(Model paper)

Time: 2 1/2Hrs.

Max. Marks: 60

Section – A

4x5 = 20 M

Answer any four of the following questions. Each question carries five marks.

1. Explain the procedure of travelling sales man problem.
2. Explain two machines and n jobs for the sequencing problem.
3. Explain the graphical method to solve rectangular game.
4. Give matrix method to solve mxn games.
5. What is unbalanced transportation problem.
6. What is degeneracy in transportation problem.

Section – B

2x10 = 20 M

Answer any two questions.

7. Define a transportation problem and explain the problem of degeneracy. Explain a method of resolving it.

8. Describe the MODI method to solve a transportation problem. Obtain an optimum solution to the following transportation problem.

D E F availability

5	1	7	10
6	4	6	30
3	2	1	15
75	20	50	

9. Explain the procedure of Hungarian Method.

10. Solve the following assignment problem

Man/ job	A	B	C	D
1	5	3	2	8
2	7	9	2	6
3	6	4	5	7
4	5	7	7	8

Section – C

2x10 = 20 M

Answer any two questions.

11. Write the Procedure to determine the sequence for performing the jobs to minimize total elapsed time T.

12. Determine the optimal sequence of jobs that minimizes total based on the following information processing time on machines is given in hours and passing is not allowed.

Job	A	B	C	D	E	F	G
Machine M1:	3	8	7	4	9	8	7
Machine M2:	4	3	2	5	1	4	3
Machine M3:	6	7	5	11	5	6	12

13. Explain the minimax criterion as applied to the theory of games.

14. Solve the game whose payoff matrix is given by:

		Player B		
Player A	-1	2	1	
	1	-2	2	
	3	4	-3	

III B.Sc. – statistics / Semester- VI(2021-22)

Paper –VIII (A2)

Course: Cluster (A2):Advanced Designs of Experiment

Total Hrs. of Teaching: 45 @ 3 h / Week

Total Credits: 03

Objectives: Statistics is an inductive science in which information is extracted from sample data in order to draw inferences. This most often involves planning experiments to ensure that valid answers to questions are obtained from the sample. Statistics is a subject that deals with the collection and analysis of data and affects most aspects of modern life.

Module-1 (11h)

Review of Design of Experiment

Review of Completely randomized Design (C.R.D), Randomized Block Design (R.B.D) and Latin Square Design (L.S.D)

Module-2 (12h)

Missing Plot Technique : Analysis of Randomized Block Design (R.B.D) with one and two missing observations and Latin Square Design (L.S.D) with one missing observation.

Module-3 (10h)

Analysis of Covariance (ANCOVA):Analysis of covariance for a one-way classification with one concomitant variable in C.R.D. Layout and for two-way classification with one concomitant variable in R.B.D

Module-4 (12h)

Factorial Design: Estimation of main effects interactions and analysis of $2^2, 2^3, 3^2$ factorial experiments

Additional Input: BIBD (not included in examination)

List of Text Books:

1. V.K.Kapoor and S.C.Gupta : Fundamentals of Applied Statistics. Sultan Chand

List of reference books:

1. .Parimal Mukhopadhyay : Applied Statistics . New Central Book agency.
2. Daroga Singh and Chowdhary: Theory and Analysis of Sample survey designs.
3. Wiley Eastern.
4. M.R.Saluja : Indian Official Statistics. ISI publications.
5. B.L.Agarwal: Basic Statistics.New Age publications.
6. S.P.Gupta : Statistical Methods. Sultan Chand and Sons.
7. PraturupaSidhanthamulu – TeluguAcademy.
8. PrayogaRachana and Visleshana – TeluguAcademy.

List of Practicals:(3 hrs/week credits:2)

Conduct any SIX (MS-Excel mandatory)

1. Analysis of CRD, RBD and LSD
2. Analysis of RBD with one missing value
3. Analysis of LSD with one missing value
4. Analysis of CRD with one covariant
5. Analysis of RBD with one covariant
6. Analysis of 2^2 and 2^3 designs
7. Analysis of 3^2 design
8. Practicals 1, 2, 3, 4, 5 using MS-Excel

Paper –VIII-Cluster (A2):Advanced Designs of Experiment

Model blue print for the Question Paper setter

Max. marks:60

Time : 2 1/2 Hrs

Unit / Chapter name	Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
Unit - 1			
Review of CRD, RBD & LSD	2	2	30
Unit - 2			
Missing plot technique	1	2	25
Unit - 3			
Analysis of Covariance (ANCOVA)	2	2	30
Unit - 4			
Factorial Design	1	2	25
-			
Total No. of Questions including choice (14)	6	8	
Total marks allotted to all questions including choice =			110

P.R.Government College (Autonomous), Kakinada
III year B.Sc., Degree Examinations- VI Semester
Statistics Paper-VIII Cluster(A2):Advanced Designs of Experiment
(Model paper)

Time: 2 1/2 Hrs.

Max. Marks: 60

Section – A

4x5 = 20 M

Answer any **Four** of the following questions. Each question carries FIVE marks.

1. Explain principles of experimental design?.
2. Discuss advantages & disadvantages of RBD?.
3. Derive single missing yield in RBD?
4. Explain analysis of covariance (ANCOVA)?
5. Construct lay out of ANCOVA in one way classification?
6. Explain interaction effect in factorial design?

Section – B

Answer any two question

2x10 = 20 M

7. Explain the analysis of CRD with ANOVA?
8. Explain concept and lay out of LSD ?
9. Explain in detail the analysis of two missing values in RBD? And also construct ANOVA tables after estimating the two missing values?
10. Derive single missing values in LSD also construct ANOVA tables after estimating the single value?

Section – C

Answer any **TWO** questions.

2x10 = 20 M

11. Derive one way classification in one concomitant variable in ANCOVA?
- 12.. Explain in brief ANCOVA in RBD with two concomitant variable?.
- 13.How to estimate main effects in 2^2 factorial designs?
14. How to estimate interaction effects in 3^2 factorial experiments?

P.R.Government College (Autonomous), Kakinada

Paper Title: Econometrics

VI Semester Cluster paper VIII A3 (2021-22)

(Total Hours of Teaching: 45@ 3 h / Week)

Objective:On successful completion of the course the students should have understood econometric Model, estimation and testing of parameters, forecasting and verification of economic theory and application of models in planning.

Module -1 (11h)

Definition-Scope
Objectives of Econometrics
Limitations-Divisions of Econometrics

Module - 2 (12h)

Single equation model two variable case
Reasons for introducing error term in the model
least square method of estimation and testing of parameters of the models
Estimation of error variance
Simple problems.

Module - 3 (11h)

General linear model
Assumptions
Least square method of estimation and testing of the parameters of the models
problems under failure of assumptions.

Module - 4 (11h)

Multicollinearity
Effects of multicollinearity
detecting multicollinearity
Remedies Autocorrelation-sources of autocorrelation

List of reference books:

- 1.Ecnometrics Basic and applied by Aaron C Johnson Jr,Marvin B Johnson and Rueben C Buse (Maxwell Maxmillan Intl editions)
2. Ecnometric methods by Johnston. J (McGraw Hill Intl students' editions)
3. Theory of Ecnometrics by Koutsoyannis. A (Palgrave publications Ltd)

Paper Title-Econometrics-VIII A3

Model blue print for the Question Paper

Max. marks :60

Time : 2 ½ Hrs.

Unit / Chapter name	Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
Unit - 1			
Module-I	1	2	25
Unit - 2			
Module-II	2	2	30
Unit - 3			
Module-III	1	2	25
Unit - 4			
Module-IV	2	2	30
Total No. of Questions including choice (14)	6	8	-
Total marks allotted to all questions including choice =			110

Cluster Paper-VIII A3-Econometrics

QUESTION BANK

SHORT ANSWERS:

1. Define econometrics.
2. Write uses of econometrics.
3. Write about simple linear regression model.
4. Write MLE for linear regression model.
5. Write CI estimation of intercept form.
6. Explain unbiased property.
7. Define general linear model.
8. Write normality of residuals in GLM.
9. Define multicollinearity.
10. Define auto correlation.

ESSAY QUESTIONS:

1. Write nature and scope of econometrics.
2. Write limitations & divisions of econometrics.
3. Write least square estimation of direct regression model.
4. Write properties of direct regression estimators.
5. Derive estimation of variance.
6. Derive estimation of variances of b_0 & b_1 in direct regression model.
7. Write about CI estimation for slope parameter
8. Explain general linear model.
9. Write assumptions of GLM.
10. Write least square estimation of GLM.
11. Explain causes and effects of multicollinearity.
12. Write sources of auto correlation.

P.R.Government College (Autonomous), Kakinada
Paper Title: Econometrics
VI Semester Cluster paper VIII-A3
MODEL PAPER

Time: 2 ½ Hrs.

Max. Marks: 60 M

Section – A

4x5 = 20M

Answer any four of the following questions. Each question carries five marks.

1. Write the limitations of econometrics.
2. Define simple linear regression model.
3. Derive estimation of error variance.
4. Define general linear model with example.
5. Explain problem having multi collinearity.
6. Define auto correlation.

Section – B

2x10 = 20 M

Answer any two questions.

- 7 .Explain scope and objectives of econometrics.
- 8.Explain limitations and divisions of econometrics.
9. Derive estimates of variances of b_0 & b_1 for single linear regression model.
10. write testing of hypothesis & C.I estimation for slope parameter.

Section –C

2x10 = 20 M

Answer any two questions.

- 11.Explain assumptions of general linear model.
12. Explain testing of parameters of the models.
- 13.Explain effects & causes of multi collinearity.
14. Explain sources of autocorrelation.

P.R.Government College (Autonomous), Kakinada
III year B.Sc., Degree Examinations- VI Semester (2021-22)
Statistics Paper VIII Cluster B1: Operations Research-I

Total Hrs. of Teaching: 45 @ 3 h / Week

Total Credits: 03

Objective: The central objective of operations research is optimization, i.e., "to do things best under the given circumstances." This general concept has great many applications, for instance, in agricultural planning, biotechnology, data analysis, distribution of goods and resources, emergency and rescue operations, engineering systems design, environmental management, financial planning, health care management, inventory control, manpower and resource allocation, manufacturing of goods, military operations, production process control, risk management, sequencing and scheduling of tasks, telecommunications, and traffic control.

Module -1

Linear programming problem –advanced technique

(12h)

Introduction to revised simplex method
Revised simplex method (RSM) algorithm
Simplex method vs revised simplex method
Bounded variables
Bounded variable simplex method

Module-2

Transportation Problem

(12h)

Definition of transportation problem,
TPP as a special case of LPP,
Feasible solutions by NWCR, MM, VAM
Optimal solution through MODI
Unbalanced transportation problem.
Degeneracy in TP and resolving it.

Module-3

(11h)

Assignment Problem

Formulation and description of Balanced Assignment problem.
Unbalanced assignment problem,
Traveling salesman problem.
Optimal solution using Hungarian method.

Module –4

(10h)

Sequencing Problem

Problem of Sequencing, assumptions
Optimal solution of N jobs on two and three machines without passing-Johnson's Algorithm

Additional Input: Sequencing problem with 2 jobs on k machines (not included in examination)

List of text books:

1. Operation Research by S.D.ShOperations Research by S.D. Sharma.
2. Operations Research by Kranthi Swaroop, Manmohan and Gupta

List of Practicals:(3 hrs/week credits:2)**Conduct any SIX:**

1. Solution of LPP by Revised Simplex Method
2. Solution of LPP by the bounded variable simplex method
3. Formulation and solution of transportation problem using North-West corner rule, Matrix

Minima methods and VAM and to test their optimality

4. Optimum solution to balanced and unbalanced transportation problems by MODI method

(both maximization and minimization cases).

5. Formulation and solution of Assignment problem using Hungarian method (both

maximization and minimization cases),

- 6.Solution of unbalanced Assignment problem.

7. Solution of traveling salesman problem.

8. Solution of sequencing problem—processing of n jobs through two machines and

processing of n jobs through three machines.

Paper –VIII Cluster B:Operations Research-I

Model blue print for the Question Paper setter

Max. marks:60

Time : 2 1/2 Hrs

Unit / Chapter name		Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
Unit - 1				
Lpp advanced techniq ue		1	2	25
Unit - 2				
Transportation		2	2	30
Unit - 3				
Assignment		2	2	30
Unit-4				
Sequencing		1	2	25
Total No. of Questions including choice (14)				
		6	8	
Total marks allotted to all questions including choice =				110

**Statistics Paper VIII Cluster B1: Operations Research-I
Question Bank**

SHORT QUESTIONS:

1. Explain the advantages and disadvantages of revised simplex method.
2. Explain the concept of bounded variables.
3. Explain North-West corner method
4. Write a short note on unbalanced transportation problem.
5. Explain travelling sales man problem.
6. Write the procedure for matrix minima method.
7. Explain unbalanced assignment problem.
8. Explain the assumptions in job sequencing

ESSAY QUESTIONS

9. Explain the Revised simplex algorithm.

10. solve the following LPP

$$\text{minimize } Z=6x_1-2x_2-3x_3$$

subject to the constraints

$$2x_1+4x_2+2x_3\leq 8$$

$$x_1-2x_2+3x_3\leq 7$$

$$\text{and } 0\leq x_1\leq 2, \quad 0\leq x_2\leq 2, \quad 0\leq x_3\leq 1$$

11. Obtain IBFS for TP by using north west corner rule

$$5 \quad 1 \quad 3 \quad 3 \quad 34$$

$$3 \quad 4 \quad 5 \quad 4 \quad 15$$

$$6 \quad 4 \quad 3 \quad 9 \quad 12$$

$$4 \quad 1 \quad 5 \quad 8 \quad 19$$

$$20 \quad 25 \quad 15 \quad 20$$

12. Obtain IBFS for TP by using VAM.

$$5 \quad 1 \quad 3 \quad 3 \quad 34$$

$$3 \quad 3 \quad 5 \quad 4 \quad 15$$

$$6 \quad 4 \quad 4 \quad 3 \quad 12$$

$$4 \quad 1 \quad 4 \quad 2 \quad 19$$

$$21 \quad 25 \quad 17 \quad 17$$

13. Explain the procedure of MODI method.
14. Describe the TP with its general mathematical formulation.
15. Explain the degeneracy in transportation problem. How can you resolve it.
16. Write the procedure for Hungarian method.
17. Solve the following assignment problem of maximization.

10 5 13 15 16
 3 9 18 13 6
 10 7 2 2 5
 7 11 9 7 12
 7 9 10 4 11

18. Explain the sequencing algorithm for n jobs on two machines. And also explain the calculation of minimum total elapsed time.
19. Determine the optimal sequence of jobs that minimizes total based on the following information processing time on machines is given in hours and passing is not allowed.

Job	A	B	C	D	E	F	G
Machine M1	3	8	7	4	9	8	7
Machine M2	4	3	2	5	1	4	3
Machine M3	6	7	5	11	5	6	12

P.R.Government College (Autonomous), Kakinada

**III year B.Sc., Degree Examinations-VI Semester
Statistics paper VIII Cluster B₁: operation research-I**

Time: 2 1/2 Hrs.

Max. Marks: 60

Section – A

4x5 = 20 M

Answer any four of the following questions. Each question carries five marks.

1. Explain the procedure of travelling sales man problem.
2. Explain the procedure of unbalanced assignment problem.
3. Explain two machines and n jobs for the sequencing problem.
4. Write advantages disadvantages of revised simplex method.
5. What is unbalanced transportation problem.
6. What is degeneracy in transportation problem.

Section – B

2x10 = 20 M

Answer any two questions.

7. solve the following LPP
minimize $Z=6x_1-2x_2-3x_3$
subject to the constraints
 $2x_1+4x_2+2x_3\leq 8$
 $x_1-2x_2+3x_3\leq 7$
and $0\leq x_1\leq 2$, $0\leq x_2\leq 2$, $0\leq x_3\leq 1$
8. write revised simplex method algorithm
9. Define a transportation problem and explain the problem of degeneracy. Explain a method of resolving it.
10. Describe the MODI method to solve a transportation problem. Obtain an optimum solution to the following transportation problem.

	D	E	F	availability
	5	1	7	10
	6	4	6	30
	3	2	1	15
	75	20	50	

Section-C

Answer any two questions.

2x10=20

11. Explain the procedure of Hungarian method
12. Solve the following assignment problem

Man/ job	A	B	C	D
1	5	3	2	8
2	7	9	2	6
3	6	4	5	7
4	5	7	7	8

13. Write the Procedure to determine the sequence for performing the jobs to minimize total elapsed time T.
14. Determine the optimal sequence of jobs that minimizes total based on the following information processing time on machines is given in hours and passing is not allowed.

Job	A	B	C	D	E	F	G
Machine M1	3	8	7	4	9	8	7
Machine M2	4	3	2	5	1	4	3
Machine M3	6	7	5	11	5	6	12

P.R.Government College (Autonomous), Kakinada
III year B.Sc., Degree Examinations- VI Semester (2021-22)
Statistics Paper VIII Cluster B2: Operations Research-II

Total Hrs. of Teaching: 45 @ 3 h / Week

Total Credits: 03

Objective:The central objective of operations research is optimization, i.e., "to do things best under the given circumstances." This general concept has great many applications, for instance, in agricultural planning, biotechnology, data analysis, distribution of goods and resources, emergency and rescue operations, engineering systems design, environmental management, financial planning, health care management, inventory control, manpower and resource allocation, manufacturing of goods, military operations, production process control, risk management, sequencing and scheduling of tasks, telecommunications, and traffic control.

Module -1 **(12h)**

Game and strategies:

Introduction, Two person zero sum game, Saddle point, Dominance property, $2 \times n$, $m \times 2$ games-Graphical method.

Module-2 **(12h)**

Inventory control-I

Types of inventories, Cost of inventories, Factors effecting inventory control, Concept of EOQ, Deterministic inventory models.

Module-3 **(10h)**

Inventory control-II

Problems on EOQ with one price & more than one price break, Simple problems, probabilistic inventory model, Instantaneous demand, No setup cost model, News paper boy problem

Module-4 **(11h)**

Net work scheduling.

PERT, CPM, Logical sequencing, Rules for net work construction, Critical path analysis, Floats and slack times.

Additional Input: Decision Analysis with Certainty (not included in examination)

List of text books:

1. Operations Research by S.D. Sharma.
2. Operations Research by Kranthi Swaroop, Manmohan and Gupta

List of Practicals:**Conduct any SIX:(3 hrs/week credits:2)**

1. Solution of games with saddle points.
2. Solution of games by dominance method
3. Solution of $2 \times n$ and $m \times 2$ games by graphical method
4. Determination of EOQ for different inventory models.
5. EOQ problems with one and two price breaks
6. News paper boy problem.
7. Network scheduling by CPM
8. Network scheduling by PERT

.Paper –VIII Cluster B₂:Operations Research-II**Model blue print for the Question Paper setter****Max. marks:60****Time : 2 1/2 Hrs**

Unit / Chapter name		Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
Unit - 1				
Game theory		1	2	25
Unit - 2				
Inventory models I		2	2	30
Unit - 3				
Inventory models II		1	2	25
Unit-4				
Networking scheduling		2	2	30
-				
Total No. of Questions including choice(14)		6	8	
Total marks allotted to all questions including choice =				110

Statistics VIII Cluster - B₂: operation research-II
Question Bank

Short Answer Questions:

1. Define two person zero sum games and pure and mixed strategies.
2. Define payoff and payoff matrix.
3. Explain the maximin and minimax principle. Define saddle point.
4. Explain the different types of inventories.
5. Explain the various costs involved in inventory control.
6. Explain the various factors involved in inventory control.
7. Explain about Economic Order Quantity.
8. Explain the EOQ model with one price break.
9. Explain the rules of constructing a network diagram.
10. Explain CPM and PERT.
11. Explain the components of a network.

Essay Questions:

12. Explain the Dominance principle to solve nxn game.
13. Explain the graphical method to solve 2xn and mx2 games.
14. Find optimal strategies for the games for which for the pay off matrices are given below also find the value of the game

		P ₂	
		I	II
P ₁	I	1	3
	II	4	2

15. Explain the different methods to determine EOQ.
16. Discuss the EOQ problem with uniform demand and infinite production rate.
17. Discuss the EOQ problem with different demand rates in different cycles and infinite production rate.

- 18.** Find EOQ for the following data

Annual usage=1,000 pages Expediting cost=RS.4 per order
Cost per price =Rs.250 Inventory holding cost=20% of average inventory
Ordering cost=RS.6per order material holding cost=Re 1 per price

19. Explain the probabilistic inventory model with instantaneous demand and no setup cost.
20. Explain forward and backward time computations.
21. Explain the critical path method.
22. Explain the PERT algorithm.
23. Find the optimum time of completion of project ,when the time of completion of each task is as follows :A < D ,E ; B,D < F ; C<G ; B ,G< H ; F,G < I.

Task	A	B	C	D	E	F	G	H	I
Time	23	8	20	16	24	18	19	4	10

P.R.Government College (Autonomous), Kakinada

**III year B.Sc., Degree Examinations-VI Semester
Statistics VIII Cluster - B₂: operation research-II**

Time: 2 1/2 Hrs.

Max. Marks: 60

Section – A

4x5 = 20 M

Answer any four of the following questions. Each question carries five marks.

1. Explain pure and mixed strategies.
2. Explain different types of inventories.
3. Explain the determination of EOQ with one price break.
4. Write about economic lot size with finite rate
5. Write basic steps in PERT technique
6. Write rules for drawing net work diagram.

Section-B

2x10=20

Answer any two of the following:

7. Find optimal strategies for the games for which for the pay off matrices are given below also find the value of the game.

		P ₂	
		I	II
P ₁	I	1	3
	II	4	2

8. Write procedure of graphical method to solve 2Xn games.
9. Find EOQ for the following data
Annual usage=1,000 pages Expediting cost=RS.4 per order
Cost per price =Rs.250 Inventory holding cost=20% of average inventory
Ordering cost=RS.6per order material holding cost=Re 1 per price
10. Explain concept of Economic order quantity and explain the different methods to compute EOQ

Section-C

2x10=20

11. Explain the determination of EOQ with one and Two price breaks.
12. Explain the probabilistic inventory modal with instantaneous demand and no setup cost.
13. Explain forward pass time computation&Backward pass time computations
14. Find the optimum time of completion of project ,when the time of completion of each task is as follows :A < D ,E ; B,D < F ; C<G ; B ,G< H ; F,G < I.

Task	A	B	C	D	E	F	G	H	I
Time	23	8	20	16	24	18	19	4	10

P.R.Government College (Autonomous), Kakinada

Paper Title: Econometrics

VI Semester Cluster paper VIII B3(2021-22)

(Total Hours of Teaching: 45@ 3 h / Week)

Objective:On successful completion of the course the students should have understood econometric Model, estimation and testing of parameters, forecasting and verification of economic theory and application of models in planning.

Module -1 (11h)

Definition-Scope
Objectives of Econometrics
Limitations-Divisions of Econometrics

Module - 2 (12h)

Single equation model two variable case
Reasons for introducing error term in the model
least square method of estimation and testing of parameters of the models
Estimation of error variance
Simple problems.

Module - 3 (11h)

General linear model
Assumptions
Least square method of estimation and testing of the parameters of the models
problems under failure of assumptions.

Module - 4 (11h)

Multicollinearity
Effects of multicollinearity
detecting multicollinearity
Remedies. Autocorrelation-sources of autocorrelation

List of reference books:

- 1.Ecnometrics Basic and applied by Aaron C Johnson Jr,Marvin B Johnson and Rueben C Buse (Maxwell Maxmillan Intl editions)
2. Ecnometric methods by Johnston. J (McGraw Hill Intl students' editions)
3. Theory of Ecnometrics by Koutsoyannis. A (Palgrave publications Ltd)

Paper Title-Econometrics-VIII B3

Model blue print for the Question Paper

Max. marks :60

Time : 2 ½ Hrs.

Unit / Chapter name	Short Answer Questions	Essay Questions	Marks allotted to the Unit/Chapter
Unit - 1			
Module-I	1	2	25
Unit - 2			
Module-II	2	2	30
Unit - 3			
Module-III	1	2	25
Unit - 4			
Module-IV	2	2	30
Total No. of Questions including choice (14)	6	8	-
Total marks allotted to all questions including choice =			110

Cluster Paper-VIII B3-Econometrics

QUESTION BANK

SHORT ANSWERS:

1. Define econometrics.
2. Write uses of econometrics.
3. Write about simple linear regression model.
4. Write MLE for linear regression model.
5. Write CI estimation of intercept form.
6. Explain unbiased property.
7. Define general linear model.
8. Write normality of residuals in GLM.
9. Define multicollinearity.
10. Define auto correlation.

ESSAY QUESTIONS:

11. Write nature and scope of econometrics.
12. Write limitations & divisions of econometrics.
13. Write least square estimation of direct regression model.
14. Write properties of direct regression estimators.
15. Derive estimation of variance.
16. Derive estimation of variances of b_0 & b_1 in direct regression model.
17. Write about CI estimation for slope parameter
18. Explain general linear model.
19. Write assumptions of GLM.
20. Write least square estimation of GLM.
21. Explain causes and effects of multicollinearity.
22. Write sources of auto correlation.

P.R.Government College (Autonomous), Kakinada
Paper Title: Econometrics
VI Semester Cluster paper VIII-B3
MODEL PAPER

Time: 2 ½ Hrs.

Max. Marks: 60 M

Section – A

4x5 = 20M

Answer any four of the following questions. Each question carries five marks.

1. Write the limitations of econometrics.
2. Define simple linear regression model.
3. Derive estimation of error variance.
4. Define general linear model with example.
5. Explain problem having multi collinearity.
6. Define auto correlation.

Section – B

2x10 = 20 M

Answer any two questions.

7. Explain scope and objectives of econometrics.
8. Explain limitations and divisions of econometrics.
9. Derive estimates of variances of b_0 & b_1 for single linear regression model.
10. write testing of hypothesis & C.I estimation for slope parameter.

Section –C

2x10 = 20 M

Answer any two questions.

11. Explain assumptions of general linear model.
12. Explain testing of parameters of the models.
13. Explain effects & causes of multi collinearity.
14. Explain sources of autocorrelation.

P.R.Government College (Autonomous), Kakinada
III year B.Sc., Degree Examinations- VI Semester (2021-22)
Project Work

Total Hrs. of Teaching: 30 @ 2 h / Week

Total Credits: 02

Guidelines:

1. A project work shall be supervised by a faculty member assigned by the Head of the Department.
2. The project work shall be done on any one of the following topics
 - Population Statistics
 - Educational Statistics
 - Accidents Statistics
 - Election Statistics
 - Agricultural Statistics
 - Industrial Statistics
 - Election Statistics
 - Medical statistics, etc.,
3. A project work should be chosen such that there is enough scope to apply and demonstrate the statistical techniques learnt in the course
4. A project may be undertaken by a group of students and the maximum number of students in a team shall not exceed five.
5. There shall be an internal examiner for the evaluation of the project work
6. The project shall be submitted as one book for each team before the due date.
7. The project analysis and reports can be created using Excel or R software or SPSS or MATLAB or any other softwares.

8. Exam pattern:(only Internal):

Total : 50 marks

- Seminar 1: 5 marks
- Seminar 2 : 5 marks
- Project report: 25 marks
 - It must include:
 - Introduction (topic, Aim & Objectives)
 - Methodology
 - Analysis
 - Conclusion
- Presentation: 10 marks
- Viva voce: 5 marks

P.R.Government College(A), Kakinada

DEPARTMENT OF STATISTICS

MOOCS

Guidelines:

- Extra credits will be given to the student who will be completed an online course (total credits achieved in the course will be considered)
- The student should submit the course completion certificate with credits to claim the extra credits
- The maximum no. of extra credits is as per guidelines of the college.
- The students may choose online course(s) in the domain of Statistics/Actuarial Science or interdisciplinary subjects related to these subjects
- The students may register and complete a course from the following online platforms

- <https://swayam.gov.in/>
- <https://swayam.gov.in/CEC>
- <https://swayam.gov.in/NPTEL>
- <https://nptel.ac.in/noc/>
- <https://swayam.gov.in/UGC>
- <https://spoken-tutorial.org/>
- <https://www.coursera.org/>

- <https://www.coursera.org/programs/iit-madras-48km0>
 - Any other
- The students may get extra credits from other sources also.
For details contact Academic Cell/Website/Notice Board
- Some suggested courses:

Name of the Course	Web Link
Applied Multivariate Analysis	https://swayam.gov.in/nd2_cec20_ma17/preview
Bio Statistics and Mathematical Biology	https://swayam.gov.in/nd2_cec20_bt23/preview
Big Data Computing	https://swayam.gov.in/nd1_noc20_cs92/preview
Business Statistics	https://swayam.gov.in/nd2_cec20_mg13/preview
Operations Research	https://swayam.gov.in/nd2_cec20_ma19/preview
Research Methodology	https://swayam.gov.in/nd2_cec20_ge37/preview
Quantitative Techniques for Management	https://swayam.gov.in/nd2_cec20_mg18/preview
Communication Research	https://swayam.gov.in/nd2_cec20_ge30/preview
Fundamental of Insurance	https://swayam.gov.in/nd2_cec20_mg24/preview
Introduction to Bio-Statistics	https://swayam.gov.in/nd1_noc20_bt28/preview
Introduction to R Software	https://swayam.gov.in/nd1_noc20_ma53/preview
Non Parametric Statistical Inference	https://swayam.gov.in/nd1_noc20_ma55/preview
Operations Research	https://swayam.gov.in/nd1_noc20_ma45/preview
Regression Analysis	https://swayam.gov.in/nd1_noc20_ma30/preview
Methods and Statistics in Social Sciences Specialization	https://www.coursera.org/specializations/social-science
Statistics with R Specialization	https://www.coursera.org/specializations/statistics

R-Programming	https://www.coursera.org/programs/iit-madras-48km0/browse?productId=RMFRum1BEeWXRAGju0fvnQ&productType=course&query=r+programming&showMiniModal=true
Hypothesis Testing in Public health	https://www.coursera.org/learn/hypothesis-testing-pub
Business Statistics and Analysis Specialization	https://www.coursera.org/programs/iit-madras-48km0/browse?collectionId=&productId=gZBrS7vSEeWQ9xLvZ6r9Zw&productType=s12n&query=r+programming&showMiniModal=true
Probability and Statistics : To p or not to p	https://www.coursera.org/learn/probability-statistics
Data Analysis and Interpretation Specialization	https://www.coursera.org/specializations/data-analysis
Introduction to Statistics and Data Analysis in Public health	https://www.coursera.org/programs/iit-madras-48km0/browse?productId=wYVFrFUOEeiXDgqeSsw0yA&productType=course&query=data+analysis+public+health&showMiniModal=true
Basic Statistics	https://www.coursera.org/programs/iit-madras-48km0/browse?productId=ZNeGqEC2EeWC4g7VhG4bTQ&productType=course&query=statistics&showMiniModal=true

P.R.Government College(A), Kakinada
DEPARTMENT OF STATISTICS

Work Load for Statistics and Actuarial Science

2021-22 (Odd Sem)

S.No	Name of the Class	Strength	No. of Theory Hours	No. of Practical Hours	No. of Batches	Total Practical Hours	Total hrs. (Theory + Practical)
1	I MSCS-stat	30	4	2	2	4	8
2	I MSAs Stat	30		2	2	4	4
3	II MSCS-Stat	31	4	2	2	4	8
4	II MAS-Stat	31		2	2	2	4
5	III MSCs-stat Paper V &VI	33	3+3	3+3	2	12	18
6	III MSAs-stat Paper V &VI	26		3+3	2	12	12
7	III MSAs Actuarial Science paper V & VI	26	3+6	3	2	6	15
	Total						69

P.R.Government College(A), Kakinada

DEPARTMENT OF STATISTICS

Work Load for Statistics and Actuarial Science

2021-22 (Even Sem)

S.No	Name of the Class	Strength	No. of Theory Hours	No. of Practical Hours	No. of Batches	Total Practical Hours	Total hrs. (Theory + Practical)
1	I MSCS-stat	30	4	2	2	4	8
2	I MSAs Stat	30		2	2	4	4
3	I MSAs Act. Sc. paper II	30	6	--	--	--	6
4	II MSCS-Stat IV	31	4	2	2	4	8
5	II MAS- Stat IV	31		2	2	4	4
6	II MSCS-Stat V	31	4	2	2	4	8
7	II MAS- Stat V	31		2	2	4	4
8	II Actuarial Sc. Paper IV	31	6				6
9	II Actuarial Sc. Paper V	31	6				6
10	III MSCS Stat paper VII	33	3	3	2	6	9
11	III MSAs Stat paper VII	26		3	2	6	6
12	Stat Cluster	40 (projected)	3+3+3	3+3	2	12	21
13	Project			2	3	6	6

14	Elementary Statistics (II Sem)		(2 classes) 2+2				4
Total Work Load for Statistics and Actuarial Sciences							100

P.R.Government College (Autonomous), Kakinada
Department of Statistics
Certificate Course 01: Statistical Package for Social Sciences (SPSS)

Duration: 40 Hours

No. of Credits(Extra): 01

Period of the course: During Even Semester

Course Overview:

Introduction to Statistical Analysis Using IBM SPSS Statistics (v24) provides an application-oriented introduction to the statistical component of IBM® SPSS® Statistics. Students will review several statistical techniques and discuss situations in which they would use each technique, the assumptions made by each method, how to set up the analysis, as well as how to interpret the results. This includes a broad range of techniques for exploring and summarizing data, as well as investigating and testing underlying relationships. Students will gain an understanding of when and why to use these various techniques as well as how to apply them with confidence, interpret their output, and graphically display the results.

Objectives:

A good knowledge of quantitative data analysis is a sine qua none for progress in academic and corporate world. Keeping this in mind this course has been designed in such way that students, researchers, teachers and corporate professionals who want to equip themselves with sound skills of data analysis and wish to progress with this skill can learn it in in-depth and interesting manner using IBM SPSS Statistics-one of the earliest and most popular statistical data analysis software package till date.

Learning Outcomes:

On completion of this course the participants will develop an ability to independently analyze and treat data, plan and carry out new research work based on their research interest. The course encompasses most of the major type of research techniques employed in academic and professional research which can be seen in syllabus.

Course Layout:

Unit 1:

Developing the familiarity with SPSS Processor: (10h)

Entering data in SPSS editor. Solving the compatibility issues with different types of file. Inserting and defining variables and cases. Managing fonts and labels. Data screening and cleaning. Missing Value Analysis. Sorting, Transposing, Restructuring, Splitting, and Merging. Compute & Recode functions. Visual Binning & Optimal Binning. Research with SPSS (random number generation).

Unit 2:

Working with descriptive statistics: (8h)

Frequency tables, Using frequency tables for analyzing qualitative data, Explore, Graphical representation of statistical data: histogram (simple vs. clustered), boxplot, line charts, scatterplot (simple, grouped, matrix, drop-line), P-P plots, Q-Q plots, Addressing conditionalities and errors, computing standard scores using SPSS, reporting the descriptive output in APA format.

Unit 3:

Testing the differences between group means: (6h)

t – test (one sample, independent- sample, paired sample), ANOVA- 1 (one way), Reporting the output in APA format.

Unit 4:

Correlation Analysis: (8h)

Data entry for correlational analysis, Choice of a suitable correlational coefficient: non-parametric correlation (Kendall's tau), Parametric correlation (Pearson's, Spearman's), Special correlation (Biserial, Point-biserial), Partial and Distance Correlation

Unit 5:

Regression (Linear & Multiple): (8h)

The method of Least Squares, Linear modeling, Assessing the goodness of fit, Simple regression, Multiple regression (sum of squares, R and R², hierarchical, step-wise), Choosing a method based on your research objectives, checking the accuracy of regression model.

- **SPSS Statistics – New User:**

Key topics

1. Introduction to statistical analysis
2. Examine individual variables
3. Test hypotheses-theory
4. Test hypotheses about individual variables
5. Test the relationship between categorical variables
6. Test the difference between two group means
7. Test the differences between more than two group means
8. Test the relationship between scale variables
9. Predict a scale variable
10. Explore nonparametric tests

P.R GOVERNMENT (A) COLLEGE, KAKINADA
DEPARTMENT OF STATISTICS
CERTIFICATE COURSE 01: SPSS
Model Paper

Time:2hrs

maxmarks:50

SECTION-A

Answer all questions. Each question carries 1 mark

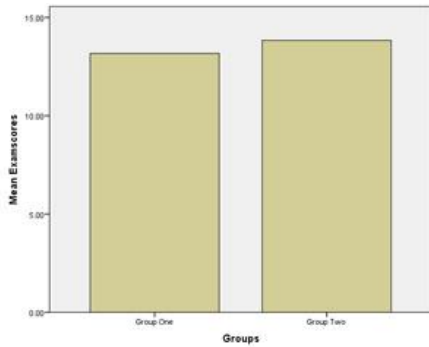
1. What are the two main windows in SPSS
 - a. Data view and variable view
 - b. Data editor and output viewer
 - c. Variable view and output viewer
 - d. Data view and output viewer
2. Which menu item contains the split file and select cases command
 - a. analyze menu
 - b. Graph menu
 - c. Transform menu
 - d. Data menu
3. Select the window where the results of your analysis appear
 - a. Output viewer
 - b. Data view
 - c. Data editor
 - d. Variable view
4. In which sub-dialog box can the Chi Square test be found?
 - a. Frequencies : percentages
 - b. cross tabs :statistics
 - c. bivariate: pearson
 - d. Gender:female
5. To generate a Spearman's *rho* test, which set of instructions should you give SPSS?
 - a. Analyze; Crosstabs; Descriptive Statistics; Spearman; OK
 - b. Analyze; Crosstabs; Descriptive Statistics; Spearman; OK
 - c. Analyze; Compare Means; Anova table; First layer; Spearman; OK
 - d. Analyze; Correlate; Bivariate; [select variables]; Spearman; OK
6. Which of the following is used for creating and defining various characteristics of variables?
 - a. Output viewer
 - b. Data view
 - c. Data editor
 - d. Variable view
7. Rating a group of variables on how much you like them is an example of
 - a. Nominal data
 - b. Ordinal data
 - c. Interval data
 - d. ratio data
8. Ordinal level data are characterized by
 - a. Equal intervals between each adjacent score.
 - b. A fixed zero
 - c. Data that can be meaningfully arranged by order of magnitude
 - d. None of the above.

9. In this tab, rows represent individual cases and columns represent variables in your data.
 - a. Output viewer
 - b. Data view
 - c. Data editor
 - d. Variable view
10. which drop down menu do you need to select in order to recode your data.
 - a. Transform
 - b. Data
 - c. Analyze
 - d. Graph
11. Which menu item contains the split file and select cases command?
 - a. Data Menu
 - b. Transform Menu
 - c. Analyze Menu
 - d. Graph Menu
12. You want to produce a graph that will show the distribution of scores in your data. An appropriate way to display the information would to be use a
 - a. Histogram
 - b. Pie chart
 - c. Line chart
 - d. Scatter plot
13. You want to produce a graph that will show the percentages of participants that belonged to different groups
 - a. Histogram
 - b. Pie chart
 - c. Line chart
 - d. Scatter plot
14. You have collected some demographic data on age groups and would like to produce a pie chart to accompany the descriptive statistics .which of the following commands could produce this pie chart
 - a. Frequencies
 - b. Descriptive
 - c. Explore
 - d. Cross tabs
15. Which of these commands enables you to produce a Bar chart of your data
 - a. Legacy dialogues
 - b. Chart Builder
 - c. Frequencies command
 - d. All the above
16. What is a research hypothesis?
 - a. A predicted relationship between variables
 - b. A theory
 - c. A way to describe a sample
 - d. A statement about the normality of the data
17. SPSS stands for which of the following?
 - a. Statistical Package for the Social Sciences
 - b. Statistics Problems Solved smart
 - c. Simple Package for Science Statistics
 - d. Simple Program for Statistics and Science
18. Boot strapping is a technique that
 - a. Can provide an estimation of population parameter
 - b. Provides a method of purchasing a sampling distribution
 - c. Provides a way of estimating bias of a statistic
 - d. All of these
19. What is the probability of getting head if throwing a coin .
 - a. $P=0.2$
 - b. $P=0.5$
 - c. $P=0.05$
 - d. $P=0.1$
20. Rating a group of vegetables on how much you like them is an example of:
 - a. Nominal data
 - b. Ordinal data
 - c. Interval data
 - d. Ratio data

SECTION-B

Answer all questions. Each question carries 3 marks

21. A researcher conducted a study exploring the impact of scary films on individuals' heart rates. The researcher measured individuals' heart rate as they watched a scary film. Measuring heart rate is an example of which level of data (as defined by SPSS)?
 - a. Nominal data
 - b. Ordinal data
 - c. Interval data
 - d. Ratio data
22. You have produced a output of a table through the custom tables command. which type of graph you you not create from this table
 - a. Bar
 - b. Line
 - c. Histogram
 - d. Area
23. Which of these commands enables you to produce a bar chart of your data
 - a. Legacy dialogues
 - b. hart builder
 - c. Frequencies command
 - d. All of the above
24. How would you change the increments on the following graph?



- a. Double click on the graph, and then select Edit and click on Select Y Axis
- b. Double click on the graph and then select Edit and click on Select X Axis
- c. Double click on the graph and click on the X icon on the toolbar
- d. Double click on the graph and then select Options and click on Y Axis Reference Line

25. Which of the following is used for creating and defining various characteristics of variables?
 - a. Output viewer
 - b. Variable view
 - c. Data editor
 - d. Data view
26. How is a variable name different from a variable label?
 - a. It is shorter and less detailed
 - b. It is longer and more detailed.
 - c. It is abstract and unspecific.
 - d. It refers to codes rather than variables.
27. in this tab rows represent variables & columns represent characteristics of variables.
 - a. Output viewer
 - b. Variable view
 - c. Data editor
 - d. Data view
28. after selecting the analyse and descriptive statistics dropdown menus, which of the following commands could you use to generate the median and mode for your data .
 - a. the frequencies or the explore command
 - b. the descriptives or the frequencies command
 - c. the descriptives or the explore command
 - d. the descriptives or the crosstabs command
29. a parameter statistical test with allows you to examine whether there is a difference in the scores between two groups (or) conditions is known as
 - a. A Pearson's test
 - b. A chi-square
 - c. A linear regression
 - d. A t-test
30. You have collected some demographic data on age groups and would like to produce a pie chart to accompany the descriptive statistics which of the following commands could produce this pie chart
 - a. Frequencies
 - b. Descriptive
 - c. Explore
 - d. Cross tabs

P.R. Government College (Autonomous), Kakinada

Department of Statistics

Certificate Course 02: Descriptive Statistics with 'R' Software

Duration:40 Hours

No. of Credits(Extra): 01

Period of the course: During Odd Semester

ABOUT THE COURSE:

Any data analysis is incomplete without statistics. After getting the data, any statistical analysis starts with descriptive statistics which aims to extract the information hidden inside the data. The tools of descriptive statistics are based on mathematical and statistical functions which are to be evaluated using the software. The statistical software are paid as well as free. Most of the statistical software are paid software. Popular free statistical software is R.

Objective of the Course: What are the basic tools of descriptive statistics and how to use the R software for descriptive statistical analysis is the objective of the course to be taught.

Learning Outcomes: After completion of the course, the learners are able apply various tools of 'R' software to analyze descriptive statistics and to derive insights of the data.

INTENDED AUDIENCE:

Any UG student of Science, commerce and Humanities with very basic mathematical and statistical background.

COURSE LAYOUT:

Unit 1: Calculations with R Software: (8 Hrs)

Introduction, Basics, Data Vectors, Matrices, Handling missing data

Unit 2: Introduction to Descriptive Statistics, frequency distribution,

Central Tendency of Data: (10 Hrs)

Absolute frequencies, Relative frequencies, Cumulative frequency distribution, Mean, Median, Mode, GM and HM

Unit 3: Variation in Data and Bi-variate data and correlation analysis: (12 Hrs)

Range, Quartile deviation, Absolute Deviation, Standard deviation and variance

Correlation analysis of bi-variate data

Unit 4: Graphics and Plots: (10 Hrs)

Bar diagrams, Pie diagrams, kernel density, stem-leaf plots, Box plots, scatter plots.

References:

1. Software for Data Analysis: Programming with R (Statistics and Computing) by John M. Chambers(Springer)
2. [R reference card](#)(PDF)by Tom Short (more can be found under Short Documents and Reference Cards [here](#))
3. [Quick-R](#): quick online reference for data input, basic statistics and plots
- 4.[R programming](#) class on Coursera, taught by Roger Peng, Jeff Leek and Brian Caffo

P.R GOVERNMENT (A) COLLEGE, KAKINADA
DEPARTMENT OF STATISTICS
CERTIFICATE COURSE 02: Descriptive Statistics with R
Model Paper

Time:2hrs

maxmarks:50

SECTION-A

Answer all questions. Each question carries 2 marks

1. The output of the command `C(1,2,3,4)*C(1,2)` is
 a. 1, 4, 3, 8 b. 1, 4 c. 1, 4, 3, 4 d. Error
2. If `x=matrix(nrow = 2, ncol = 2, data = c(1,0,0,1))`, then which one of the following relations hold true ?
 a. `x%%x-x=x` b. `x%%x=x` c. `x*2=2+x` d. `x/x=1`
3. The outcome of the R command `c(3,4,5,6)^c(2,3,1)` is
 a. 9 64 5 36 b. 9 64 5 36 with a warning message
 c. 6 12 5 12 d. 6 12 5 12 with a warning message
4. Five cars run between two given points which are at a distance of 10 kilometres. The average of the time taken by these five cars is found and the experiment is repeated 100 times. The nature of variables defined by the “average time” is
 a. discrete b. continuous. c. sometimes discrete and sometimes continuous
 d. not clear as the information is inadequate
5. Which of the following command is to find out the cumulative frequency of a discrete data
 a. `cumsum(table(var, seq(a,b, by=c), right=FALSE))`
 b. `cumsum(table(cut(var, seq(a,b, by=c), right=FALSE)))`
 c. `cumsum(table(cut(var, right=FALSE)))`
 d. `cumfreq(table(cut.var, seq(a,b, by=c), right=FALSE))`
6. Suppose the number of graduate students in 15 localities are recorded and three such numbers get missed. The collected observations are as follows: 104,215,215,251,167,NA,308,NA,342,215,346,315,NA,364,253.
 Which one of the following is the correct command to obtain the arithmetic mean of this data in R?
 a. `mean(c(104,215,215,251,167,NA,308,NA,342,215,346,315,NA,364,253), na.rm=TRUE)`
 b. `mean(104,215,215,251,167,NA,308,NA,342,215,346,315,NA,364,253, na.rm=TRUE)`
 c. `mean((104,215,215,251,167,NA,308,NA,342,215,346,315,NA,364,253), na.rm=TRUE)`
 d. `sum((104,215,215,251,167,NA,308,NA,342,215,346,315,NA,364,253), na.rm=TRUE)/length((104,215,215,251,167,NA,308,NA,342,215,346,315,NA,364,253), na.rm=TRUE)`
7. The arithmetic means and variances of two data sets on volume of medicine on different bottles are obtained as follows. Based on the information provided by the coefficient of variations, which of the data set has more variability?

Data Set	A.M	Variance
I	200	36
II	180	81

 a. Both data sets have the same variability b. Second data set has more variability.
 c. First data set has more variability d. Inadequate data to compute the coefficient of variation.

8. The command in R to find absolute mean deviation around median of a data on X is

- a. `mean(abs(X-median(X)))` b. `abs(X-median(X))`
c. `Median(abs(X-median(X)))` d. `mean deviation(X-median(X))`

9. The command in R to get bar diagram with relative frequency data is

- a. `barplot(table(X))` b. `barplot(table(X)/length(X))`
c. `bardiagram(table(X))` d. `bardiagram(table(X)/length(X))`

10. The command in R to get a scatter plot for two data vectors X and Y

- a. `plot(X,Y)` b. `scatterplot(X,Y)` c. `lineplot(X,Y)` d. `barplot(X,Y)`

SECTION-B

Answer all questions. Each question carries 3 mark

11. If x is a matrix given by the R command

`x = matrix(nrow=3, ncol=3, data=c(1,8,8,10, 12, 4, 12, 18, 16))`, the output of `t(x)+2*t(x)+t(x)%t(x)` is

- a. `[,1] [,2] [,3]`
`[1,] 36 54 48`
`[2,] 30 36 12`
`[3,] 3 24 24`
b. `[,1] [,2] [,3]`
`[1,] 3 24 24`
`[2,] 30 36 12`
`[3,] 36 54 48`
c. `[,1] [,2] [,3]`
`[1,] 36 54 48`
`[2,] 3 24 24`
`[3,] 30 36 12`
d. `[,1] [,2] [,3]`
`[1,] 3 30 36`
`[2,] 24 36 54`
`[3,] 24 12 48`

Questions 12 to 14 are based on the following data set.

Following marks out of 100 were given to 200 students in an examination.

marks:

12.1, 80.0, 49.6, 83.5, 76.1, 90.3, 28.6, 45.1, 27.9, 33.7, 86.5, 11.9, 40.8, 41.2, 44.2, 18.5, 27.3, 66.3, 81.8, 42.7, 16.8, 29.6, 80.4, 17.3, 79.2, 52.9, 32.7, 28.2, 80.4, 11.3, 84.0, 8.8, 72.0, 86.6, 97.9, 25.7, 3.5, 23.1, 13.1, 39.1, 9.3, 29.0, 57.1, 33.5, 94.4, 38.4, 95.4, 28.1, 69.0, 14.6, 81.2, 76.5, 44.8, 46.2, 68.4, 8.4, 65.0, 79.2, 23.1, 5.1, 39.1, 35.1, 45.2, 39.3, 91.9, 18.2, 15.8, 61.7, 2.7, 7.5, 78.1, 93.6, 21.5, 64.7, 33.8, 95.6, 81.9, 74.3, 23.0, 5.5, 37.3, 74.4, 93.4, 67.6, 70.4, 84.9, 70.9, 86.0, 45.1, 68.0, 13.7, 73.9, 7.7, 28.8, 41.8, 94.4, 97.8, 4.8, 59.2, 4.0, 57.0, 10.7, 63.4, 82.0, 35.7, 14.3, 9.0, 35.7, 99.6, 53.8, 34.3, 32.1, 38.9, 2.8, 4.6, 88.0, 40.8, 47.5, 40.8, 70.5, 40.5, 50.7, 4.7, 30.5, 96.3, 93.6, 96.1, 79.5, 75.7, 7.5, 14.4, 13.2, 76.5, 90.4, 40.9, 19.1, 38.1, 51.1, 91.4, 8.6, 11.9, 75.7, 31.2, 72.7, 24.0, 40.0, 51.3, 94.1, 6.7, 31.2, 24.9, 39.1, 76.5, 86.6, 68.2, 68.0, 17.3, 80.5, 71.5, 92.9, 1.7, 60.0, 37.3, 74.5, 76.4, 26.8, 26.2, 68.2, 49.1, 38.5, 6.5, 90.0, 80.4, 48.6, 4.2, 51.7, 37.9, 50.4, 40.5, 3.1, 52.9, 16.9, 21.3, 97.5, 96.7, 76.2, 8.6, 52.1, 60.4, 44.3, 1.2, 44.1, 50.6, 67.3, 69.8, 78.5, 14.8, 17.2, 76.2, 44.9

12. The arithmetic mean of the data on marks is

- a. 44.85 b. 48.49 c. 65.46 d. 68.34

13. The median of the data on marks is

- a. 44.85 b. 48.49 c. 65.46 d. 68.34

14. The 25% and 75% quartiles of the data on marks are

- a. 1.200 and 75.800 respectively b. 23.775 and 99.600 respectively
c. 23.775 and 75.800 respectively d. 1.200 and 99.600 respectively

Questions 15 to 17 are based on the following data set.

Following yield (in kilograms) are reported from 200 agricultural fields of same size where 10 values are missing and are expressed as NA. The data is stored in a data vector yieldna:

yieldna:

34.4, 47.0, 19.6, 20.9, NA, NA, 47.2, 28.5, NA, 22.5, 18.3, 46.8, 12.1, 26.4, 28.3, 26.6, 36.8, 40.3, NA, 42.8, 13.7, 17.1, 35.7, NA, 33.7, 20.5, 45.4, 17.5, 29.6, 10.4, 24.4, 27.7, 15.0, 35.0, 22.1, 19.6, 24.3, 45.7, NA, 39.3, 49.7, 31.6, 27.4, NA, 15.9, 12.7, 11.0, 34.5, 37.9, 42.0, 15.5, 16.4, NA, 25.9, 17.5, 29.1, 31.8, 23.1, NA, 31.1, 15.3, 27.5, 34.8, 18.1, 15.4, 41.1, 35.4, 21.3, 17.7, 20.6, 31.2, 37.4, 25.3, NA, 14.7, 11.6, 30.2, 33.1, 43.6, 36.2, 47.8, 30.5, 13.4, 49.8, 26.1, 45.8, 45.1, 21.9, 15.3, 20.6, 10.2, 42.8, 17.0, 43.7, 16.7, 40.6, 30.8, 20.9, 23.7, 38.2, 33.7, 28.8, 23.5, 48.7, 35.8, 17.9, 24.3, 30.5, 45.3, 16.1, 19.2, 16.5, 34.6, 30.1, 17.5, 26.3, 33.3, 22.4, 29.2, 47.6, 11.8, 31.4, 27.7, 46.3, 45.2, 16.5, 40.1, 26.1, 32.3, 13.2, 14.7, 47.0, 45.2, 16.5, 31.3, 47.2, 23.0, 16.4, 48.0, 28.5, 18.8, 10.1, 34.8, 26.1, 46.0, 30.2, 39.1, 11.1, 25.2, 25.5, 23.5, 24.6, 35.6, 11.3, 37.8, 42.6, 30.3, 14.5, 46.3, 26.5, 29.0, 38.5, 19.7, 22.0, 38.2, 40.9, 10.6, 32.1, 36.1, 47.3, 37.6, 20.2, 26.4, 14.9, 15.3, 35.6, 23.9, 26.9, 47.6, 25.4, 19.1, 37.6, 10.4, 37.4, 41.7, 30.3, 22.3, 39.5, 22.2, 41.0, 14.5, 41.9, 29.6, 43.3, 40.3, 46.1, 21.1, 27.8, 20.9, 23.2

15. The absolute mean deviation around median of the data on yieldna is

- a. 19.3984 b. 19.638 c. 9.81932 d. 9.398421

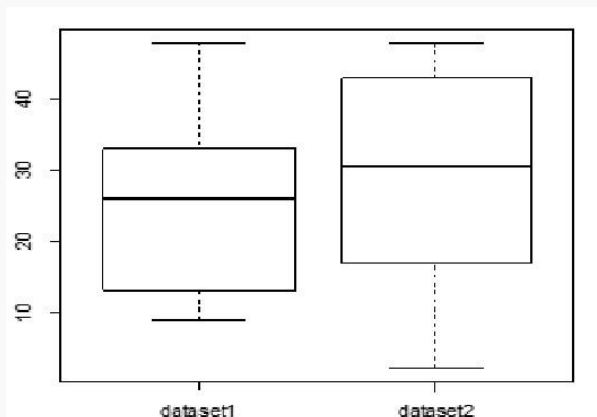
16. The value of variance of the data on yieldna is

- a. 131.3516 b. 130.6949 c. 122.6149 d. 120.4329

17. The value of coefficient of variation of the data on yieldna is

- a. 0.3833847 b. -0.3833847 c. 2.608346 d. -2.608346

18. Following are the boxplots of two datasets- dataset1 and dataset 2:



Which of the following statements are correct:

- (i) Quartile range of dataset 1 is more than the quartile range of dataset 2.
(ii) Quartile range of dataset 2 is more than the quartile range of dataset 1
(iii) Difference between minimum value of data and its median is smaller in dataset 1 than in dataset 2.
(iv) Difference between minimum value of data and its median is smaller in dataset 2 than in

dataset 1.

- a. (i) and (iii) b. (i) and (iv) c. (ii) and (iii) d. (ii) and (iv)

19. For the following data weight on the weights of 20 children

2.25, 1.43, 1.31, 9.24, 8.56, 2.61, 5.46, 3.76, 3.47, 2.15, 4.86, 7.26, 4.02, 7.31, 8.56, 8.94, 7.90, 3.90, 1.38, 9.03 ,

the outcome of the R command `stem(weight, scale=1)` is

a. 1 | 344

2 | 136

3 | 589

4 | 229

7 | 339

8 | 669

9 | 552

b. 1 | 344

2 | 136

3 | 589

4 | 229

7 | 339

8 | 669

9 | 552

c. 1 | 344

2 | 136

3 | 589

4 | 91

5 | 590

6 | 452

7 | 339

8 | 669

9 | 1

d. 1 | 344

3 | 589

5 | 5

7 | 339

9 | 02

20. Which of the commands are used to find correlation and plotting smooth trend line respectively

a. `cor(X,Y)` and `smooth.scatter(X,Y)` b. `cor(X,Y)` and `scatter.smooth(X,Y)`

c. `cor(X,Y)` and `plot(X,Y)`

d. `correlation(X,Y)` and `plot(X,Y)`

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