FOUR YEAR UNDERGRADUATE PROGRAM (NEP–2020)
Program: Bachelor in Science (2024 -28)
DISCIPLINE – STATISTICS
Session – 2024 -25

DSC -01 to 08		DSE -01 to 12	
Code	**Title**	**Code**	**Title**
STSC -01T	Descriptive Statistics	**STSE -01**	Numerical Analysis
STSC -01P	Lab Course – I (Descriptive Statistics)	**STSE -02T**	Time Series Analysis
STSC -02	Probability and Probability Distributions	**STSE -02P**	Lab Course - (Time Series Analysis)
STSC -03	Sampling Distribution	**STSE -03T**	Demography
STSC -04T	Survey Sampling and Indian Official Statistics	**STSE -03P**	Lab Course – (Demography)
STSC -04P	Lab Course (Survey Sampling and Indian Official Statistics)	**STSE -04T**	Multivariate Analysis
STSC -05T	Statistical Inference – I	**STSE -04P**	Lab Course – (Multivariate Analysis)
STSC -05P	Lab Course (Statistical Inference – I)	**STSE -05T**	Operations Research
STSC -06T	Statistical Inference – II	**STSE -05P**	Lab Course -1 (Operations Research)
STSC -06P	Lab Course (Statistical Inference – II)	**STSE -06**	Survival Analysis and Biostatistics
STSC -07T	Linear Models and Analysis of Variance	**STSE -07**	Reliability and Life Testing
STSC -07P	Lab Course - (Linear Models and Analysis of Variance)	**STSE -08T**	Econometrics
STSC -08T	Design of Experiments	**STSE -08P**	Lab Course - (Econometrics)
STSC -08P	Lab Course (Design Of Experiments)	**STSE -09**	Stochastic Processes and Queuing Theory
		STSE -10	Actuarial Analysis
		STSE -11	Categorical Data Analysis
		STSE -12	Financial Statistics
GE -01 & 02		**VAC**	
		STVAC-01	Quantitative Aptitude and MS Excel
STGE -01T	Descriptive Statistics	**SEC**	
STGE -01P	Lab Course – I (Descriptive Statistics)	**STSEC-01**	Statistical Data Analysis Using SPSS and R
STGE -02	Probability and Probability Distributions		

10/6/2024
(Dr. VYAS DUBEY)
Prof. & Head
SOS in Statistics
Pt. R.S.U., Raipur

(Dr. D.S. Thakur)
Representative of
comm. higher
education

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Program Outcomes (PO):

Qualification descriptors for a Bachelor's Degree: The qualification descriptors for a Bachelor's degree will demonstrate applications with a number of emerging

1. a systematic knowledge of an academic field of study and its issues,
2. procedural knowledge that creates professionals in the field of Statistics including government and public services
3. skills in the areas related to current developments in applications of Statistics. analysis and
4. demonstrate skills in collection of relevant quantitative and/or qualitative data, interpretation of data using appropriate statistical methodologies. ideas and complex
5. use knowledge, understanding and skills for critical assessment of a wide range of problems and issues relating to the chosen field of study.
6. communicate the results of studies undertaken in statistics in a range of different main concepts, constructs and techniques of the subject.
7. address one's learning needs relating to current and emerging areas of study, making professional materials as appropriate, including those related to new frontiers of knowledge.
8. apply one's statistical knowledge and skills to several contexts and to identify and
9. analyze problems and issues and seek solutions to real-life problems. Demonstrate subject-related skills that are relevant to some of the job trades and employment opportunities.

Program Specific Outcomes (PSO):

The student graduating with the Degree B.Sc. (General) Statistics should be able to

1. Demonstrate the ability to use skills in Statistics and different practicing areas for formulating and tackling Statistics related problems and identifying and applying appropriate principles and methodologies to solve a wide range of problems associated with Statistics.

2. Acquire (i) fundamental/systematic or coherent understanding of the academic field of Statistics and its different learning areas and applications. (ii) procedural knowledge that creates different types of professionals related to subject area of Statistics, including professionals engaged in government/public service and private sectors; skills in areas related to one's specialization area within the disciplinary/subject area of Statistics and emerging developments in the field of Statistics.

3. Recognize the importance of statistical modeling and computing, and the role of approximation and mathematical approaches to analyze the real problems using various statistical tools.

4. Plan and execute Statistical experiments or investigations, analyze and interpret data/information collected using appropriate methods, including the use of appropriate statistical software including programming languages, and report accurately the findings of the experiment/investigations.

5. Demonstrate relevant generic skills and global competencies such as

(i) problem-solving skills that are required to solve different types of Statistics related problems with well-defined solutions, and tackle open-ended problems that belong to the disciplinary-area boundaries;

(ii) investigative skills, including skills of independent thinking of Statistics-related issues and problems; communication skills involving the ability to listen carefully, to read texts and reference material analytically and to present information in a concise manner to different groups/audiences of technical or popular nature;

(iii) analytical skills involving paying attention to detail and ability to construct logical arguments using correct technical language related to Statistics and ability to translate them with popular language when needed;

(iv) ICT skills;

(v) personal skills such as the ability to work both independently and in a group.

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics Certificate / Diploma / Degree / Honors		**Semester - I**	**2024-25**
1.	**Course Code**	**STSC –01T**	
2.	**Course Title**	**Descriptive Statistics**	
3.	**Course Type**	**Discipline Specific Course**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Students will acquire ➢Knowledge of Statistics and its scope and importance in various areas such as Medical, Engineering, Agricultural and Social Sciences etc. ➢Knowledge of various types of data, their organization and evaluation of summary measures such as measures of central tendency and dispersion etc. ➢Insights into preliminary exploration of different types of data. ➢Kowledge of correlation, regression analysis, regression diagnostics, partial and multiple correlations.	
6.	**Credit Value**	**3 Credits**	**Credit = 15 Hours of teaching & Observation**
7.	**Total Marks**	**Max. Marks : 100**	**Min Passing Marks : 40**

PART B – Content Of the Course		
Total Number of Teaching learning periods (01 hr. per period) – 45 periods (45 hours)		
Unit	**Topics (Course Content)**	**No. of Periods**
I	**Statistical Methods** Definition and scope of Statistics, concepts of statistical population and sample.Data: quantitative and qualitative, attributes, variables, scales of measurement- nominal, ordinal, interval and ratio. Presentation: tabular and graphical, including histogram and ogives, consistency and independence of data with special reference to attributes.	**12**
II	**Measures of Central Tendency** Mathematical and positional measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments, absolute moments, factorial moments, skewness and kurtosis, Sheppard's corrections.	**11**
III	**Bivariate Data** Definition, scatter diagram, simple, partial and multiple correlation(3 variables only), rank correlation. Simple linear regression, principle of least squares and fitting of polynomials and exponential curves.	**11**
IV	**Index Numbers** Definition, construction of index numbers and problems thereof for weighted and unweighted index numbers including Laspeyre's, Paasche's, Edgeworth-Marshall and Fisher's. Chain index numbers, conversion of fixed based to chain based index numbers andvice-versa. Consumer price index numbers.	**11**
Keywords	***Statistical Methods, Measures of central tendency, Correlation, regression , Index Numbers***	
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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Gupta S.C. and Kapoor V.K. (2017): Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
3. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.

Reference Books Recommended –

1. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.

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- www.eshiksha.mp.gov.in
- www.vlab.co.in
- www.internshala.com
- www.ndl.iitkgp.ac.in

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**100 Marks**
Continuous Internal Assessment (CIA)	**30 Marks**
End Semester Exam (ESE)	**70 Marks**

Continuous Internal Assessment (CIA) (By Course Teacher)	Internal Test / Quiz (2) – **20 + 20** Assignment / Seminar – **10** Total Marks - **30**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **30** marks
End Semester Exam (ESE)	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1 = 10 marks** Q2. Short Answer Type – **5 X 4 = 20 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – **4 X 10 = 40 marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics Certificate / Diploma / Degree / Honors		Semester - I	2027 – 28
1.	Course Code	STSC –01P	
2.	Course Title	Lab Work – Descriptive Statistics	
3.	Course Type	Lab Course	
4.	Pre – Requisite (If Any)	As Per Program	
5.	Course Learning Outcomes (CLO)	➢ insights into preliminary exploration of different types of data, their representation through tabular and graphical means . ➢ organization and evaluation of measures of central tendency and dispersion. ➢ Practical applications of correlation, regression analysis, regression diagnostics, partial and multiple correlations. ➢ Calculation of various indices through Index number analysis, and its importance in economics.	
6.	Credit Value	1 Credits	Credit = 30 Hours of practical
7.	Total Marks	Max. Marks : 30	Min Passing Marks : 20

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 30 periods (30 hours)

Unit	Topics (Course Content)	No. of Periods
Lab Work / Field Work/ Experiments	1. Graphical representation of data. 2. Problems based on measures of central tendency. 3. Problems based on measures of dispersion. 4. Problems based on combined mean and variance and coefficient of variation. 5. Problems based on moments, skewness and kurtosis. 6. Fitting of polynomials, exponential curves. 7. Karl Pearson correlation coefficient. 8. Correlation coefficient for a bi-variate frequency distribution. 9. Lines of regression, angle between lines and estimated values of variables. 10. Spearman rank correlation with and without ties. 11. Partial and multiple correlations. 12. Planes of regression and variances of residuals for given simple correlations. 13. Calculate price and quantity index numbers using simple and weighted average ofprice relatives. 14. To calculate the Chain Base index numbers. 15. To calculate consumer price index number.	30
Keywords	*Graph, Correlation, dispersion , coefficient of variation, frequency distribution, rank correlation*	

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Text Books, References , Books and Others

Text Books Recommended –

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.

Reference Books Recommended –

1. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory ofStatistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.

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- www.eskillindia.org
- www.eshiksha.mp.gov.in
- www.vlab.co.in
- www.internshala.com
- www.ndl.iitkgp.ac.in

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**50 Marks**
Continuous Internal Assessment (CIA)	**15 Marks**
End Semester Exam (ESE)	**35 Marks**

Continuous Internal Assessment (CIA)15 (By Course Teacher)	Internal Test / Quiz (2) – **10 + 10** Assignment / Seminar – **05** Total Marks - **15**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **15** marks
End Semester Exam (ESE) 35	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics Certificate / Diploma / Degree / Honors		**Semester - II**	**2024 – 25**
1.	**Course Code**	**STSC –02**	
2.	**Course Title**	**Probability and Probability Distributions**	
3.	**Course Type**	**Discipline Specific Course**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Students will acquire ➢ ability to distinguish between random and non-random experiments, ➢ knowledge to conceptualise the probabilities of events including frequentist and axiomatic approach. Simultaneously, they will learn the notion of conditional probability including the concept of Bayes' Theorem, ➢ knowledge related to concept of discrete and continuous random variables and their probability distributions including expectation and moments, ➢ knowledge of important discrete and continuous distributions for applying in different situations.	
6.	**Credit Value**	**4 Credits**	**Credit = 15 Hours of teaching & Observation**
7.	**Total Marks**	**Max. Marks : 100**	**Min Passing Marks : 40**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 60 periods (60 hours)

Unit	Topics (Course Content)	No. of Periods
I	**Probability-** Introduction, random experiments, sample space, events and algebra of events. Definitions of Probability – classical, statistical, and axiomatic. Conditional Probability, laws of addition and multiplication, independent events, theorem of total probability, Bayes' theorem and its applications.	15
II	**Random variables-**Discrete and continuous random variables, p.m.f., p.d.f. and c.d.f., illustrations and properties of random variables, univariate transformations with illustrations. Two dimensional random variables: discrete and continuous type, joint, marginal and conditional p.m.f, p.d.f., and c.d.f., independence of variables, bivariate transformations withillustrations.	15
III	**Mathematical Expectation and Generating Functions -** Expectation of single and bivariate random variables and its properties. Moments and Cumulants, moment generating function, cumulant generating function and characteristic function. Uniqueness and inversion theorems (without proof) along with applications. Conditional expectations.	15
IV	**Standard Probability Distributions -** Binomial, Poisson, geometric, negative binomial, hypergeometric, uniform, normal, exponential, Cauchy, beta and gamma along with their properties and limiting/approximation cases	15
Keywords	*Probability, Random Variable, Moments, Cumulants*	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Gupta S.C. and Kapoor V.K. (2017): Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.
3. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.

Reference Books Recommended –

1. Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford &IBH Publishing, New Delhi

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- www.eskillindia.org
- www.eshiksha.mp.gov.in
- www.vlab.co.in
- www.internshala.com
- www.ndl.iitkgp.ac.in

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**100 Marks**
Continuous Internal Assessment (CIA)	**30 Marks**
End Semester Exam (ESE)	**70 Marks**

Continuous Internal Assessment (CIA) (By Course Teacher)	Internal Test / Quiz (2) – **20 + 20** Assignment / Seminar – **10** Total Marks - **30**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **30** marks
End Semester Exam (ESE)	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1 = 10 marks** Q2. Short Answer Type – **5 X 4 = 20 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – **4 X 10 = 40 marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics (Diploma / Degree / Honors)		**Semester - III**	Session: **2025-2026**
1.	**Course Code**	**STSC –03**	
2.	**Course Title**	**Sampling Distribution**	
3.	**Course Type**	**Discipline Specific Course**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Students will acquire ➢ The knowledge of various results regarding convergence of random variable,especially, to Normal Distribution. ➢ Distribution of various observations in order statistics. ➢ Obvious errors arises in testing of Hypothesis. ➢ Application of Chi-square, t and F tests in testing of Statistical Hypothesis.	
6.	**Credit Value**	**4 Credits**	**Credit = 15 Hours of teaching & Observation**
7.	**Total Marks**	**Max. Marks : 100**	**Min Passing Marks : 40**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 60 periods (60 hours)

Unit	Topics (Course Content)	No. of Periods
I	**Limit laws and Order Statistics** -Convergence in probability, almost sure convergence, convergence in mean square and convergence in distribution and their inter relations, Chebyshev's inequality, W.L.L.N., S.L.L.N. and their applications, De-Moivre Laplace theorem, Central Limit Theorem (C.L.T.) for i.i.d. variates, applications of C.L.T. and Liapunov Theorem (without proof). Introduction to Order Statistics, distribution of the rth order statistic, smallest and largest order statistics. Joint distribution of rth and sth order statistics, distribution of sample median and sample range.	15
II	**Sampling Methods** - Definitions of random sample, parameter and statistic, sampling distribution of a statistic, sampling distribution of sample mean, standard errors of sample mean, sample variance and sample proportion. Null and alternative hypotheses, level of significance, Type I and Type II errors, their probabilities and critical region. Large sample tests, use of CLT for testing single proportion, difference of two proportions, single mean, difference of two means, standard deviation and difference of standard deviations by classical and p-value approaches.	15
III	**Exact Sampling Distribution – I** - Definition and derivation of p.d.f. of $\chi 2$ with n degrees of freedom (d.f.) using m.g.f., nature of p.d.f. curve for different degrees of freedom, mean, variance, m.g.f., cumulant generating function, mode, additive property and limiting form of $\chi 2$ distribution. Tests of significance and confidence intervals based on χ^2 distribution.	15
IV	**Exact Sampling Distribution – II** - Student's and Fishers t-distribution, Derivation of its p.d.f., nature of probability curve with different degrees of freedom, mean, variance, moments and limiting form of t distribution. Snedecore's F-distribution, Derivation of p.d.f., nature of p.d.f. curve with different degrees of freedom, mean, variance and mode. Distribution of $1/F(n_1,n_2)$. Relationship between t, F and $\chi 2$ distributions. Test of significance and confidence Intervals based on t and F distributions.	15
Keywords	*Sampling Distribution, Random Sample, Exact Sample , t –Test, F – Test, Degree of Freedom*	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Gupta S.C. and Kapoor V.K. (2017): Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2003): *An Outline of Statistical Theory*, Vol. I, 4th Edn. World Press, Kolkata.
3. Rohatgi V. K. and Saleh, A.K. Md. E. (2009): An Introduction to Probability andStatistics. 2nd Edn. (Reprint) John Wiley and Sons.
4. Hogg, R.V. and Tanis, E.A. (2009): *A Brief Course in Mathematical Statistics*.Pearson Education.

Reference Books Recommended –

1. Johnson, R.A. and Bhattacharya, G.K. (2001): *Statistics-Principles and Methods*, 4thEdn. John Wiley and Sons.
2. Mood, A.M., Graybill, F.A. and Boes, D.C. (2007): *Introduction to the Theory ofStatistics*, 3rd Edn. (Reprint).Tata McGraw-Hill Pub. Co. Ltd.

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- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
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PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**100 Marks**
Continuous Internal Assessment (CIA)	**30 Marks**
End Semester Exam (ESE)	**70 Marks**

Continuous Internal Assessment (CIA) (By Course Teacher)	Internal Test / Quiz (2) – **20 + 20** Assignment / Seminar – **10** Total Marks - **30**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **30** marks
End Semester Exam (ESE)	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1 = 10 marks** Q2. Short Answer Type – **5 X 4 = 20 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – **4 X 10 = 40 marks**	

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DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics (Diploma / Degree / Honors)		**Semester - IV**	**2025 - 2026**
1.	**Course Code**	**STSC – 04 T**	
2.	**Course Title**	**Survey Sampling and Indian Official Statistics**	
3.	**Course Type**	**Discipline Specific Course**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Students will acquire ➢ basic knowledge of sampling techniques ➢ introduced to various statistical sampling schemes such as simple, stratified and systematic sampling. ➢ an idea of conducting the sample surveys and selecting appropriate sampling techniques, ➢ knowledge about comparing various sampling techniques. ➢ role of various statistical organizations in national development.	
6.	**Credit Value**	**3 Credits**	**Credit = 15 Hours of teaching & Observation**
7.	**Total Marks**	**Max. Marks : 100**	**Min Passing Marks : 40**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 45 periods (45 hours)

Unit	Topics (Course Content)	No. of Periods
I	Concept of population and sample, complete enumeration versus sampling, sampling and non-sampling errors. Types of sampling: non-probability and probability sampling, basic principle of sample survey, simple random sampling with and without replacement, definition and procedure of selecting a sample, estimates of: population mean, total and proportion, variances of these estimates, estimates of their variances and sample size determination.	12
II	Stratified random sampling: Technique, estimates of population mean and total, variances of these estimates, proportional and optimum allocations and their comparison with SRS.Practical difficulties in allocation, estimation of gain in precision, post stratification and its performance. Systematic Sampling: Technique, estimates of population mean and total, variances of these estimates (N=nxk). Comparison of systematic sampling with SRS and stratified sampling in the presence of linear trend and corrections.	11
III	Introduction to Ratio and regression methods of estimation, first approximation to the population mean and total (for SRS of large size), variances of these estimates and estimates of these variances, variances in terms of correlation coefficient for regression method of estimation and their comparison with SRS. Cluster sampling (equal clusters only) estimation of population mean and its variance, comparison (with and without randomly formed clusters). Relative efficiency of cluster sampling with SRS in terms of intra class correlation. Concept of sub sampling	11
IV	Present official statistical system in India, Methods of collection of official statistics, their reliability and limitations. Role of Ministry of Statistics & Program Implementation (MoSPI), Central Statistical Office (CSO), National Sample Survey Office (NSSO), and National Statistical Commission. Government of India's Principal publications containing data on the topics such as population, industry and finance.	11
Keywords	***Sampling, Errors of type 1 and 2, survey, SRS, MoSPI, CSO***	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Sukhatme,P.V., Sukhatme,B.V. Sukhatme,S. Asok,C.(1984). Sampling Theories of Survey With Application, IOWA State University Press and Indian Society of Agricultural Statistics
2. Murthy M.N. (1977): Sampling Theory & Statistical Methods, Statistical Pub. Society, Calcutta.
3. Des Raj and Chandhok P. (1998): Sample Survey Theory, Narosa Publishing House.
4. Goon A.M., Gupta M.K. and Dasgupta B. (2001): Fundamentals of Statistics (Vol.2), World Press.
5. Guide to current Indian Official Statistics, Central Statistical Office, GOI, New Delhi.

Reference Books Recommended –

1. Singh, D. and Chaudhary, F.S. (1986). Theory and Analysis of Sample Survey Designs. New Age International Publishers.
2. Cochran W.G. (1984):Sampling Techniques(3rd Ed.), Wiley Eastern.

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PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**100 Marks**
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End Semester Exam (ESE)	**70 Marks**

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End Semester Exam (ESE)	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1 = 10 marks** Q2. Short Answer Type – **5 X 4 = 20 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – **4 X 10 = 40 marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics (Diploma / Degree / Honors)		**Semester - IV**	**2025 - 2026**
1.	**Course Code**	**STSC – 04 P**	
2.	**Course Title**	**Lab Work - Survey Sampling and Indian Official Statistics**	
3.	**Course Type**	**Lab Course**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Students will acquire ➢ Practical knowledge of sampling techniques & various statistical sampling schemes ➢ Practical knowledge of conducting the sample surveys and selecting appropriate sampling techniques, ➢ knowledge about comparing various sampling techniques.	
6.	**Credit Value**	**1 Credits**	**Credit = 30 Hours of Practical**
7.	**Total Marks**	**Max. Marks : 30**	**Min Passing Marks : 20**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 45 periods (45 hours)

Unit	Topics (Course Content)	No. of Periods
Lab Work / Field Work/ Experiments	1. For a population of size 5, estimate population mean, population mean square and population variance. Enumerate all possible samples of size 2 by WR and WOR and establish all properties relative to SRS. 2. For SRSWOR, estimate mean, standard error, the sample size 3. Stratified Sampling: allocation of sample to strata by proportional and Neyman's methods Compare the efficiencies of above two methods relative to SRS 4. Estimation of gain in precision in stratified sampling. 5. Comparison of systematic sampling with stratified sampling and SRS in the presence of a linear trend. 6. Ratio and Regression estimation: Calculate the population mean or total of the population. Calculate mean squares. Compare the efficiencies of ratio and regression estimators relative to SRS. 7. Cluster sampling: estimation of mean or total, variance of the estimate, estimate of intra-class correlation coefficient, efficiency as compared to SRS.	
Keywords	***Sample, population mean, precision, systematics and stratified sampling***	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Sukhatme,P.V., Sukhatme,B.V. Sukhatme,S. Asok,C.(1984). Sampling Theories of Survey With Application, IOWA State University Press and Indian Society of Agricultural Statistics
2. Murthy M.N. (1977): Sampling Theory & Statistical Methods, Statistical Pub. Society, Calcutta.

Reference Books Recommended –

1. Singh, D. and Chaudhary, F.S. (1986). Theory and Analysis of Sample Survey Designs. New Age International Publishers.
2. Cochran W.G. (1984):Sampling Techniques(3rd Ed.), Wiley Eastern.

Online Resources –
E – resources / E – Books and E – Learning Portals

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- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**
- http://mospi.nic.in/

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**50 Marks**
Continuous Internal Assessment (CIA)	**15 Marks**
End Semester Exam (ESE)	**35 Marks**

Continuous Internal Assessment (CIA)15 (By Course Teacher)	Internal Test / Quiz (2) – **10 + 10** Assignment / Seminar – **05** Total Marks - **15**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **15** marks
End Semester Exam (ESE) 35	**Laboratory / Field Skill Performance: On spot Assessment** **D. Performed the Task based on lab. work - 20 Marks** **E. Spotting based on tools & technology (written) – 10 Marks** **F. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics Degree / Honors		**Semester - V**	**2026 – 27**
1.	**Course Code**	**STSC – 05 T**	
2.	**Course Title**	**Statistical Inference - I**	
3.	**Course Type**	**Discipline Specific Course**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	The students will acquire ➢ Concept of law large numbers and their uses ➢ Concept of central limit theorem and its uses in statistics ➢ knowledge about important inferential aspects such as point estimation, test of hypotheses and associated concepts, ➢ knowledge about inferences from Binomial, Poisson and Normal distributions asillustrations, ➢ concept about non-parametric method and some important non-parametric tests.	
6.	**Credit Value**	**3 Credits**	**Credit = 15 Hours of teaching & Observation**
7.	**Total Marks**	**Max. Marks : 100**	**Min Passing Marks : 40**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 45 periods (45 hours)

Unit	Topics (Course Content)	No. of Periods
I	Unbiasedness , Consistency, efficiency and sufficiency of point estimator, Fisher –Neyman factorization theorem, Cramer -Rao inequality, Bhattacharya bounds, Minimum Variance unbiased estimators, Minimal sufficient statistics,	12
II	Likelihood function, examples from standard discrete and continuous distributions. such as Bernoulli, Binomial, Poisson, normal, exponential gamma etc Methods of estimation – Method of maximum likelihood estimators, properties of maximum likelihood estimators. Method of scoring, method of moments, method of minimum chi-square, method of minimum variance, B.A.N. estimators. CAN estimators.	11
III	**Principles of test of significance** Null and alternative hypotheses (simple and composite), Type-I and Type-II errors, critical region, level of significance, size and power, best critical region, most powerful test, uniformly most powerful test, Neyman Pearson Lemma (statement and applications to construct most powerful test). Likelihood ratio test, properties of likelihood ratio tests (without proof). α, β,	11
IV	**Sequential Analysis** Sequential probability ratio test (SPRT) for simple vs simple hypotheses. Fundamental relations among α, β, A and B, determination of A and B in practice. Wald's fundamental identity and the derivation of operating characteristics (OC) and average sample number (ASN) functions, examples based on normal, Poisson, binomial and exponential distributions.	11
Keywords	**Minimal sufficient statistics, discrete and continuous distributions, SPRT**	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Goon A.M., Gupta M.K.: Das Gupta.B. (2005), Fundamentals of Statistics, Vol. I, World Press, Calcutta.
2. Rohatgi V. K. and Saleh, A.K. Md. E. (2009): An Introduction to Probability and Statistics. 2nd Edn. (Reprint) John Wiley and Sons.
3. Miller, I. and Miller, M. (2002) : John E. Freund's Mathematical Statistics (6th addition, low price edition), Prentice Hall of India.
4. Dudewicz, E. J., and Mishra, S. N. (1988): Modern Mathematical Statistics. John Wiley & Sons.

Reference Books Recommended –

1. Mood A.M, Graybill F.A. and Boes D.C,: Introduction to the Theory of Statistics,McGraw Hill.
2. Bhat B.R, Srivenkatramana T and Rao Madhava K.S. (1997) Statistics: A Beginner's Text, Vol. I, New Age International (P) Ltd.
3. Snedecor G.W and Cochran W.G.(1967) Statistical Methods. Iowa State UniversityPress.

Online Resources –

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- www.egyankosh.ac.in
- www.iitm.ac.in
- www.eskillindia.org
- www.eshiksha.mp.gov.in
- www.vlab.co.in
- www.internshala.com
- www.ndl.iitkgp.ac.in

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**100 Marks**
Continuous Internal Assessment (CIA)	**30 Marks**
End Semester Exam (ESE)	**70 Marks**

Continuous Internal Assessment (CIA) (By Course Teacher)	Internal Test / Quiz (2) – **20 + 20** Assignment / Seminar – **10** Total Marks - **30**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **30** marks
End Semester Exam (ESE)	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1 = 10 marks** Q2. Short Answer Type – **5 X 4 = 20 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – **4 X 10 = 40 marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics (Degree / Honors)		**Semester - V**	**2026 – 27**
1.	**Course Code**	**STSC – 05 P**	
2.	**Course Title**	**LAB WORK – Statistical Inference - I**	
3.	**Course Type**	**Discipline Specific Course**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Learn Practical aspect of law large numbers central limit theorem important inferential aspects inferences from Binomial, Poisson and Normal distributions asillustrations, non-parametric method	
6.	**Credit Value**	**1 Credits**	**Credit = 30 Hours of Practical**
7.	**Total Marks**	**Max. Marks : 50**	**Min Passing Marks : 40**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 30 periods (30 hours)

Unit	Topics (Course Content)	No. of Periods
Lab Work / Field Work/ Experiments	(1) Unbiased estimators (including unbiased but absurd estimators) (2) To compute Consistent estimators, efficient estimators and relative efficiency of estimators. (3) Cramer-Rao inequality and MVB estimators (4) Maximum Likelihood Estimation of parameter (5) Estimation by the method of moments, minimum Chi-square (6) To calculate Type I and Type II errors for given data	**30**
Keywords	**Minimal sufficient statistics, discrete and continuous distributions, SPRT**	

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Text Books Recommended –

1. Goon A.M., Gupta M.K.: Das Gupta.B. (2005), Fundamentals of Statistics, Vol. I, World Press, Calcutta.
2. Rohatgi V. K. and Saleh, A.K. Md. E. (2009): An Introduction to Probability and Statistics. 2nd Edn. (Reprint) John Wiley and Sons.

Reference Books Recommended –

1. Mood A.M, Graybill F.A. and Boes D.C,: Introduction to the Theory of Statistics,McGraw Hill.
2. Bhat B.R, Srivenkatramana T and Rao Madhava K.S. (1997) Statistics: A Beginner's Text, Vol. I, New Age International (P) Ltd.
3. Snedecor G.W and Cochran W.G.(1967) Statistical Methods. Iowa State UniversityPress.

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- www.eskillindia.org
- www.eshiksha.mp.gov.in
- www.vlab.co.in
- www.internshala.com
- www.ndl.iitkgp.ac.in

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**50 Marks**
Continuous Internal Assessment (CIA)	**15 Marks**
End Semester Exam (ESE)	**35 Marks**

Continuous Internal Assessment (CIA) 15 (By Course Teacher)	Internal Test / Quiz (2) – **10 + 10** Assignment / Seminar – **05** Total Marks - **15**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **15** marks
End Semester Exam (ESE)	**Laboratory / Field Skill Performance: On spot Assessment** **G. Performed the Task based on lab. work - 20 Marks** **H. Spotting based on tools & technology (written) – 10 Marks** **I. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics Certificate / Diploma / Degree / Honors		**Semester - VI**	**2026 – 27**
1.	**Course Code**	**STSC – 06 T**	
2.	**Course Title**	**Statistical Inference – II**	
3.	**Course Type**	**Discipline Specific Course**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	The student will able to learn ➢ to identify various poopulations, ➢ to take decision regaring population at smaller sample size with maximum probibility of true decision, ➢ systematic account of Neyman Pearson theory of testing and closely related theory of point estimation and confidence sets, together with their applications, ➢ To find out various best critical region for correct decision	
6.	**Credit Value**	**3 Credits**	**Credit = 15 Hours of teaching & Observation**
7.	**Total Marks**	**Max. Marks : 100**	**Min Passing Marks : 40**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 45 periods (45 hours)

Unit	Topics (Course Content)	No. of Periods
I	Non parametric test, Rank test, Wilcoxon test, Median test, Sign test, Mann-Whitney U test, Wald-Wolfowitz run test, Kolomogorov-Smirnov test, One sample location problem, chi square test of goodness of fit.	**12**
II	Sequential analysis: Wald's sequential probability ratio test (SPRT) with prescribed errors of two types, OC and ASN function of SPRT.	**11**
III	Generalized form of Neyman Pearson lemma, UMP test for simple null hypothesis against one sided alternatives in one parameter exponential family .Unbiased test, uniformly most powerful unbiased test ,Type "A" and type A_1 critical regions or locally most powerful unbiased test.	**11**
IV	Composite Hypothesis and similar regions, similar regions and complete sufficient statistics, Construction of most powerful similar regions, Unbiased critical regions, optimum regions and Sufficient Statistics. Likelihood ratio test, properties of likelihood ratio test, Likelihood ratio test for the mean of normal population, LR test for equality of means and variances of two and several normal populations.	**11**
Keywords	***Non parametric test, Sequential analysis, null hypothesis, Likelihood ratio test***	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Kale, B.K. (1999): A first Course on Parametric Inference, Narosa Publishing House.
2. Rohatgi V. (1988): An Introduction to Probability and Mathematical Statistics. Wiley Eastern Ltd. NewDelhi (Student Edition)
3. Lehmann, E.L.(1986)-(Latest): Theory of point Estimation (Student Edition).
4. Lehmann, E.L.(1986): Testing Statistical hypotheses (Student Edition).
5. Rao, C. R. (1973): Linear Statistical Inference.

Reference Books Recommended –

1. Zacks, S. (1971): Theory of Statistical Inference, John Wiley and Sons, New York.
2. Gibbons,J.D.(1985) : Nonparametric statistical inference 2nd Ed.,Marcel dekker,Inc.
3. Dudewicz, E.J. and Mishra, S.N. (1988). Modern Mathematical Statistics. Wiley Series in Prob. Math. Stat., John Wiley and Sons, New York (International Student Edition)
4. Ferguson, T.S. (1996). A course on Large Sample Theory. Chapman and Hall, London.
5. Ferguson, T.S. (1967) : Mathematical Statistics, Academic Press.

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- www.egyankosh.ac.in
- www.iitm.ac.in
- www.eskillindia.org
- www.eshiksha.mp.gov.in
- www.vlab.co.in
- www.internshala.com
- www.ndl.iitkgp.ac.in

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**100 Marks**
Continuous Internal Assessment (CIA)	**30 Marks**
End Semester Exam (ESE)	**70 Marks**

Continuous Internal Assessment (CIA) (By Course Teacher)	Internal Test / Quiz (2) – **20 + 20** Assignment / Seminar – **10** Total Marks - **30**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **30** marks
End Semester Exam (ESE)	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1 = 10 marks** Q2. Short Answer Type – **5 X 4 = 20 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – **4 X 10 = 40 marks**	

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DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics (Degree / Honors)		**Semester - VI**	**2026 – 27**
1.	**Course Code**	**STSC – 06 P**	
2.	**Course Title**	**LAB WORK – Statistical Inference - II**	
3.	**Course Type**	**Discipline Specific Course**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	The student will able to learn ➢ to take decision regaring population at smaller sample size with maximum probibility of true decision, ➢ ApplyingNeyman Pearson theory of testing and theory of point estimation and confidence sets, together with their applications, ➢ To find out various best critical region for correct decision	
6.	**Credit Value**	**3 Credits**	**Credit = 30 Hours of practical**
7.	**Total Marks**	**Max. Marks : 30**	**Min Passing Marks : 20**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 30 periods (30 hours)

Unit	Topics (Course Content)	No. of Periods
Lab Work / Field Work/ Experiments	1. Computation of Most powerful critical region 2. Computation of Uniformly most powerful critical region 3. Computation of Unbiased critical region 4. Draw Power curves 5. Likelihood ratio tests for simple null hypothesis against simple alternative hypothesis 6. Likelihood ratio tests for simple null hypothesis against composite alternative hypothesis 7. Computation of OC function and draw OC curve 8. Computation of ASN function and draw ASN curve	**30**
Keywords		

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PART C – Learning Resources		
Text Books, References , Books and Others		
Text Books Recommended – Reference Books Recommended –		
Online Resources – E – resources / E – Books and E – Learning Portals		
PART D – Assessment and Evaluation		
Suggested Continuous evaluation methods – **Max. Marks:** **50 Marks** **Continuous Internal Assessment (CIA)** **15 Marks** **End Semester Exam (ESE)** **35 Marks**		
Continuous Internal Assessment (CIA) 15 (By Course Teacher)	Internal Test / Quiz (2) – **10 + 10** Assignment / Seminar – **05** Total Marks - **15**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **15** marks
End Semester Exam (ESE) 35	**Laboratory / Field Skill Performance: On spot Assessment** **J. Performed the Task based on lab. work - 20 Marks** **K. Spotting based on tools & technology (written) – 10 Marks** **L. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**
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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics (Honors)		**Semester - VII**	**2027-28**
1.	**Course Code**	**STSC – 07 T**	
2.	**Course Title**	**Linear models and Analysis of Variance**	
3.	**Course Type**	**Discipline Specific Course**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Students will acquire ➢ the need of modeling random responses using independent predictors through various linear models in real life situations. ➢ Least square estimation of parameters of these models will be discussed along with their statistical significance. ➢ Comaprision of various population means under multi-way classified data.	
6.	**Credit Value**	**3 Credits**	**Credit = 15 Hours of teaching & Observation**
7.	**Total Marks**	**Max. Marks : 100**	**Min Passing Marks : 40**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 45 periods (45 hours)

Unit	Topics (Course Content)	No. of Periods
I	**Gauss-Markov set-up:** Theory of linear estimation, Estimability of linear parametric functions, Method of least squares, Gauss-Markov theorem, Estimation of error variance.	12
II	**Regression analysis:** Simple regression analysis, Estimation and hypothesis testing in case of simple and multiple regression models, Concept of model matrix and its use in estimation.	11
III	**Analysis of variance:** Definitions of fixed, random and mixed effect models, analysis of variance and covariance in one-way classified data for fixed effect models, analysis of variance and covariance in two-way classified data with one observation per cell for fixed effect models	11
IV	**Model checking**: Prediction from a fitted model, Violation of usual assumptions concerning normality, Homoscedasticity and collinearity, Diagnostics using quantile-quantile plots	11
Keywords	***Linear Estimation Regression Analysis Analysis Of Variance And Covariance Homoscedasticity And Collinearity***	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Weisberg, S. (2005). Applied Linear Regression (Third edition). Wiley.
2. Wu, C. F. J. And Hamada, M. (2009). Experiments, Analysis, and Parameter Design Optimization (Second edition), John Wiley.

Reference Books Recommended –

1. Renchner, A. C. And Schaalje, G. B. (2008). Linear Models in Statistics (Secondedition), John Wiley and Sons.

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E – resources / E – Books and E – Learning Portals
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PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**100 Marks**
Continuous Internal Assessment (CIA)	**30 Marks**
End Semester Exam (ESE)	**70 Marks**

Continuous Internal Assessment (CIA) (By Course Teacher)	Internal Test / Quiz (2) – **20 + 20** Assignment / Seminar – **10** Total Marks - **30**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **30** marks
End Semester Exam (ESE)	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1 = 10 marks** Q2. Short Answer Type – **5 X 4 = 20 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – **4 X 10 = 40 marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics (Honors)		**Semester - VII**	**2027 – 28**
1.	**Course Code**	**STSC – 07 P**	
2.	**Course Title**	**Lab Work - Linear models and Analysis of Variance**	
3.	**Course Type**	**Discipline Specific Course**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Students will acquire ➢ Practical knowledge of sampling techniques & various statistical sampling schemes ➢ Practical knowledge of conducting the sample surveys and selecting appropriate sampling techniques, ➢ knowledge about comparing various sampling techniques.	
6.	**Credit Value**	**1 Credits**	**Credit = 30 Hours of Practical**
7.	**Total Marks**	**Max. Marks : 30**	**Min Passing Marks : 20**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 30 periods (30 hours)

Unit	Topics (Course Content)	No. of Periods
Lab Work / Field Work/ Experiments	1. Estimability when X is a full rank matrix and not a full rank matrix 2. Distribution of Quadratic forms 3. Simple Linear Regression 4. Multiple Regression 5. Tests for Linear Hypothesis 6. Analysis of Variance of a one way classified data 7. Analysis of Variance of a two way classified data with one observation per cell 8. Analysis of Covariance of a one way classified data 9. Analysis of Covariance of a two way classified data	**30**
Keywords	***Sample, population mean, precision, systematics and stratified sampling***	

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Text Books, References , Books and Others

Text Books Recommended –

1. Weisberg, S. (2005). Applied Linear Regression (Third edition). Wiley.
2. Wu, C. F. J. And Hamada, M. (2009). Experiments, Analysis, and Parameter Design Optimization (Second edition), John Wiley.

Reference Books Recommended –

1. Renchner, A. C. And Schaalje, G. B. (2008). Linear Models in Statistics (Second edition), John Wiley and Sons.

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- www.eshiksha.mp.gov.in
- www.vlab.co.in
- www.internshala.com
- www.ndl.iitkgp.ac.in

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**50 Marks**
Continuous Internal Assessment (CIA)	**15 Marks**
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End Semester Exam (ESE) 35	**Laboratory / Field Skill Performance: On spot Assessment** **M. Performed the Task based on lab. work - 20 Marks** **N. Spotting based on tools & technology (written) – 10 Marks** **O. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction				
Program – Bachelor in Statistics (Degree / Honors)		**Semester - VIII**		**2027 – 28**
1.	**Course Code**	**STSC – 08 T**		
2.	**Course Title**	**Design of Experiments**		
3.	**Course Type**	**Discipline Specific Course**		
4.	**Pre – Requisite (If Any)**	**As Per Program**		
5.	**Course Learning Outcomes (CLO)**	Students will acquire ➢ carry out one way and two way Analysis of Variance. ➢ understand the basic terms used in design of experiments, ➢ use appropriate experimental designs to analyze the experimental data, ➢ apply Multiple range tests, the multiple t–test.		
6.	**Credit Value**	**3 Credits**	**Credit = 15 Hours of teaching & Observation**	
7.	**Total Marks**	**Max. Marks : 100**	**Min Passing Marks : 40**	

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 45 periods (45 hours)

Unit	Topics (Course Content)	No. of Periods
I	**Experimental designs:** Role, historical perspective, terminology, experimental error, basic principles, uniformity trials, fertility contour maps, choice of size and shape of plots and blocks. **Basic designs:** Completely Randomized Design (CRD), Randomized Block Design (RBD), Latin Square Design (LSD) – layout, model and statistical analysis, relative efficiency, analysis with missing observations.	
II	**Incomplete Block Designs:** Balanced Incomplete Block Design (BIBD) – parameters, relationships among its parameters, incidence matrix and its properties, Symmetric BIBD, resolvable BIBD, Affine Resolvable BIBD, Intra Block analysis, complimentary BIBD, Residual BIBD, Dual BIBD, Derived BIBD.	
III	**Factorial experiments:** advantages, notations and concepts, 2^2, 2^3…2^n and 3^2 factorial experiments, design and analysis, Total and Partial confounding for 2^n ($n \leq 5$), 3^2 and 3^3. Factorial experiments in a single replicate.	
IV	**Fractional factorial experiments:** Construction of one-half and one-quarter fractions of 2^n ($n \leq 5$) factorial experiments, Alias structure, Resolution of a design.	
Keywords	**Experimental designs, Incomplete Block Designs, Factorial experiments**	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Cochran, W.G. and Cox, G.M. (1959): Experimental Design. Asia Publishing House.
2. Das, M.N. and Giri, N.C. (1986): Design and Analysis of Experiments. Wiley Eastern Ltd.
3. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2005): Fundamentals of Statistics. Vol. II, 8th Edn. World Press, Kolkata.

Reference Books Recommended –

1. Kempthorne, O. (1965): The Design and Analysis of Experiments. John Wiley.
2. Montgomery, D. C. (2008): Design and Analysis of Experiments, John Wiley.

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- www.eskillindia.org
- www.eshiksha.mp.gov.in
- www.vlab.co.in
- www.internshala.com
- www.ndl.iitkgp.ac.in

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**100 Marks**
Continuous Internal Assessment (CIA)	**30 Marks**
End Semester Exam (ESE)	**70 Marks**

Continuous Internal Assessment (CIA) (By Course Teacher)	Internal Test / Quiz (2) – **20 + 20** Assignment / Seminar – **10** Total Marks - **30**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **30** marks
End Semester Exam (ESE)	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1 = 10 marks** Q2. Short Answer Type – **5 X 4 = 20 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – **4 X 10 = 40 marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics (Honors)		**Semester - VIII**	**2027 – 28**
1.	**Course Code**	**STSC – 08 P**	
2.	**Course Title**	**Lab Work – Design of Experiment**	
3.	**Course Type**	**Discipline Specific Course**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	➢ Understand practical aspects of design of experiment, selecting appropriate experimental designs to analyze the experimental data, understand the basic terms used in design of experiments, understand application of one way and two way Analysis of Variance, Multiple range tests, the multiple t–test.	
6.	**Credit Value**	**1 Credits**	**Credit = 30 Hours of practical**
7.	**Total Marks**	**Max. Marks : 30**	**Min Passing Marks : 20**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 30 periods (30 hours)

Unit	Topics (Course Content)	No. of Periods
Lab Work / Field Work/ Experiments	1. Analysis of data using CRD 2. Analysis of data using RBD 3. Analysis of data using LSD 4. Analysis of data using RBD with one missing observation 5. Analysis of data using LSD with one missing observation 6. Analysis of data using 2^2 and 2^3 factorial in CRD and RBD 7. Analysis of 2^2 and 2^3 factorial in LSD 8. Analysis of data using completely confounded two level factorial design in 2 blocks 9. Analysis of data using completely confounded two level factorial design in 4 blocks 10. Analysis of data using partially confounded two level factorial design	**30**
Keywords		

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Cochran, W.G. and Cox, G.M. (1959): Experimental Design. Asia Publishing House.
2. Das, M.N. and Giri, N.C. (1986): Design and Analysis of Experiments. Wiley Eastern Ltd.
3. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2005): Fundamentals of Statistics. Vol. II, 8th Edn. World Press, Kolkata.

Reference Books Recommended –

1. Kempthorne, O. (1965): The Design and Analysis of Experiments. John Wiley.
2. Montgomery, D. C. (2008): Design and Analysis of Experiments, John Wiley.

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- www.iitm.ac.in
- www.eskillindia.org
- www.eshiksha.mp.gov.in
- www.vlab.co.in
- www.internshala.com
- www.ndl.iitkgp.ac.in

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**50 Marks**
Continuous Internal Assessment (CIA)	**15 Marks**
End Semester Exam (ESE)	**35 Marks**

Continuous Internal Assessment (CIA)15 (By Course Teacher)	Internal Test / Quiz (2) – **10 + 10** Assignment / Seminar – **05** Total Marks - **15**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **15** marks
End Semester Exam (ESE) 35	**Laboratory / Field Skill Performance: On spot Assessment** **P. Performed the Task based on lab. work - 20 Marks** **Q. Spotting based on tools & technology (written) – 10 Marks** **R. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics (Diploma / Degree / Honors)		**Semester - III**	**2025-26**
1.	**Course Code**	**STSE – 01**	
2.	**Course Title**	**Numerical Analysis**	
3.	**Course Type**	**Discipline Specific Elective**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Students will acquire ➢ intermediate as well as out of range values using variuos formulae. ➢ missing value from a series of available values. ➢ integral values using numerical integration formulae.	
6.	**Credit Value**	**4 Credits**	**Credit = 15 Hours of teaching & Observation**
7.	**Total Marks**	**Max. Marks : 100**	**Min Passing Marks : 40**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 60 periods (60 hours)

Unit	Topics (Course Content)	No. of Periods
I	**Numerical Analysis:** Factorial, finite differences and interpolation. Operators, E and divided difference. Newton's forward interpolation formula and Newton's backward interpolation formula.	15
II	Newton's divided differences interpolation formula for unequal intervals. Lagrange's interpolation formulae. Central differences, Gauss Forward and backwok interpolation formula, Stirling and Bessel's interpolation formulae. Chioce of interpolation formula. Numerical differentiation.	15
III	Solution of Numerical Algebric and Trancedental equations, Graph Method, Regula-Falsi Method, Newton-Raphson method, Inherent error in Newton-Raphson method, Covergence of Newton-Raphson method, Multiple Roots and Nebhouring roots, Newton-Raphson method for solving equation, Graffe's Root squaring process. Homogeneous and non-homogeneous equation of first and second order.	15
IV	Numerical integration. Newton-Cotes Quadrature formula, Trapezoidal rule, Simpson's one-third rule, three-eights rule, Weddle's rule with error terms, Euler-Maclaurin Formula, Lubox formula Stirling's approximation to factorial n. Solution of difference equations of first order.	15
Keywords	***Finite Differences, Interpolation, Central Differences, Regula-Falsi, Difference Equations.***	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Saxena, H. C.: Finite diferences.
2. Grewal, B. S.: Numerical Methods in Engineeering and Science.
3. Jain,M. K., Iyengar, S. R. K. and Jain, R. K. (2003): Numerical methods for scientific and engineering computation, New age International Publisher, India.
4. Mukherjee, Kr. Kalyan (1990): Numerical Analysis. New Central Book Agency.

Reference Books Recommended –

1. Sastry, S.S. (2000): Introductory Methods of Numerical Analysis, 3rd edition,Prentice Hall of India Pvt. Ltd., New Delhi.

Online Resources –
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- www.egyankosh.ac.in
- www.iitm.ac.in
- www.eskillindia.org
- www.eshiksha.mp.gov.in
- www.vlab.co.in
- www.internshala.com
- www.ndl.iitkgp.ac.in

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**100 Marks**
Continuous Internal Assessment (CIA)	**30 Marks**
End Semester Exam (ESE)	**70 Marks**

Continuous Internal Assessment (CIA) (By Course Teacher)	Internal Test / Quiz (2) – **20 + 20**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **30** marks
	Assignment / Seminar – **10**	
	Total Marks - **30**	
End Semester Exam (ESE)	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1 = 10 marks** Q2. Short Answer Type – **5 X 4 = 20 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – **4 X 10 = 40 marks**	

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DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics (Diploma / Degree / Honors)		**Semester - IV**	**2025-26**
1.	**Course Code**	**STSE –2T**	
2.	**Course Title**	**Time Series Analysis**	
3.	**Course Type**	**Discipline Specific Elective**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Students will acquire ➢ the behaviour of data depending on time, ➢ specific way of analyzing a sequence of data points collected over an interval of time,	
6.	**Credit Value**	**3 Credits**	**Credit = 15 Hours of teaching & Observation**
7.	**Total Marks**	**Max. Marks : 100**	**Min Passing Marks : 40**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 45 periods (45 hours)

Unit	Topics (Course Content)	No. of Periods
I	Introduction to times series data, application of time series from various fields, Components of a times series, Decomposition of time series. Trend: Estimation of trend by free hand curve method, method of semi averages, fitting a various mathematical curve, and growth curves.	12
II	Method of moving averages. Detrending. Effect of elimination of trend on other components of the time series. Seasonal Component: Estimation of seasonal component by Method of simple averages, Ratio to Trend.	11
III	Ratio to Moving Averages and Link Relative method, Deseasonalization. Cyclic Component: Harmonic Analysis. Some Special Processes: Moving-average (MA) process and Autoregressive (AR) process of orders one and two, Estimation of the parameters of AR (1) and AR (2) – Yule-Walker equations.	11
IV	Random Component: Variate component method. Forecasting: Exponential smoothing methods, Short term forecasting methods: Brown's discounted regression, Box-Jenkins method and Bayesian forecasting. Stationary Time series: Weak stationarity, autocorrelation function and correlogram of moving average.	11
Keywords	***Times Series, Moving Averages, Deseasonalization, Forecasting, MA And AR***	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Kendall M.G. (1976): Time Series, Charles Griffin.
2. Chatfield C. (1980): The Analysis of Time Series –An Introduction, Chapman & Hall.

Reference Books Recommended –

1. Mukhopadhyay P. (2011): Applied Statistics, 2nd ed. Revised reprint, Books and Allied

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- www.eskillindia.org
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- www.internshala.com
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PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**100 Marks**
Continuous Internal Assessment (CIA)	**30 Marks**
End Semester Exam (ESE)	**70 Marks**

Continuous Internal Assessment (CIA) (By Course Teacher)	Internal Test / Quiz (2) – **20 + 20** Assignment / Seminar – **10** Total Marks - **30**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **30** marks
End Semester Exam (ESE)	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1 = 10 marks** Q2. Short Answer Type – **5 X 4 = 20 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – **4 X 10 = 40 marks**	

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DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics (Diploma / Degree / Honors)		**Semester - IV**	**2025-26**
1.	**Course Code**	**STSE – 02 P**	
2.	**Course Title**	**Lab Work - Time Series Analysis**	
3.	**Course Type**	**Discipline Specific Elective**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Students will acquire ➢ the behaviour of data over time, ➢ specific way of analyzing a time series	
6.	**Credit Value**	**1 Credits**	**Credit = 30 Hours of Practical**
7.	**Total Marks**	**Max. Marks : 30**	**Min Passing Marks : 20**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 30 periods (30 hours)

Unit	Topics (Course Content)	No. of Periods
Lab Work / Field Work/ Experiments	1. Fitting and plotting of modified exponential curve 2. Fitting and plotting of Gompertz curve 3. Fitting and plotting of logistic curve 4. Fitting of trend by Moving Average Method 5. Measurement of Seasonal indices Ratio-to-Trend method 6. Measurement of Seasonal indices Ratio-to-Moving Average method 7. Measurement of seasonal indices Link Relative method 8. Calculation of variance of random component by variate difference method 9. Forecasting by exponential smoothing 10. Forecasting by short term forecasting methods.	**30**
Keywords	***Times Series, Moving Averages, Deseasonalization, Forecasting, MA And AR***	

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Text Books, References , Books and Others

Text Books Recommended –

1. Kendall M.G. (1976): Time Series, Charles Griffin.
2. Chatfield C. (1980): The Analysis of Time Series –An Introduction, Chapman & Hall.

Reference Books Recommended –

1. Mukhopadhyay P. (2011): Applied Statistics, 2nd ed. Revised reprint, Books and Allied

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- www.eskillindia.org
- www.eshiksha.mp.gov.in
- www.vlab.co.in
- www.internshala.com
- www.ndl.iitkgp.ac.in

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**50 Marks**
Continuous Internal Assessment (CIA)	**15 Marks**
End Semester Exam (ESE)	**35 Marks**

Continuous Internal Assessment (CIA)15 (By Course Teacher)	Internal Test / Quiz (2) – **10 + 10** Assignment / Seminar – **05** Total Marks - **15**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **15** marks
End Semester Exam (ESE) 35	**Laboratory / Field Skill Performance: On spot Assessment** **S. Performed the Task based on lab. work - 20 Marks** **T. Spotting based on tools & technology (written) – 10 Marks** **U. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics (Degree / Honors)		**Semester - V**	**2026-27**
1.	**Course Code**	**STSE –03T**	
2.	**Course Title**	**Demography**	
3.	**Course Type**	**Discipline Specific Elective**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	The students will acquire ➢ commonly used measures of demography pertaining to its three basic aspects, viz. the fertility, mortality and migration, ➢ various data collection methods enabling them to have a better insight in policy making, planning and systematic implementation, ➢ Construction and implication of life tables, ➢ Population growth curves, population estimates and projections,	
6.	**Credit Value**	**3 Credits**	**Credit = 15 Hours of teaching & Observation**
7.	**Total Marks**	**Max. Marks : 100**	**Min Passing Marks : 40**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 45 periods (45 hours)

Unit	Topics (Course Content)	No. of Periods
I	**Population Theories -**Coverage and content errors in demographic data, use of balancing equations and Chandrasekhar and Deming formula to check completeness of registration data.Adjustment of age data, use of Myer and UN indices, Population composition, dependency ratio.	12
II	**Vital Statistics-** Introduction and sources of collecting data on vital statistics, errors in census and registration data. Measurement of population, rate and ratio of vital events. Measurements of Mortality: Crude Death Rate (CDR), Specific Death Rate (SDR), Infant Mortality, Rate (IMR) and Standardized Death Rates.	11
III	**Mortality Tables-** Stationary and Stable population, Central Mortality Rates and Force of Mortality. Life(Mortality) Tables, Assumption, description, construction of Life Tables and Uses of Life Tables.	11
IV	**Abridged Life Tables-** Concept and construction of abridged life tables by Reed-Merrell method, Greville's method and King's Method. Measurements of Fertility: Crude Birth Rate (CBR), General Fertility Rate (GFR), Specific Fertility Rate (SFR) and Total Fertility Rate (TFR). Measurement of Population Growth: Crude rates of natural increase, Pearl's Vital Index, Gross Reproduction Rate (GRR) and Net Reproduction Rate (NRR).	11
Keywords	***Demography, Vital Statistics , Mortality , Life Tables, Reproduction Rate***	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Gun, A.M., Gupta, M.K. and Dasgupta, B. (2008): Fundamentals of Statistics, Vol. II, 9th Edition, World Press.
2. Biswas, S. (1988): Stochastic Processes in Demography & Application, Wiley Eastern Ltd.
3. Croxton, Fredrick E., Cowden, Dudley J. and Klein, S. (1973): Applied GeneralStatistics, 3rd Edition. Prentice Hall of India Pvt. Ltd.
4. Keyfitz N., Beckman John A.: Demogrphy through Problems S-Verlag New york.

Reference Books Recommended –

1. Mukhopadhyay P. (1999): Applied Statistics, Books and Allied (P) Ltd.

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- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

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Continuous Internal Assessment (CIA)	**30 Marks**
End Semester Exam (ESE)	**70 Marks**

Continuous Internal Assessment (CIA) (By Course Teacher)	Internal Test / Quiz (2) – **20 + 20** Assignment / Seminar – **10** Total Marks - **30**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **30** marks
End Semester Exam (ESE)	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1 = 10 marks** Q2. Short Answer Type – **5 X 4 = 20 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – **4 X 10 = 40 marks**	

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DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics (Diploma / Degree / Honors)		**Semester - IV**	**2025-26**
1.	**Course Code**	**STSE – 03 P**	
2.	**Course Title**	**Lab Work - Demography**	
3.	**Course Type**	**Discipline Specific Elective**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	The students will acquire ➢ various data collection methods related to demography and vital statistics ➢ Construction and implication of life tables, ➢ Construction and analysis of Population growth curves, population estimates and projections,	
6.	**Credit Value**	**1 Credits**	**Credit = 30 Hours of Practical**
7.	**Total Marks**	**Max. Marks : 30**	**Min Passing Marks : 20**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 30 periods (30 hours)

Unit	Topics (Course Content)	No. of Periods
Lab Work / Field Work/ Experiments	1. Practical based on life models and tables 2. To calculate CDR and Age Specific death rate for a given set of data 3. To find Standardized death rate by:- (i) Direct method (ii) Indirect method 4. To construct a complete life table 5. To fill in the missing entries in a life table 6. To calculate probabilities of death at pivotal ages and use it construct abridged lifetable using (i) Reed-Merrell Method, (ii) Greville's Method and (iii) King'sMethod 7. To calculate CBR, GFR, SFR, TFR for a given set of data 8. To calculate Crude rate of Natural Increase and Pearle's Vital Index for a given set ofdata 9. Calculate GRR and NRR for a given set of data and compare them	**30**
Keywords	***Life Table, CDR, Death Rate, Reproduction Rate, Vital Index, GRR, NRR***	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Biswas, S. (1988): Stochastic Processes in Demography & Application, Wiley Eastern Ltd.
2. Croxton, Fredrick E., Cowden, Dudley J. and Klein, S. (1973): Applied GeneralStatistics, 3rd Edition. Prentice Hall of India Pvt. Ltd.
3. Keyfitz N., Beckman John A.: Demogrphy through Problems S-Verlag New york.

Reference Books Recommended –

1. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory ofStatistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.

Online Resources –

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- www.internshala.com
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Suggested Continuous evaluation methods –

Max. Marks:	**50 Marks**
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End Semester Exam (ESE)	**35 Marks**

Continuous Internal Assessment (CIA)15 (By Course Teacher)	Internal Test / Quiz (2) – **10 + 10** Assignment / Seminar – **05** Total Marks - **15**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **15** marks
End Semester Exam (ESE) 35	**Laboratory / Field Skill Performance: On spot Assessment** **V. Performed the Task based on lab. work - 20 Marks** **W. Spotting based on tools & technology (written) – 10 Marks** **X. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction				
Program – Bachelor in Statistics Certificate / Diploma / Degree / Honors		**Semester - VI**		**2026 – 27**
1.	**Course Code**	**STSE – 04 T**		
2.	**Course Title**	**Multivariate Analysis**		
3.	**Course Type**	**Discipline Specific Elective**		
4.	**Pre – Requisite (If Any)**	**As Per Program**		
5.	**Course Learning Outcomes (CLO)**	Students will acquire ➢ the statistical estimation and testing problems when the underlying structure is multivariate in nature. ➢ Various multivariate techniques (estimation and testing) required to handle two or more correlated response variables. ➢ two or more sample multivariate normal mean vectors testing problems.		
6.	**Credit Value**	**3 Credits**	**Credit = 15 Hours of teaching & Observation**	
7.	**Total Marks**	**Max. Marks : 100**	**Min Passing Marks : 40**	

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 45 periods (45 hours)

Unit	Topics (Course Content)	No. of Periods
I	**Bivariate Normal Distribution (BVN)** p.d.f. of BVN, properties of BVN, marginal and conditional p.d.f. of BVN.	
II	**Multivariate Normal distribution and its properties** Conditional distribution of a sub-set of multivariate normal variable/ Random sampling from a multivariate normal distribution. Maximum likelihood estimators of parameters.	
III	**Applications of Multivariate Analysis** Multiple and partial correlation coefficient and their properties. Discriminant Analysis, Principal Components Analysis and Factor Analysis.	
IV	**Multivariate Statistics** Distribution of sample mean vector, Distribution of Hotelling's T^2 statistic. Application in tests on mean vector for one and more multivariate normal populations, Mahalanobis D^2 Statistic.	
Keywords	BVN, Multivariate Statistics, Multivariate Analysis, Discriminant Analysis	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Anderson, T.W. (2003): An Introduction to Multivariate Statistical Analysis, 3rd Edn.,John Wiley
2. Muirhead, R.J. (1982): Aspects of Multivariate Statistical Theory, John Wiley.
3. Kshirsagar, A.M. (1972) :Multivariate Analysis, 1st Edn. Marcel Dekker.
4. Johnson, R.A. and Wichern, D.W. (2007): Applied Multivariate Analysis, 6th Edn.,Pearson & Prentice Hall

Reference Books Recommended –

1. Mukhopadhyay, P. :Mathematical Statistics.
2. Gibbons, J. D. and Chakraborty, S (2003): Nonparametric Statistical Inference. 4th Edition. Marcel Dekker, CRC.

Online Resources –
E – resources / E – Books and E – Learning Portals

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**100 Marks**
Continuous Internal Assessment (CIA)	**30 Marks**
End Semester Exam (ESE)	**70 Marks**

Continuous Internal Assessment (CIA) 30 (By Course Teacher)	Internal Test / Quiz (2) – **20 + 20** Assignment / Seminar – **10** Total Marks - **30**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **30** marks
End Semester Exam (ESE) 70	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1 = 10 marks** Q2. Short Answer Type – **5 X 4 = 20 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – **4 X 10 = 40 marks**	

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DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction				
Program – Bachelor in Statistics Certificate / Diploma / Degree / Honors		Semester - VI		2026 – 27
1.	Course Code	STSE – 04 P		
2.	Course Title	Lab work - Multivariate Analysis		
3.	Course Type	Discipline Specific Elective		
4.	Pre – Requisite (If Any)	As Per Program		
5.	Course Learning Outcomes (CLO)			
6.	Credit Value	1 Credits	Credit = 30 Hours of Practical Work	
7.	Total Marks	Max. Marks : 50	Min Passing Marks : 20	

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 30 periods (30 hours)

Unit	Topics (Course Content)	No. of Periods
Lab Work / Field Work/ Experiments	1. Computation of Multiple Correlation 2. Computation of Partial Correlation 3. Estimation of Bivariate Normal Distribution, 4. Estimation of Multivariate Normal Distribution 5. Estimation of Discriminant Analysis 6. Estimation of Principal Components Analysis 7. Estimation of Factor Analysis	**30**
Keywords		

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Anderson, T.W. (2003): An Introduction to Multivariate Statistical Analysis, 3rd Edn.,John Wiley
2. Muirhead, R.J. (1982): Aspects of Multivariate Statistical Theory, John Wiley.
3. Kshirsagar, A.M. (1972) :Multivariate Analysis, 1st Edn. Marcel Dekker.

Reference Books Recommended –

1. Gibbons, J. D. and Chakraborty, S (2003): Nonparametric Statistical Inference. 4th Edition. Marcel Dekker, CRC.

Online Resources –
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PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**50 Marks**
Continuous Internal Assessment (CIA)	**15 Marks**
End Semester Exam (ESE)	**35 Marks**

Continuous Internal Assessment (CIA) 15 (By Course Teacher)	Internal Test / Quiz (2) – **10 + 10** Assignment / Seminar –**05** Total Marks - **15**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **15**marks
End Semester Exam (ESE) 35	**Laboratory / Field Skill Performance: On spot Assessment** **Y. Performed the Task based on lab. work - 20 Marks** **Z. Spotting based on tools & technology (written) – 10 Marks** **AA. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics Certificate / Diploma / Degree / Honors		**Semester - VII**	**2027-28**
1.	**Course Code**	**STSE – 05 T**	
2.	**Course Title**	**Operations Research**	
3.	**Course Type**	**Discipline Specific Elective**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Students will acquire ➢ the idea of formulation and solution of linear programming problems related to industry. ➢ various methods of solving transportation problems in industry. ➢ solution of inventory problems in industry. ➢ various inventory management methods and their solutions in industry.	
6.	**Credit Value**	**3 Credits**	**Credit = 15 Hours of teaching & Observation**
7.	**Total Marks**	**Max. Marks : 100**	**Min Passing Marks : 40**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 60 periods (60 hours)

Unit	Topics (Course Content)	No. of Periods
I	**Introduction to Operations Research** phases of O.R., model building, various types of O.R. problems. Linear Programming Problem, Mathematical formulation of the L.P.P, graphical solutions of a L.P.P. Simplex method for solving L.P.P. Charne's M-technique for solving L.P.P. involving artificial variables. Special cases of L.P.P. Concept of Duality in L.P.P: Dual simplex method. Post-optimality analysis	12
II	**Transportation Problem:** Initial solution by North West corner rule, Least cost method and Vogel's approximation method (VAM), MODI's method to find the optimal solution, special cases of transportation problem. Assignment problem: Hungarian method to find optimal assignment, special cases of assignment problem.	11
III	**Game theory:** Rectangular game, minimax-maximin principle, solution to rectangular game using graphical method, dominance and modified dominance property to reduce the game matrixand solution to rectangular game with mixed strategy. Networking: Shortest route and minimal spanning tree problem.	11
IV	**Inventory Management:** ABC inventory system, characteristics of inventory system. EOQ Model and its variations, with and without shortages, Quantity Discount Model with price breaks.	11
Keywords	*Operations Research, LPP, Transport problem, Assignment problem, Game theory, Inventory , EOQ*	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Taha, H. A. (2007): Operations Research: An Introduction, 8th Edition, Prentice Hall of India.
2. KantiSwarup, Gupta, P.K. and Manmohan (2007): Operations Research, 13th Edition, Sultan Chand and Sons.
3. Hadley, G: (2002) : Linear Programming, Narosa Publications

Reference Books Recommended –

1. Hillier, F.A and Lieberman, G.J. (2010): Introduction to Operations Research-Concepts and cases, 9th Edition, Tata McGraw Hill

Online Resources –
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PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**100 Marks**
Continuous Internal Assessment (CIA)	**30 Marks**
End Semester Exam (ESE)	**70 Marks**

Continuous Internal Assessment (CIA) (By Course Teacher)	Internal Test / Quiz (2) – **20 + 20** Assignment / Seminar – **10** Total Marks - **30**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **30** marks
End Semester Exam (ESE)	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1 = 10 marks** Q2. Short Answer Type – **5 X 4 = 20 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – **4 X 10 = 40 marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics (Honors)		**Semester - VII**	**2027-28**
1.	**Course Code**	**STSE – 05 P**	
2.	**Course Title**	**Lab Work – Operations Research**	
3.	**Course Type**	**Discipline Specific Elective**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Students will acquire practical knowledge of ➢ the idea of formulation and solution of linear programming problems related to industry. ➢ various methods of solving transportation problems in industry. ➢ solution of inventory problems in industry. various inventory management methods and their solutions in industry	
6.	**Credit Value**	**1 Credits**	**Credit = 30 Hours of Practical**
7.	**Total Marks**	**Max. Marks : 30**	**Min Passing Marks : 20**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 45 periods (45 hours)

Unit	Topics (Course Content)	No. of Periods
Lab Work / Field Work/ Experiments	1. Mathematical formulation of L.P.P and solving the problem using graphical method,Simplex technique and Charne's Big M method involving artificial variables. 2. Identifying Special cases by Graphical and Simplex method and interpretation -Degenerate solution -Unbounded solution -Alternate solution -Infeasible solution 3. Post-optimality -Addition of constraint -Change in requirement vector -Addition of new activity -Change in cost vector 4. Allocation problem using Transportation model 5. Allocation problem using Assignment model 6. Networking problem -Minimal spanning tree problem -Shortest route problem 7. Problems based on game matrix -Graphical solution to m x 2 / 2 x n rectangular game -Mixed strategy 8. To find optimal inventory policy for EOQ models and its variations 9. To solve all-units quantity discounts model	**30**
Keywords	*Operations Research, LPP, Transport problem, Assignment problem, Game theory, Inventory , EOQ*	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Taha, H. A. (2007): Operations Research: An Introduction, 8th Edition, Prentice Hall of India.
2. KantiSwarup, Gupta, P.K. and Manmohan (2007): Operations Research, 13th Edition, Sultan Chand and Sons.
3. Hadley, G: (2002) : Linear Programming, Narosa Publications

Reference Books Recommended –

1. Hillier, F.A and Lieberman, G.J. (2010): Introduction to Operations Research-Concepts and cases, 9th Edition, Tata McGraw Hill

Online Resources –
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PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**50 Marks**
Continuous Internal Assessment (CIA)	**15 Marks**
End Semester Exam (ESE)	**35 Marks**

Continuous Internal Assessment (CIA)15 (By Course Teacher)	Internal Test / Quiz (2) – **10 + 10** Assignment / Seminar – **05** Total Marks - **15**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **15** marks
End Semester Exam (ESE) 35	**Laboratory / Field Skill Performance: On spot Assessment** **BB. Performed the Task based on lab. work - 20 Marks** **CC. Spotting based on tools & technology (written) – 10 Marks** **DD. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics (Honors)		**Semester - VII**	**2027-28**
1.	**Course Code**	**STSE – 06**	
2.	**Course Title**	**Survival Analysis and Biostatistics**	
3.	**Course Type**	**Discipline Specific Elective**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Students will acquire ➢ statistical analysis used in survival data, ➢ knowledge about behavior of biological data,	
6.	**Credit Value**	**4 Credits**	**Credit = 15 Hours of teaching & Observation**
7.	**Total Marks**	**Max. Marks : 100**	**Min Passing Marks : 40**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 60 periods (60 hours)

Unit	Topics (Course Content)	No. of Periods
I	**Survival Analysis:** Functions of survival times, survival distributions and their applications-exponential, gamma, Weibull, Rayleigh, lognormal, death density function for a distribution having bath-tub shaped hazard function. **Censoring Schemes:** Type I, Type II and progressive or random censoring with biological examples. Estimation of mean survival time and variance of the estimator for Type I and Type II censored data with numerical examples. Non-parametric methods: Actuarial and Kaplan-Meier methods for estimating survival function and variance of the Estimator.	15
II	**Competing Risk Theory:** Indices for measurement of probability of death under competing risks and their inter-relations. Estimation of probabilities of death using maximum likelihood principle and modified minimum Chi-square methods. Theory of independent and dependent risks. Bivariate normal dependent risk model.	15
III	**Stochastic Epidemic Models**: Simple epidemic models, general epidemic model definition and concept (without derivation). Duration of an epidemic.	15
IV	**Statistical Genetics**: Introduction, concepts-Genotype, Phenotype, Dominance, Recessiveness, Linkage and Recombination, Coupling and Repulsion. Mendelian laws of Heredity, Random mating, Gametic Array .relation between genotypic array and gametic array under random mating. Distribution of genotypes under random mating. Clinical Trials: Planning and design of clinical trials, Phase I, II and III trials. Single Blinding	15
Keywords	***Survival Analysis, Censoring Schemes, Stochastic Epidemic Models, Statistical Genetics***	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Lee, E.T. and Wang, J.W. (2003): Statistical Methods for Survival data Analysis, 3rd Edition, John Wiley and Sons.
2. Biswas, S. (2007): Applied Stochastic Processes: A Biostatistical and Population Oriented Approach, Reprinted 2ndCentral Edition, New Central Book Agency.
3. Kleinbaum, D.G. (1996): Survival Analysis, Springer.

Reference Books Recommended –

1. Chiang, C.L. (1968): Introduction to Stochastic Processes in Bio Statistics, John Wiley and Sons.
2. Indrayan, A. (2008): Medical Biostatistics, 2nd Edition Chapman and Hall/CRC.

Online Resources –
E – resources / E – Books and E – Learning Portals

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**100 Marks**
Continuous Internal Assessment (CIA)	**30 Marks**
End Semester Exam (ESE)	**70 Marks**

Continuous Internal Assessment (CIA) (By Course Teacher)	Internal Test / Quiz (2) – **20 + 20** Assignment / Seminar – **10** Total Marks - **30**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **30** marks
End Semester Exam (ESE)	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1 = 10 marks** Q2. Short Answer Type – **5 X 4 = 20 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – **4 X 10 = 40 marks**	

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DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics Certificate / Diploma / Degree / Honors		**Semester - VII**	**2027-28**
1.	**Course Code**	**STSE – 07**	
2.	**Course Title**	**Reliability and Life Testing**	
3.	**Course Type**	**Discipline Specific Elective**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Students will acquire ➢ Survival analysis of equipments in the industry. ➢ Getting the decision of surviving time to any product.	
6.	**Credit Value**	**4 Credits**	**Credit = 15 Hours of teaching & Observation**
7.	**Total Marks**	**Max. Marks : 100**	**Min Passing Marks : 40**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 60 periods (60 hours)

Unit	Topics (Course Content)	No. of Periods
I	**Reliability concepts and measures** - reliability function; hazard rate; components and systems; coherent systems; reliability of coherent systems; cuts and paths; modular decomposition; bounds on system reliability ; structural and reliability importance of components.	15
II	**Life distributions** - common life distributions-exponential, Weibull, gamma etc. Estimation of parameters and tests in these models. Notions of ageing; IFR, IFRA, NBU, DMRL, and NBUE Classes and their duals; loss of memory property of the exponential distribution; closures or these classes under formation of coherent systems, convolutions and mixtures.	15
III	Univariate shock models and life distributions arising out of them; bivariate shock models; common bivariate exponential distributions and their properties. Reliability estimation based on failure times in variously censored life tests and in tests with replacement of failed items.	15
IV	Stress-strength reliability and its estimation. Maintainability and availability, Maintenance and replacement policies; availability of repairable systems; modeling of a repairable system by a non-homogeneous Poisson process. Reliability growth models; Hollander-Proschan and Deshpande tests for exponentiality; tests for HPP vs NHPP with repairable systems. Basic ideas of accelerated life testing.	15
Keywords	***Reliability, Life distributions, Univariate shock models, Maintainability, HPP , NHPP***	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Barlow R.E. and Prochan F.(1985): Statistical theory of reliability and life testing ,Rinehart and Winston
2. Lawless J.F. (1982): Statistical Models and Methods of Life time data; John Wiley.
3. Bain L.J. and Engelhardt (1991): Statistical Analysis of Reliability and Life testing Models, Marcel Dekker.

Reference Books Recommended –

1. Nelson, W (1982): Applied Life data analysis: john Wiley .
2. Zacks S.: Reliability Theory, Springer.

Online Resources –
E – resources / E – Books and E – Learning Portals

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**100 Marks**
Continuous Internal Assessment (CIA)	**30 Marks**
End Semester Exam (ESE)	**70 Marks**

Continuous Internal Assessment (CIA) (By Course Teacher)	Internal Test / Quiz (2) – **20 + 20** Assignment / Seminar – **10** Total Marks - **30**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **30** marks
End Semester Exam (ESE)	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1 = 10 marks** Q2. Short Answer Type – **5 X 4 = 20 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – **4 X 10 = 40 marks**	

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DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics (Honors)		**Semester - VII**	**2027-28**
1.	**Course Code**	**STSE –8T**	
2.	**Course Title**	**Econometrics**	
3.	**Course Type**	**Discipline Specific Elective**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Students will acquire The course is useful in study economical events using linear statistical models which is highly useful in the forecasting purpose.	
6.	**Credit Value**	**3 Credits**	**Credit = 15 Hours of teaching & Observation**
7.	**Total Marks**	**Max. Marks : 100**	**Min Passing Marks : 40**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 45 periods (45 hours)

Unit	Topics (Course Content)	No. of Periods
I	**Introduction:** Objective behind building econometric models, nature of econometrics, model building, role of econometrics, structural and reduced forms. General linear model (GLM).Estimation under linear restrictions.	12
II	**Multicollinearity:** Introduction and concepts, detection of multicollinearity, consequences, tests and solutions of multicollinearity, specification error.	11
III	**Generalized least squares estimation**, Aitken estimators. Autocorrelation: concept, consequences of autocorrelated disturbances, detection and solution of autocorrelation.	11
IV	**Heteroscedastic disturbances**: Concepts and efficiency of Aitken estimator with OLS estimator under heteroscedasticity. Consequences of heteroscedasticity. Tests and solutions of heteroscedasticity. Autoregressive and Lag models, Dummy variables, Qualitative data.	11
Keywords	***Econometric Models, Multicollinearity, Least Squares Estimation, Heteroscedastic Disturbances***	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Gujarati, D. and Sangeetha, S. (2007): Basic Econometrics, 4th Edition, McGraw Hill Companies.
2. Johnston, J. (1972): Econometric Methods, 2nd Edition, McGraw Hill International.
3. Koutsoyiannis, A. (2004): Theory of Econometrics, 2nd Edition, Palgrave Macmillan Limited,

Reference Books Recommended –

1. Maddala, G.S. and Lahiri, K. (2009): Introduction to Econometrics, 4th Edition, John Wiley & Sons.

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PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**100 Marks**
Continuous Internal Assessment (CIA)	**30 Marks**
End Semester Exam (ESE)	**70 Marks**

Continuous Internal Assessment (CIA) (By Course Teacher)	Internal Test / Quiz (2) – **20 + 20** Assignment / Seminar – **10** Total Marks - **30**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **30** marks
End Semester Exam (ESE)	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1 = 10 marks** Q2. Short Answer Type – **5 X 4 = 20 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – **4 X 10 = 40 marks**	

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DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics (Honors)		**Semester - VII**	**2027-28**
1.	**Course Code**	**STSE – 08 P**	
2.	**Course Title**	**Lab Work - Econometrics**	
3.	**Course Type**	**Discipline Specific Elective**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Students will acquire practical knowledge and applications of linear statistical models which is highly useful in the economic forecasting and model building.	
6.	**Credit Value**	**1 Credits**	**Credit = 30 Hours of Practical**
7.	**Total Marks**	**Max. Marks : 30**	**Min Passing Marks : 20**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 30 periods (30 hours)

Unit	Topics (Course Content)	No. of Periods
Lab Work / Field Work/ Experiments	1. Forecasting by exponential smoothing 2. Forecasting by short term forecasting methods. 3. Problems based on estimation of General linear model 4. Testing of parameters of General linear model 5. Forecasting of General linear model 6. Problems concerning specification errors 7. Diagnostics of Multicollinearity 8. Problems related to consequences of Autocorrelation (AR(I)) 9. Estimation of problems of General linear model under Autocorrelation 10. Problems related to consequences Heteroscedasticity 11. Diagnostics of Heteroscedasticity 12. Problems related to General linear model under (Aitken Estimation)	**30**
Keywords	***Forecasting, estimation, linear model, exponential smoothing, Heteroscedasticity***	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Gujarati, D. and Sangeetha, S. (2007): Basic Econometrics, 4th Edition, McGraw Hill Companies.
2. Johnston, J. (1972): Econometric Methods, 2nd Edition, McGraw Hill International.
3. Koutsoyiannis, A. (2004): Theory of Econometrics, 2nd Edition, Palgrave Macmillan Limited,

Reference Books Recommended –

1. Maddala, G.S. and Lahiri, K. (2009): Introduction to Econometrics, 4th Edition, John Wiley & Sons.

Online Resources –
E – resources / E – Books and E – Learning Portals

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**50 Marks**
Continuous Internal Assessment (CIA)	**15 Marks**
End Semester Exam (ESE)	**35 Marks**

Continuous Internal Assessment (CIA)15 (By Course Teacher)	Internal Test / Quiz (2) – **10 + 10** Assignment / Seminar – **05** Total Marks - **15**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **15** marks

End Semester Exam (ESE) 35	**Laboratory / Field Skill Performance: On spot Assessment** **EE. Performed the Task based on lab. work - 20 Marks** **FF. Spotting based on tools & technology (written) – 10 Marks** **GG. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics (Honors)		**Semester - VIII**	**2027-28**
1.	**Course Code**	**STSE – 09**	
2.	**Course Title**	**Stochastic Processes and Queuing Theory**	
3.	**Course Type**	**Discipline Specific Elective**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Students will acquire ➢ the existence of several stochastic processes in real life situations. ➢ the techniques to study their statistical behaviour as a sequence of dependent random variables.	
6.	**Credit Value**	**4 Credits**	**Credit = 15 Hours of teaching & Observation**
7.	**Total Marks**	**Max. Marks : 100**	**Min Passing Marks : 40**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 60 periods (60 hours)

Unit	Topics (Course Content)	No. of Periods
I	**Probability Distributions:** Generating functions, Bivariate probability generating function. Stochastic Process: Introduction, Stationary Process.	15
II	**Markov Chains:** Definition of Markov Chain, transition probability matrix, order of Markov chain, Markov chain as graphs, higher transition probabilities. Generalization of independent Bernoulli trials, classification of states and chains, stability of Markov system, graph theoretic approach.	15
III	**Poisson Process:** postulates of Poisson process, properties of Poisson process, inter-arrival time, pure birth process, Yule Furry process, birth and death process, pure death process.	15
IV	**Queuing System:** General concept, steady state distribution, queuing model, M/M/1 with finite and infinite system capacity, waiting time distribution (without proof). Gambler's Ruin Problem: Classical ruin problem, expected duration of the game.	15
Keywords	**Probability Distributions,**	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Medhi, J. (2009): Stochastic Processes, New Age International Publishers.
2. Basu, A.K. (2005): Introduction to Stochastic Processes, Narosa Publishing.
3. Bhat,B.R.(2000): Stochastic Models: Analysis and Applications, New Age International Publishers.

Reference Books Recommended –

1. Taha, H. (1995): Operations Research: An Introduction, Prentice- Hall India.
2. Feller, William (1968): Introduction to probability Theory and Its Applications, Vol I,3rd Edition, Wiley International.

Online Resources –
E – resources / E – Books and E – Learning Portals

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**100 Marks**
Continuous Internal Assessment (CIA)	**30 Marks**
End Semester Exam (ESE)	**70 Marks**

Continuous Internal Assessment (CIA) (By Course Teacher)	Internal Test / Quiz (2) – **20 + 20** Assignment / Seminar – **10** Total Marks - **30**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **30** marks
End Semester Exam (ESE)	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1 = 10 marks** Q2. Short Answer Type – **5 X 4 = 20 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – **4 X 10 = 40 marks**	

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DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics (Honors)		**Semester - VIII**	**2027-28**
1.	**Course Code**	**STSE – 10**	
2.	**Course Title**	**Actuarial Science**	
3.	**Course Type**	**Discipline Specific Elective**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Students will acquire ➢ modelling of individual and aggregate losses, ➢ fitting of distributions to claims data, deductibles and retention limits, proportional andexcess-of-loss reinsurance, ➢ Risk models: models for individual claims and their sums, ➢ finding distribution of aggregate claims, compound distributions and their applications, ➢ applications of credibility theory, ➢ finding of survival function, curate future lifetime, force of mortality, ➢ handling problems on joint life and last survivor status and multiple decrement model,	
6.	**Credit Value**	**4 Credits**	**Credit = 15 Hours of teaching & Observation**
7.	**Total Marks**	**Max. Marks : 100**	**Min Passing Marks : 40**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 60 periods (60 hours)

Unit	Topics (Course Content)	No. of Periods
I	**Introductory Statistics and Insurance Applications:** Discrete, continuous and mixed probability distributions. Insurance applications, sum of random variables. Utility theory: Utility functions, expected utility criterion, types of utility function, insurance and utility theory.	15
II	**Principles of Premium Calculation:** Properties of premium principles, examples of premium principles. Individual risk models: models for individual claims, the sum of independent claims, approximations and their applications.	15
III	**Survival Distribution and Life Tables:** Uncertainty of age at death, survival function, time-until-death for a person, curate future lifetime, force of mortality, life tables with examples, deterministic survivorship group, life table characteristics, assumptions for fractional age, some analytical laws of mortality.	15
IV	**Life Insurance:** Models for insurance payable at the moment of death, insurance payable at the end of the year of death and their relationships. Life annuities: continuous life annuities, discrete life annuities, life annuities with periodic payments. Premiums: continuous and discrete premiums.	15
Keywords	***Insurance, Premium, Life Tables, Life annuities***	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Dickson, C. M. D. (2005): Insurance Risk And Ruin (International Series On Actuarial Science), Cambridge University Press.
2. Bowers, N. L., Gerber, H. U., Hickman, J. C., Jones, D. A. And Nesbitt, C. J. (1997): Actuarial Mathematics, Society Of Actuaries, Itasca, Illinois, U.S.A.

Reference Books Recommended –

Online Resources –
E – resources / E – Books and E – Learning Portals

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**100 Marks**
Continuous Internal Assessment (CIA)	**30 Marks**
End Semester Exam (ESE)	**70 Marks**

Continuous Internal Assessment (CIA) (By Course Teacher)	Internal Test / Quiz (2) – **20 + 20** Assignment / Seminar – **10** Total Marks - **30**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **30** marks
End Semester Exam (ESE)	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1 = 10 marks** Q2. Short Answer Type – **5 X 4 = 20 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – **4 X 10 = 40 marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics (Honors)		**Semester - VIII**	**2027-28**
1.	**Course Code**	**STSE – 11**	
2.	**Course Title**	**Categorical Data Analysis**	
3.	**Course Type**	**Discipline Specific Elective**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Students will acquire ➢ the analysis of categorical data measured on different scales. ➢ the estimation and testing techniques related to various advance models are discussed. ➢ Fitting of models and strategies in model selection are also discussed.	
6.	**Credit Value**	**4 Credits**	**Credit = 15 Hours of teaching & Observation**
7.	**Total Marks**	**Max. Marks : 100**	**Min Passing Marks : 40**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 60 periods (60 hours)

Unit	Topics (Course Content)	No. of Periods
I	**Categorical response variables:** Nominal, ordinal, interval Categorical data describing two-way contingency tables, measures of nominal and ordinal association, inference for two-way contingency tables	15
II	Likelihood functions and maximum likelihood estimates, testing goodness of fit and testing independence. Screening tests, sensitivity, specificity, and predictive value positive and negative, partitioning chi-squared, large sample confidence intervals, delta method to estimate standard error, exact tests for small samples.	15
III	**Models for binary response variables**: Generalized linear models, logit, log linear, linear probability and logistic regression models. Logit models for categorical data, probit and extreme value models, models with log-log link, model diagnostics.	15
IV	Fitting logit models, conditional logistic regression, exact trend test. Loglinear models for two dimensions –independence model, saturated model and models for cell probabilities. Log linear model for three dimensions. Fitting Loglinear models. Strategies in model selection, analysis of residuals, Cochran-Mantel-Haenszel test.	15
Keywords	***Categorical Response Variables, Contingency Tables, Binary Response Variables, Logit Models***	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Agresti, A. (2002) : Categorical Data Analysis, 2nd Ed. Wiley Publication.
2. 2. Kleinbaum, D. G. (1994) : Logistic Regression, Springer Verlag.
3. 3. Bowerman, O. (2000) : Linear Statistical models.

Reference Books Recommended –

1. Agresti, A. (2007) : An introduction to categorical data Analysis, Wiley
2. Agresti, A. (2010) : Analysis of ordinal categorical data, Wiley

Online Resources –

E – resources / E – Books and E – Learning Portals

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**100 Marks**
Continuous Internal Assessment (CIA)	**30 Marks**
End Semester Exam (ESE)	**70 Marks**

Continuous Internal Assessment (CIA) (By Course Teacher)	Internal Test / Quiz (2) – **20 + 20** Assignment / Seminar – **10** Total Marks - **30**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **30** marks
End Semester Exam (ESE)	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1 = 10 marks** Q2. Short Answer Type – **5 X 4 = 20 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – **4 X 10 = 40 marks**	

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DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics (Honors)		**Semester - VIII**	**2027-28**
1.	**Course Code**	**STSE – 12**	
2.	**Course Title**	**Financial Statistics**	
3.	**Course Type**	**Discipline Specific Elective**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Students will acquire ➢ knowledge of data about behaviour of income, expenditure, salary of employee etc. ➢ some discrete and continuous models related to financial data,	
6.	**Credit Value**	**4 Credits**	**Credit = 15 Hours of teaching & Observation**
7.	**Total Marks**	**Max. Marks : 100**	**Min Passing Marks : 40**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 60 periods (60 hours)

Unit	Topics (Course Content)	No. of Periods
I	**Probability review:** Real valued random variables, expectation and variance, skewness and kurtosis, conditional probabilities and expectations. Discrete Stochastic Processes, Binomial processes, General random walks, Geometric random walks, Binomial models with state dependent increments.	15
II	**Tools Needed For Option Pricing**: Wiener process, stochastic integration, and stochastic differential equations. Introduction to derivatives: Forward contracts, spot price, forward price, future price. Call and put options, zero-coupon bonds and discount bonds	15
III	**Pricing Derivatives:** Arbitrage relations and perfect financial markets, pricing futures, put-call parity for European options, relationship between strike price and option price. Stochastic Models in Finance: Discrete time process- binomial model with period one.	15
IV	**Stochastic Models in Finance:** Continuous time process- geometric Brownian motion. Ito's lemma, Black-Scholes differential equation, Black-Scholes formula for European options, Hedging portfolios: Delta, Gamma and Theta hedging. Binomial Model for European options: Cox-Ross-Rubinstein approach to option pricing. Discrete dividends	15
Keywords	***Expectation, Random Walks, Option Pricing, Arbitrage, Hedging***	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Franke, J., Hardle, W.K. And Hafner, C.M. (2011): Statistics of Financial Markets: An Introduction, 3rdEdition, Springer Publications.
2. Stanley L. S. (2012): A Course on Statistics for Finance, Chapman and Hall

Reference Books Recommended –

Online Resources –
E – resources / E – Books and E – Learning Portals

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**100 Marks**
Continuous Internal Assessment (CIA)	**30 Marks**
End Semester Exam (ESE)	**70 Marks**

Continuous Internal Assessment (CIA) (By Course Teacher)	Internal Test / Quiz (2) – **20 + 20** Assignment / Seminar – **10** Total Marks - **30**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **30** marks
End Semester Exam (ESE)	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1 = 10 marks** Q2. Short Answer Type – **5 X 4 = 20 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – **4 X 10 = 40 marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics Certificate / Diploma / Degree / Honors		**Semester - I**	**2024-25**
1.	**Course Code**	**STGE –01T**	
2.	**Course Title**	**Descriptive Statistics**	
3.	**Course Type**	**General Elective**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Students will acquire ➢ Knowledge of Statistics and its scope and importance in various areas such as Medical, Engineering, Agricultural and Social Sciences etc. ➢ Knowledge of various types of data, their organization and evaluation of summary measures such as measures of central tendency and dispersion etc. ➢ Insights into preliminary exploration of different types of data. ➢ Kowledge of correlation, regression analysis, regression diagnostics, partial and multiple correlations.	
6.	**Credit Value**	**3 Credits**	**Credit = 15 Hours of teaching & Observation**
7.	**Total Marks**	**Max. Marks : 100**	**Min Passing Marks : 40**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 45 periods (45 hours)

Unit	Topics (Course Content)	No. of Periods
I	**Statistical Methods** Definition and scope of Statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurement- nominal, ordinal, interval and ratio. Presentation: tabular and graphical, including histogram and ogives, consistency and independence of data with special reference to attributes.	12
II	**Measures of Central Tendency** Mathematical and positional measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments, absolute moments, factorial moments, skewness and kurtosis, Sheppard's corrections.	11
III	**Bivariate Data** Definition, scatter diagram, simple, partial and multiple correlation(3 variables only), rank correlation. Simple linear regression, principle of least squares and fitting of polynomials and exponential curves.	11
IV	**Index Numbers** Definition, construction of index numbers and problems thereof for weighted and unweighted index numbers including Laspeyre's, Paasche's, Edgeworth-Marshall and Fisher's. Chain index numbers, conversion of fixed based to chain based index numbers and vice-versa. Consumer price index numbers.	11
Keywords	*Statistical Methods, Measures of central tendency, Correlation, regression , Index Numbers*	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Gupta S.C. and Kapoor V.K. (2017): Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
3. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.

Reference Books Recommended –

1. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.

Online Resources –
E – resources / E – Books and E – Learning Portals

- www.swayam.ac.in
- www.ignou.ac.in
- www.egyankosh.ac.in
- www.iitm.ac.in
- www.eskillindia.org
- www.eshiksha.mp.gov.in
- www.vlab.co.in
- www.internshala.com
- www.ndl.iitkgp.ac.in

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**100 Marks**
Continuous Internal Assessment (CIA)	**30 Marks**
End Semester Exam (ESE)	**70 Marks**

Continuous Internal Assessment (CIA) (By Course Teacher)	Internal Test / Quiz (2) – **20 + 20** Assignment / Seminar – **10** Total Marks - **30**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **30** marks
End Semester Exam (ESE)	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1 = 10 marks** Q2. Short Answer Type – **5 X 4 = 20 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – **4 X 10 = 40 marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics Certificate / Diploma / Degree / Honors		**Semester - I**	**2027 – 28**
1.	**Course Code**	**STGE –01P**	
2.	**Course Title**	**Lab Work – Descriptive Statistics**	
3.	**Course Type**	**Lab Course**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	➢ insights into preliminary exploration of different types of data, their representation through tabular and graphical means . ➢ organization and evaluation of measures of central tendency and dispersion. ➢ Practical applications of correlation, regression analysis, regression diagnostics, partial and multiple correlations. ➢ Calculation of various indices through Index number analysis, and its importance in economics.	
6.	**Credit Value**	**1 Credits**	**Credit = 30 Hours of practical**
7.	**Total Marks**	**Max. Marks : 30**	**Min Passing Marks : 20**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 30 periods (30 hours)

Unit	Topics (Course Content)	No. of Periods
Lab Work / Field Work/ Experiments	16. Graphical representation of data. 17. Problems based on measures of central tendency. 18. Problems based on measures of dispersion. 19. Problems based on combined mean and variance and coefficient of variation. 20. Problems based on moments, skewness and kurtosis. 21. Fitting of polynomials, exponential curves. 22. Karl Pearson correlation coefficient. 23. Correlation coefficient for a bi-variate frequency distribution. 24. Lines of regression, angle between lines and estimated values of variables. 25. Spearman rank correlation with and without ties. 26. Partial and multiple correlations. 27. Planes of regression and variances of residuals for given simple correlations. 28. Calculate price and quantity index numbers using simple and weighted average ofprice relatives. 29. To calculate the Chain Base index numbers. 30. To calculate consumer price index number.	**30**
Keywords	*Graph, Correlation, dispersion , coefficient of variation, frequency distribution, rank correlation*	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

3. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
4. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.

Reference Books Recommended –

2. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory ofStatistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.

Online Resources –
E – resources / E – Books and E – Learning Portals

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- **www.ignou.ac.in**
- **www.egyankosh.ac.in**
- **www.iitm.ac.in**
- **www.eskillindia.org**
- **www.eshiksha.mp.gov.in**
- **www.vlab.co.in**
- **www.internshala.com**
- **www.ndl.iitkgp.ac.in**

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**50 Marks**
Continuous Internal Assessment (CIA)	**15 Marks**
End Semester Exam (ESE)	**35 Marks**

Continuous Internal Assessment (CIA)15 (By Course Teacher)	Internal Test / Quiz (2) – **10 + 10** Assignment / Seminar – **05** Total Marks - **15**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **15** marks
End Semester Exam (ESE) 35	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics Certificate / Diploma / Degree / Honors		**Semester - II**	**2024 – 25**
1.	**Course Code**	**STGE –02**	
2.	**Course Title**	**Probability and Probability Distributions**	
3.	**Course Type**	**Discipline Specific Course**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Students will acquire ➢ ability to distinguish between random and non-random experiments, ➢ knowledge to conceptualise the probabilities of events including frequentist and axiomatic approach. Simultaneously, they will learn the notion of conditional probability including the concept of Bayes' Theorem, ➢ knowledge related to concept of discrete and continuous random variables and their probability distributions including expectation and moments, ➢ knowledge of important discrete and continuous distributions for applying in different situations.	
6.	**Credit Value**	**4 Credits**	**Credit = 15 Hours of teaching & Observation**
7.	**Total Marks**	**Max. Marks : 100**	**Min Passing Marks : 40**

PART B – Content Of the Course

Total Number of Teaching learning periods (01 hr. per period) – 60 periods (60 hours)

Unit	Topics (Course Content)	No. of Periods
I	**Probability-** Introduction, random experiments, sample space, events and algebra of events. Definitions of Probability – classical, statistical, and axiomatic. Conditional Probability, laws of addition and multiplication, independent events, theorem of total probability, Bayes' theorem and its applications.	15
II	**Random variables-**Discrete and continuous random variables, p.m.f., p.d.f. and c.d.f., illustrations and properties of random variables, univariate transformations with illustrations. Two dimensional random variables: discrete and continuous type, joint, marginal and conditional p.m.f, p.d.f., and c.d.f., independence of variables, bivariate transformations withillustrations.	15
III	**Mathematical Expectation and Generating Functions -** Expectation of single and bivariate random variables and its properties. Moments and Cumulants, moment generating function, cumulant generating function and characteristic function. Uniqueness and inversion theorems (without proof) along with applications. Conditional expectations.	15
IV	**Standard Probability Distributions -** Binomial, Poisson, geometric, negative binomial, hypergeometric, uniform, normal, exponential, Cauchy, beta and gamma along with their properties and limiting/approximation cases	15
Keywords	***Probability, Random Variable, Moments, Cumulants***	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

4. Gupta S.C. and Kapoor V.K. (2017): Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
5. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.
6. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.

Reference Books Recommended –

2. Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford &IBH Publishing, New Delhi

Online Resources –

E – resources / E – Books and E – Learning Portals

- www.swayam.ac.in
- www.ignou.ac.in
- www.egyankosh.ac.in
- www.iitm.ac.in
- www.eskillindia.org
- www.eshiksha.mp.gov.in
- www.vlab.co.in
- www.internshala.com
- www.ndl.iitkgp.ac.in

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**100 Marks**
Continuous Internal Assessment (CIA)	**30 Marks**
End Semester Exam (ESE)	**70 Marks**

Continuous Internal Assessment (CIA) (By Course Teacher)	Internal Test / Quiz (2) – **20 + 20** Assignment / Seminar – **10** Total Marks - **30**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **30** marks
End Semester Exam (ESE)	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1 = 10 marks** Q2. Short Answer Type – **5 X 4 = 20 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – **4 X 10 = 40 marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in STATISTICS *(Certificate / Diploma / Degree/Honors)*			**Semester – I/II/V**	Session:
1	**Course Code**	**STVAC - 01**		
2	**Course Title**	**Quantitative Aptitude and MS Excel**		
3	**Course Type**	**Value Added Course**		
4	**Pre-requisite** (if, any)	***As per requirement***		
5	**Course Learning. Outcomes (CLO)**	➢ *Basic knowledge of Quantitative aptitude* ➢ *Statistical data analysis* ➢ *MS Excel handling and formulae*		
6	**Credit Value**	**2 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 30 Periods (30 Hours)

Unit	Topics (Course contents)	No. of Period
I	Arithmetic Ability, Percentage, Problems on Numbers and ages, Profit and loss	08
II	Time & Work, Time & Distance, Interest (Simple and Compound)	07
III	Number series, Alphabet series and Alpha-Numeric series, Arthmetic, geometric and harmonic series	08
IV	Tabulation, Pie chart, Line graph., Intro to Spreadsheets, MS – EXCEL, basic formulae, and their application.	08
Keywords	*Quantitative aptitude, percentage, series,*	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Arihant Handbook of Mathematics, Arihant Publication
2. M. S. Tyra, Magical Book of Quiker Mathematics, ABS Publications

Reference Books Recommended –

1. Ritu Arora, , Mastering Advance Excle, BPB publications

Online Resources –
E – resources / E – Books and E – Learning Portals

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**50 Marks**
Continuous Internal Assessment (CIA)	**15 Marks**
End Semester Exam (ESE)	**35 Marks**

Continuous Internal Assessment (CIA) (By Course Teacher)	Internal Test / Quiz (2) – **10 + 10** Assignment / Seminar – **05** Total Marks - **15**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **30** marks
End Semester Exam (ESE)	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1/2 = 5 marks** Q2. Short Answer Type – **5 X 2 = 10 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – 4 **X 5 = 20 marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF STATISTICS
COURSE CURRICULUM

PART A - Introduction			
Program – Bachelor in Statistics Certificate / Diploma / Degree / Honors		**Semester – II/IV/VI**	
1.	**Course Code**	**STSEC - 01**	
2.	**Course Title**	**Statistical Data Analysis Using SPSS and R**	
3.	**Course Type**	**Skill Enhancement Course**	
4.	**Pre – Requisite (If Any)**	**As Per Program**	
5.	**Course Learning Outcomes (CLO)**	Students will acquire ➢ various basic concepts related to computer architecture and its organization, variousperipheral devices, ➢ languages: machine language, assembly language and high level languages, ➢ ideas on operating systems, linker, loader and compiler etc., ➢ R programming with some basic notions for developing their own simple programsand visualizing graphics in SPSS and R,	
6.	**Credit Value**	**2 Credits**	**Credit = 15 Hours of teaching & Observation**
7.	**Total Marks**	**Max. Marks : 50**	**Min Passing Marks : 20**

PART B – Content Of the Course		
Total Number of Teaching learning periods (01 hr. per period) – 30 periods (30 hours)		
Unit	**Topics (Course Content)**	**No. of Periods**
I	Learn how to load data, plot a graph viz. histograms (equal class intervals and unequal class intervals), box plot, stem-leaf, frequency polygon, pie chart, ogives with graphical summaries of data.	**08**
II	Generate automated reports giving detailed descriptive statistics, correlation and lines of regression.	**07**
III	Random number generation and sampling procedures. Fitting of polynomials and exponential curves. Application Problems based on fitting of suitable distribution, Normal probability plot.	**08**
IV	Simple analysis and create and manage statistical analysis projects, import data, code editing, Basics of statistical inference in order to understand hypothesis testing and compute p-values and confidence intervals.	**08**
Keywords	SPSS, R language, Histograms, Chart, reports, descriptive statistics.	

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PART C – Learning Resources

Text Books, References , Books and Others

Text Books Recommended –

1. Moore, D.S. and McCabe, G.P. and Craig, B.A. (2014): Introduction to the Practice of Statistics, W.H. Freeman
2. Cunningham, B.J (2012):Using SPSS:An Interactive Hands-on approach

Reference Books Recommended –

1. Cho, M.J., Martinez, W.L. (2014) Statistics in MATLAB: A Primer, Chapman andHall/CRC

Online Resources –
E – resources / E – Books and E – Learning Portals

PART D – Assessment and Evaluation

Suggested Continuous evaluation methods –

Max. Marks:	**50 Marks**
Continuous Internal Assessment (CIA)	**15 Marks**
End Semester Exam (ESE)	**35 Marks**

Continuous Internal Assessment (CIA) (By Course Teacher)	Internal Test / Quiz (2) – **10 + 10** Assignment / Seminar – **05** Total Marks - **15**	Best marks out of the two Test / Quiz + Obtained marks in assignment shall be considered against **30** marks
End Semester Exam (ESE)	**Two Sections – A & B** **Section A – Q1**. Objective – **10 X 1/2 = 5 marks** Q2. Short Answer Type – **5 X 2 = 10 marks** **Section B**: Descriptive answer type questions **1 out of 2** from each unit – 4 **X 5 = 20 marks**	

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