Scheme of Complementary Courses In Statistics

The following table shows the structure of the courses which indicates title of the courses, instructional hours and credits.

1. Statistics for B.Sc. Mathematics and Physics

Semester	Title of the paper	Course Code	Number of hours per week	Total Credits	Total hours/ semester	End Semester Assessment duration (hrs)
I	**Basic Statistics**	STA1BS	4	3	72	3
II	**Theory of Random Variables**	STA2TRV	4	3	72	3
III	**Probability Distributions**	STA3PD	5	4	90	3
IV	**Statistical Inference**	STA4SI	5	4	90	3

2. Statistics for B.A. Sociology

Semester	Title of the paper	Course Code	Number of hours per week	Total Credits	Total hours/ semester	End Semester Assessment duration (hrs)
III	**Basic Statistics**	STA3BS	6	4	108	3
IV	**Statistical Tools**	STA4ST	6	4	108	3

Examinations:

The evaluation of each course shall contain two parts such as or Sessional Assessment and Final Assessment. The ratio between internal and external examinations shall be 1:4(20%: 80%)

Assessment Pattern:

Item	**Percentage**
Sessional Assessment	**20**
Final Assessment	**80**

In-Semester Assessment (IA):

Sessional Assessment is to be done by continuous assessments on the following components. The Components of the Sessional Assessment for theory papers are as below.

Theory:

Component	**Marks**
Attendance	5
Assignment/Seminar	5
Average of two test papers	10

Attendance:

% of Attendance	**Marks**
>90%	5
Between 85 and 90	4
Between 80 and 85	3
Between 75 and 80	2
75 %	1
< 75	0

Assignments:

There will be one assignment per course in each of the first four Semesters.

Sessional Assessment :

The evaluation of all components is to be published and is to be acknowledged by the candidate. The responsibility of evaluating the internal assessment is vested on the teacher(s) who teach the course.

Final Assessment :

The Final examination of all courses shall be conducted by the College on the close of each semester. For reappearance/ improvement, students can appear along with the next batch.

Pattern of Question Paper :

A question paper shall be a judicious mix of short answer type, short essay type/ problem solving type and long essay type questions.

For each course the Final Assessment is of 3 hours duration. The question paper has 4 parts. Part A is compulsory which contains 10 objective type questions each of 1 mark .Part B contains 12 short answer questions of which 8 are to be answered and each has 2 marks. Part C has 9 short essay questions of which 6 are to be answered and each has 4 marks. Part D has 4 long essay questions of which 2 are to be answered and each has 15 marks.

Part	**No. of Questions**	**No. of questions to be answered**	**Marks**
A (Objective type)	10	10	10x1 = 10
B (Short Answer)	12	8	8x2 = 16
C (Short Essay)	9	6	6x4 = 24
D (Long Essay)	4	2	2x15 = 30

Note: A separate minimum of 30% marks each for sessional and final and aggregate minimum of 40% are required for a pass for a course.

Syllabus of Courses:

The detailed syllabus of the complementary courses is appended.

Complementary Course to Mathematics, Physics
I Semester – Complementary – Statistics - Course I

STA1BS - Basic Statistics

Hours per week – 4

Module I

Introduction to Statistics, Population and Sample, Collection of Data, Various methods of data collection, Census and Sampling Methods of Sampling – Simple Random Sampling (with and without replacement) – stratified sampling – systematic sampling (Method only), Types of data – quantitative, qualitative, Classification and Tabulation, Diagrammatic representation – Bar diagram, pie diagram; pictogram and cartogram, Graphical representation – histogram; frequency polygon; frequency curve; ogives and stem and leaf chart.

Module II

Measures of Central Tendency – Mean; Median; Mode; Geometric Mean; Harmonic Mean and Properties, Absolute and Relative measures of Dispersion – Range, Quartile Deviation, Percentiles, Deciles, Box Plot, Mean Deviation, Standard Deviation, Coefficient of Variation.

Module III

Idea of Permutations and Combinations, Probability Concepts – Random Experiment, Sample Space, Events, Probability Measure, Approaches to Probability – Classical, Statistical and Axiomatic, Addition Theorem (upto 3 evens) Conditional Probability, Independence of events, Multiplication theorem (upto 3 events), Total Probability Law, Baye's Theorem and its applications.

Module IV

Index Numbers – definition, Simple Index Numbers; Weighted Index Numbers – Laspeyer's Paasche's and Fisher's Index Numbers, Test of Index Numbers, Construction of Index Numbers, Cost of Living Index Numbers – Family Budget Method, Aggregate Expenditure Method.

Core Reference

1. S.P. Gupta: Statistical Methods (Sultan Chand & Sons Delhi).
2. S.C. Gupta and V.K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
3. B.L. Agarwal: Basic Statistics, New Age International (p) Ltd.

Additional References

1. Parimal Mukhopadhya: Mathematical Statistics, New Central Book Agency (p) Ltd, Calcutta
2. Murthy M.N.: Sampling theory and Methods, Statistical Publishing Society, Calcutta.

Blueprint

Title of the Course: BASIC STATISTICS

Course Code: STA1BS

Module	1Mark 10/10	2Marks 8/12	4 Marks 6/9	15 Marks 2/4
I	3	2	2	0
II	3	4	3	2
III	2	3	2	1
IV	2	3	2	1

MODEL QUESTION PAPER

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION

First Semester

Complementary Course (Statistics)

STA1BS - BASIC STATISTICS

(Common for MATHEMATICS, PHYSICS and COMPUTER APPLICATIONS)

Time: 3 hours Max.: 80 marks

Use of Scientific calculators and Statistical tables are permitted.

Part A (Short Answer Questions)

Answer ***all*** questions.

Each question carries 1 mark.

1. Distinguish between population and sample
2. What is Tabulation?
3. Name the statistical measures that can be found out using ogives
4. Define Geometric mean
5. Give the empirical relation between mean, median and mode
6. What is coefficient of variation?
7. Give classical definition of probability

8. What is the Sample space when three coins are tossed?
9. What is Commodity reversal test?
10. Name the different methods of finding the Cost of living Index number

(10x1=10 marks)

Part B (Brief Answer Questions)

Answer any ***eight*** questions.

Each question carries 2 marks.

11. Distinguish between Primary and Secondary data
12. What are the bases of Classification?
13. Prove that the sum of deviations of a set of observations from their mean is zero.
14. Calculate Median and Mode of 8 6, 3,2,1,5,7
15. Find the Standard deviation of 2,3,5,7,8
16. Define any three measures of Central tendency
17. Show that A and B are Independent if and only if $P(B/A) = P(B/A^c)$.
18. Distinguish between Pair-wise Independence and Mutual Independence in the case of three events
19. What is the Probability of getting 53 Sundays in a leap year?
20. Why is Fisher's Index number known as Fisher's Ideal Index number?
21. Construct Cost of living Index number from the following data.

Group	A	B	C	D
Index	100	150	125	200
Weight	6	4	2	3

22. Give any four Limitations of an Index number.

(8x2 = 16 marks)

Part C (Short Essay Questions)

Answer any ***six*** questions.

Each question carries 4 marks.

23. Explain the Construction of a frequency distribution table
24. What are the desirable properties of a good measure of dispersion? Examine Standard deviation in the light of your answer.
25. Find mean deviation of the following data.

X:	4	8	12	16	20	24
F:	2	7	15	11	9	6

26. Represent the following data by a Box plot

    74,75,75,76,79,82,83,85,87,90

27. Find Median and Mode for the following data

C.I:	0-10	10-20	20-30	30-40	40-50
F:	3	13	18	12	5

28. State and prove addition theorem for two events.
29. The Chance of two Athletes to win in a competition are $1/2$ and $1/3$ respectively. If they participate in the same competition, what is the probability that at least one will win? What is the probability that at least one will win if they participate in different competitions?
30. Explain the various steps involved in the construction of an Index number
31. From the following data using A.M and G.M method regarding price relatives find Index numbers.

Commodity	A	B	C	D	E
Base Year price	25	20	30	12	90
Current year price	30	22	33	15	99

(6x4 = 24 marks)

Part D (Essay Questions)

Answer any ***two*** questions.

Each question carries 15 marks.

32. (a) Distinguish between absolute and relative measures of dispersion

    (b) Find co-efficient of Quartile deviation from the following data

C.I	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
F	8	7	15	18	22	14	10	6

33. An analysis of monthly wages paid to workers in two firms A and B, belonging to the same industry gave the following results.

	Firm A	Firm B
No. of wage earners	550	650
Average monthly wages	50	45
Variance of wages	90	120

(a) Which firm pays out larger amount as monthly wages

(b) Which firm shows greater variability?

(c) What are the average monthly wage and standard deviation of wages of all the workers in the two firms?

34. (a) State and prove Baye's theorem

(b) The chances of A, B and C becoming managers of a company are in the ratio 4:2:3. The probabilities that a reform will be introduced if A, B and C are appointed as managers are 0.3, 0.5, 0.8 respectively. The reform has been introduced. What is the probability that B is appointed as the manager?

35. (a)Explain the steps in the construction of Index numbers.

(b) Find Laspeyer's, Paasche's and Fisher's Index numbers from the following data.

Commodity	Price		Quantity	
	Base period	Current period	Base period	Current period
A	6	8	70	120
B	8	10	90	100
C	12	16	140	280

(2x15 = 30 marks)

Complementary Course to Mathematics, Physics
II Semester – Complementary – Statistics - Course II

STA2TRV – Theory of Random Variables

Hours per week – 4

Module I

Random Variables – Discrete and Continuous, Probability Distributions – Probability Mass Function; Probability Density Function and Cumulative (distribution) function and their properties, change of variables (Univariate only), Bivariate random variables – Definition – Discrete and Continuous, Joint Probability Density Functions, Marginal and Conditional Distributions, Independence of Random Variables.

Module II

Mathematical Expectations – Expectation of a Random Variable, Moments in terms of Expectations, Moment Generating Functions (m.g.f.) and its properties. Characteristic Functions and its Simple Properties, Conditional Expectation

Module III

Raw Moments, Central Moments, Absolute Moments, Inter Relationships (First Four Moments), Skewness – Measures – Pearson, Bowley and Moment Measure Kurtosis- Measures of Kurtosis – Moment Measure, Measure based on partition values.

Module IV

Introduction to bivariate data – Method of Least Squares – Curve Fitting – Fitting of Straight Lines, Second Degree Equation, Exponential Curve, Power Curve, Linear Correlation – Methods of Correlation – Scatter Diagram, Covariance Method, Rank Correlation (equal ranks). Linear Regression – Regression Equations – Fitting and identification, properties.

Core Reference

1. John E. Freund: Mathematical Statistics, Prentice Hall of India
2. S.C. Gupta and V.K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons
3. S.P. Gupta: Statistical Methods, , Sultan Chand and Sons, New Delhi

Additional References

1. V.K. Rohatgi: An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
2. Mood A.M., Graybill F.A. and Boes D.C. Introduction to Theory of Statistics, McGraw Hill.
3. B.R. Bhat, Modern Probability Theory, New Age International (p) Ltd.

Blueprint

Title of the Course: THEORY OF RANDOM VARIABLES

Course Code: STA2TRV

<table>
<tr><th>Module</th><th>1Mark
10/10</th><th>2Marks
8/12</th><th>4 Marks
6/9</th><th>15 Marks
2/4</th></tr>
<tr><td>I</td><td>3</td><td>3</td><td>2</td><td rowspan="2">1</td></tr>
<tr><td>II</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>III</td><td>1</td><td>2</td><td>1</td><td>1</td></tr>
<tr><td>IV</td><td>3</td><td>4</td><td>3</td><td>2</td></tr>
</table>

MODEL QUESTION PAPER

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION

Second Semester

Complementary Course (Statistics)

STA2TRV – THEORY OF RANDOM VARIABLES

(Common for MATHEMATICS, PHYSICS and COMPUTER APPLICATIONS)

Time: 3 hours Max.: 80 marks

Use of Scientific calculators and Statistical tables are permitted.

Part A (Short Answer Questions)

Answer ***all*** questions.

Each question carries 1 mark.

1. A random variable is a function from the sample space of a random experiment into _______.
2. The p.d.f. of a random variable X is f(x)=k, when $0<x<2$, then what is the value of k?
3. Define distribution function of a random variable.
4. Define moment generating function of a random variable.
5. State the addition theorem on Expectation for two random variables X and Y.
6. If f(x) = $\frac{1}{2}$, $-1 < x < 1$ is the p.d.f. of a random variable X, find φ_X(t).
7. Give the formula for Pearson's co-efficient of skewness.

8. Give the relation between the correlation co-efficient and regression co-efficients in case of a bi-variate distribution.
9. What is a Scatter diagram?
10. If the two regression lines of a bivariate data are perpendicular to each other, what should be the value of the correlation co-efficient?

(10x1=10 marks)

Part B (Brief Answer Questions)

Answer any ***eight*** questions.

Each question carries 2 marks.

11. Can the function $f(x)=3x^3$; $0<x<1$, be a p.d.f. ? Why?
12. If F(x) = 0 ; x < 0

    x ; $0 \leq x \leq 1$

    1 ; x > 1 is the distribution function of a random variable X, then find $P[2X+3\leq 3.6]$
13. If X is a random variable with distribution function F(x), then find the p.d.f. of Y=F(x).
14. For any two independent random variables X and Y, show that E (XY) = E(X) E(Y).
15. Define characteristic function of a random variable and state its important properties.
16. The joint p.d.f. of a bivariate random variable (X, Y) is f(x , y) = x + y; 0 < x < 1, 0 < y < 1, obtain the marginal p.d.f. of Y.
17. What is Sheppard's correction? Write down the Sheppard's correction for the first four moments.
18. The first three raw moments of a distribution are 1, 3 and 5 respectively. Find β_1.
19. If one of the regression co-efficients is greater than 1, show that the other regression co-efficient should be less than 1.
20. Write down the normal equations to fit a curve of the form $y = ab^x$ to a given bivariate data.
21. The regression equations of a bivariate data are $3x + 11y - 7 = 0$ and $8x + 3y + 16 = 0$. Find the values of $\bar{x}$ and $\bar{y}$.
22. Find Karl Pearson's co-efficient of correlation for the following data

x:	7	8	9	6	5
y:	8	6	7	9	10

(8x2 = 16 marks)

Part C (Short Essay Questions)

Answer any ***six*** questions.

Each question carries 4 marks.

23. An unbiased die is tossed till an odd number appears. Obtain the probability distribution of the number of tosses.
24. A random variable X has p.d.f. $f(x) = Ax^2$; $0 \leq x \leq 10$. Find A and $P[2 < X < 5]$.
25. State and prove the Cauchy-Schwartz inequality.
26. If X and Y are any two random variables, show that E[E(X/Y)] = E(X).
27. If X and Y are two random variables and a & b are any two constants, find V(aX – bY).
28. For a distribution mean =3, variance = 4, $\beta_1 = +1$ and $\beta_2 = 2$. Obtain the first four moments about zero.
29. Derive the expression to find the acute angle between the regression lines.
30. Show that Karl Pearson's co-efficient of correlation is independent of change of origin and scale.
31. Derive the formula for finding rank correlation co-efficient.

(6x4 = 24 marks)

Part D (Essay Questions)

Answer any ***two*** questions.

Each question carries 15 marks.

32. Define conditional expectation and conditional variance. If f(x,y) = x + y; 0<x<1 0<y<1 find correlation between X and Y and conditional variance of Y given X.
33. Examine the nature of skewness and kurtosis for the data given below using β_1 and β_2

Variable	Frequency
2.5-7.5	4
7.5-12.5	38
12.5-17.5	65
17.5-22.5	90
22.5-27.5	70
27.5-32.5	42
32.5-37.5	6

34. (a) Find the Karl Pearson's co-efficient of correlation from the following data

X:	115	109	112	87	98	120	98	100	98	118
Y:	75	73	85	70	76	82	65	73	68	80

(b) Find the Spearman's rank correlation co-efficient for the above data.

35. Given the following observations on two variables x and y , find the most probable value of x when y = 72 and also the most probable value of y when x = 61

x:	59	65	45	52	60	62	70	55	45	49
y:	75	70	55	65	60	69	80	65	59	61

(2x15 = 30 marks)

Complementary Course to Mathematics, Physics
III Semester – Complementary – Statistics - Course III

STA3PD – Probability Distributions

Hours per week : 5

Module I

Discrete Distributions : Uniform; Geometric; Bernoulli; Binomial; Poisson; Fitting of Distributions (Binomial and Poisson). Properties : Mean, Variance, m.g.f., Additive property; recurrence relation for moments (binomial and Poisson) Memory lessness property of Geometric distribution.

Module II

Continuous distributions : Uniform; Exponential; Gamma; Beta (type I and II); Normal; Standard Normal - definitions, Mean, Variance, m.g.f., Additive property, Memorylessness property of exponential distribution Fitting of Normal, Use of Standard Normal Tables for Computation of Various Probabilities.

Module III

Law of large Numbers, Tchebycheff's Inequality, Weak Law of Large Numbers, Bernoulli's Law of Large Numbers, Central Limit Theorem (Lindberg-Levy form) without proof.

Module IV

Sampling Distributions - definition, Statistic, Parameter, Standard Error, Sampling Distributions of Mean and Variance, χ^2, t and F (without derivation), properties, Inter relationships.

Core Reference

1. S.C. Gupta and V.K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons

2. Hogg, R.V. and Craig A.T. (1970). Introduction to Mathematical Statistics, Amerind Publishing Co, Pvt. Ltd.

Additional References

1. V.K. Rohatgi: An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
2. Mood A.M., Graybill F.A. and Boes D.C. Introduction to Theory of Statistics, McGraw Hill.
3. Johnson, N.L, Kotz, S. and Balakrishnan N. (1994). Continuous Univariate Distribution, John Wiley, New York.
4. Johnson, N.L, Kotz, S. and Kemp, A.W. : Univariate Discrete Distributions, John Wiley, New York.

Blueprint

Title of the Course: PROBABILITY DISTRIBUTIONS

Course Code: STA3PD

Module	1Mark 10/10	2Marks 8/12	4 Marks 6/9	15 Marks 2/4
I	4	4	2	1
II	3	4	3	1
III	1	2	2	1
IV	2	2	2	1

MODEL QUESTION PAPER

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION

Third Semester

Complementary Course (Statistics)

STA3PD – PROBABILITY DISTRIBUTIONS

(Common for MATHEMATICS, PHYSICS and COMPUTER APPLICATIONS)

Time: 3 hours Max.: 80 marks

Use of Scientific calculators and Statistical tables are permitted.

Part A (Short Answer Questions)

Answer ***all*** questions.

Each question carries 1 mark.

1. Which is the distribution for which mean = variance?
2. Give the moment generating function of Bernoulli distribution with parameter p.
3. If for a binomial distribution, p = ½, Then what will be the skewness of the distribution?
4. If X follows Uniform distribution over [0,1], then state the distribution of Y = - 2 log X.
5. State the Tchebychev's inequality.
6. If X ~ N(0,1), then what is the distribution of X^2 ?
7. What is the distribution of the ratio of two χ^2 variates?
8. Name the continous distribution that satisfies lack of memory property.
9. If X follows Geometric distribution with p = ½, then what is the value of E(X) ?

10. Define Beta distribution of the first type.

(10 x1 =10)

Part B (Brief Answer Questions)

Answer any ***eight*** questions.

Each question carries 2 marks.

11. State the relation between exponential and gamma distributions.
12. Define Statistic and Parameter with an example each.
13. If X ~ B(n, p), find cov [$\frac{x}{n}$, $\frac{n-x}{n}$]
14. Find the m.g.f. of Uniform distribution over (a, b).
15. Compute the mode of B(7, ¼).
16. Find the characteristic function of the geometric distribution.
17. If X ~ N(30, 5), find P[26 < X < 40].
18. If 2% of the items made by a factory are defective, find the probability that there are 3 defective items in a sample of 100 items.
19. Two unbiased dice are tossed. If X is the sum of the numbers obtained, show that $P[|X-7|\geq 3] \leq \frac{35}{54}$.
20. Find mode of N(μ, σ).
21. What are the assumptions in Lindberg-Levy form of Central Limit Theorem?
22. Define F statistic and give an example.

(8 x 2 = 16)

Part C (Short Essay Questions)

Answer any ***six*** questions.

Each question carries 4 marks.

23. State and prove Weak Law of Large Numbers.
24. Obtain the points of inflexion of N(μ, σ).
25. Find the moment generating function of χ_n^2 and hence prove its additive property.
26. Derive the recurrence relation for raw moments of B(n, p).
27. Find the mean and variance of Beta distribution of the first type.
28. Obtain Poisson distribution as a limiting form of Binomial distribution.
29. Obtain the moment generating function of U(a,b) and hence find its mean and variance.

30. How many trials should be performed so that the probability of obtaining atleast 40 successes is atleast 0.95, if the trials are independent and probability of success in a single trial is 0.2?
31. Find the maximum difference that can be expected with probability 0.95 between the means of samples of sizes 10 and 12 from Normal populations with same standard deviation, if the standard deviations in the samples are 2 and 3 respectively.

(6 x 4 = 24)

Part D (Essay Questions)

Answer any ***two*** questions.

Each question carries 15 marks.

32. Derive the recurrence relation for central moments of a Normal distribution with parameters μ and σ and hence obtain β_1 and β_2.
33. (a) Derive the sampling distribution of sample mean when samples are taken from a normal distribution

    (b) Write the relation between t, F and χ^2
34. (a) The following table gives the number of heads obtained in 30 repetitions when 4 biased coins were tossed. Fit an appropriate Binomial distribution and calculate the expected frequencies

No. of heads	0	1	2	3	4
Frequency	2	7	13	6	2

    (b) What are the expected frequencies if the coins are assumed to be unbiased?
35. An unbiased die is tossed 100 times. Use Central Limit Theorem to find probability that the mean of the numbers obtained will be less than 3.8.

(2 x 15 = 30)

Complementary Course to Mathematics, Physics
IV Semester – Complementary – Statistics - Course IV

STA4SI – Statistical Inference

Hours per week : 5

Module I
Concepts of Estimation, Types of Estimation Point Estimation; Interval Estimation, Properties of Estimation Unbiasedness, Efficiency; Consistency; Sufficiency.

Module II
Methods of Estimation MLE, Methods of Moments, Method of Minimum Variance, Cramer Rao Inequality (without proof), Interval Estimation for Mean, Variance and Proportion.

Module III
Testing of hypothesis- Statistical hypothesis, Simple and composite hypothesis Null and Alternate hypothesis, Type I and Type II errors, Critical Region, Size of the test, P value, Power, Neyman Pearson approach , Large Sample test Z test, Chi-Square test-goodness of fit, test of independence.

Module IV
Small sample tests Normal, t test, Chi-square test, F test, analysis of Variance (one way classification).

Core Reference

1. S.C. Gupta and V.K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons
2. Richard Johnson (2006): Probability and Statistics for Engineers (Miller and Freund). Prentice Hall.

Additional References

1. S.C Gupta : Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
2. V.K. Rohatgi: An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
3. Mood A.M., Graybill F.A. and Boes D.C. Introduction to Theory of Statistics, McGraw Hill.

Blueprint

Title of the Course: STATISTICAL INFERENCE

Course Code: STA4SI

Module	1Mark 10/10	2Marks 8/12	4 Marks 6/9	15 Marks 2/4
I	4	3	1	1
II	2	3	3	
III	3	4	2	2
IV	1	2	3	1

MODEL QUESTION PAPER

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION

Fourth Semester

Complementary Course (Statistics)

STA4SI – STATISTICAL INFERENCE

(Common for MATHEMATICS, PHYSICS and COMPUTER APPLICATIONS)

Time: 3 hours Max.: 80 marks

Use of Scientific calculators and Statistical tables are permitted.

Part A (Short Answer Questions)

Answer ***all*** questions.

Each question carries 1 mark.

1. Differentiate between point estimation and internal estimation.
2. Define a sufficient statistic.
3. Give an example of an estimator which is consistent but not unbiased.
4. An unbiased estimator whose variance tends to zero is said to be ....
5. What is the method of moments?
6. What is meant by confidence coefficient?
7. Define the size of the test.
8. Explain the two types of errors?
9. Define the power of a test.

10. What is the test statistic used for testing the equality of variance of two normal populations for small samples?

(10 x1 =10 marks)

Part B (Brief Answer Questions)

Answer any ***eight*** questions.

Each question carries 2 marks.

11. Define unbiasedness of an estimator. If T is an unbiased estimator of θ, is T^2 an unbiased estimation of θ^2 ?
12. What is Neyman's condition for sufficiency of an estimate?
13. Distinguish between parameter and statistic.
14. Write any four properties of maximum likelihood estimates.
15. Obtain the m.l.e. of θ in $f(x, \theta) = \frac{1}{\theta}$ where $0 < x < \theta$.
16. Obtain the interval estimate of mean of a normal distribution when the standard deviation is known.
17. State Neyman- Pearson lemma.
18. What is meant by degree of freedom?
19. How will you test the equality of proportions of two normal populations using large samples?
20. Define simple hypothesis and alternative hypothesis.
21. Write the test statistic for testing the equality of means of two normal populations in the case of unknown standard deviations using small samples.
22. Write the mathematical model for one way classifications.

(8 x 2 = 16 marks)

Part C (Short Essay Questions)

Answer any ***six*** questions.

Each question carries 4 marks.

23. Let $X_1, X_2 .....X_n$ be a random sample from $N(\mu, \sigma^2)$where σ^2 is known show that $Y= (X_1+ X_2)/2$ is an unbaised estimator of μ. Find the efficiency of Y.
24. Find the Cramer- Rao lower bound for the variance of any unbiased estimator of λ where λ is parameter of a Poisson population.
25. Let P be the proportion of tea drinkers in Kerala. If a random sample of 1234 Keralites yielded 789 tea drinkers find 95% 0f confidence internal of P.
26. Show by an example that m.l.e. need not be unbiased.

27. Obtain the best region of size α for testing H_0 : $\mu = \mu_0$ against the alternative H_1 : $\mu = \mu_1$ in a normal population N(μ,1).
28. Explain the chi -square test of goodness of fit.
29. A sample from a population is 7,4,6,11,20,8,10,6,13,11 and 9. Can it regarded as from a normal population with S.D 3.
30. Explain a paired t- test.
31. Explain the procedure to carry out ANOVA.

(6 x 4 = 24 marks)

Part D (Essay Questions)

Answer any ***two*** questions.

Each question carries 15 marks.

32. (a) Show that $\bar{x}$ is a sufficient estimate for μ if σ^2 is known where $\bar{x}$ is the mean of a sample taken from N(μ,σ)

    (b) A sample of 100 voters were assigned to vote in a gallop poll. 55% of them voted in favour of candidate. Find 95% and 99% confidence intervals for proportion of voters who are in favour of the candidate.
33. Fit a binomial population for the following data and test for goodness of fit.

x	0	1	2	3	4	5	6
f	105	80	43	30	26	9	7

34. Examine whether the following two samples are from populations with same variance

    Sample A : 11, 26, 18, 31, 23, 15, 9, 0, 13, 19.

    Sample B : 67, 53, 61, 88, 73, 56, 49.

35. (a) Derive the expression of χ^2 -test of independence in a 2×2 contingency table.

    (b) Examine whether there is an influence of sex in the consumption of coffee.

	Male	female
Like coffee	42	33
Don't like coffee	18	17

(2 x 15 = 30 marks)

Complementary Course to Sociology

III Semester- Complementary - Statistics - Course I

STA3BS – BASIC STATISTICS

Hours per week-6

Module I

Introduction to Statistics- Collection of data-primary and secondary, census and sampling, classification and tabulation, grouped and ungrouped frequency table.

Module II

Diagrammatical and graphical representation of data- bar diagram, pie diagram, frequency polygon and curve, histogram, ogives.

Module III

Measures of central tendency- mean, median and mode- properties, merits and demerits.

Module IV

Measures of dispersion-Range, quartile deviation, mean deviation, standard deviation-properties, merits and demerits, coefficient of variation.

Core reference:

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

Additional Reference:

2. B.N. Asthana : Elements of Statistics
3. Meyer : Introduction to Probability and Statistical Application
4. Croxton and Cowden : Applied general Statistics.

Blue Print

Title of the Course: STA3BS

Course Code: BASIC STATISTICS

Module	1Mark 10/10	2Marks 8/12	4 Marks 6/9	15 Marks 2/4
I	3	4	2	--
II	2	3	2	2
III	2	2	2	1
IV	3	3	3	1

MODEL QUESTION PAPER

B.A. DEGREE EXAMINATION

Third Semester

Complementary Course (Statistics)

STA3BS – BASIC STATISTICS

(For B.A. Sociology)

Time: 3 hours Max.: 80 marks

Use of Scientific calculators and Statistical tables are permitted.

Part A (Short Answer Questions)

Answer ***all*** questions. Each question carries 1 mark.

1. Define Secondary data.
2. What is a simple random sample?
3. What is chronological classification?
4. What are cartograms?
5. Define frequency of a class interval.
6. What are Quartiles?
7. What is the empirical relation between Mean , Median and Mode?
8. Find median of the numbers 9, 3, 7, 5, 8, 11, 10 and 12.

9. The Standard Deviation of a set of observations is 2. If each observation is multiplied by 4, what is the Standard deviation of the new set of observations?
10. If mean is 10 and standard deviation is 5, find the co-efficient of variation.

(10 x1 =10)

Part B (Brief Answer Questions)

Answer any ***eight*** questions. Each question carries 2 marks.

11. Explain the construction of a frequency polygon.
12. Give the characteristics of a good questionnaire.
13. Find the quartile deviation of the observations 21, 30, 27, 36, 12, 41, 15, 97, 84, 25, 32, and 62.
14. What is meant by a measure of dispersion?
15. Define discrete and continuous variables.
16. Name any three two-dimensional diagrams.
17. There are three groups of observations having 40, 50 and 60 items with means 20, 26 and15 respectively. Find the mean of the combined group.
18. Team A has mean score 7 and variance 25. Team B has mean score 6 and variance 9. Which team shows more consistency?
19. Write the merits of arithmetic mean.
20. Distinguish between bar diagram and histogram.
21. What are the objectives of classification?
22. Distinguish between questionnaire and schedule.

(8 x 2 = 16)

Part C (Short Essay Questions)

Answer any ***six*** questions. Each question carries 4 marks.

23. Form an appropriate grouped frequency table for the following data

    32, 47, 41, 51, 41, 30, 39, 18, 48, 53, 54, 32, 31, 36, 15, 37, 32, 56, 42, 48.
24. Draw a histogram for the following frequency distribution

Classes	10-14	15-19	20-29	30-49
Frequency	5	10	30	20

25. Distinguish between absolute and relative measures of dispersion.
26. Explain Pie diagram.

27. Find mean, median and mode of the following observations.

    14,11,11,10,12,13,10,14,11,11,10,12,12,13,13,11,14,12,12,12,13,12,12,13,12.

28. Find Mean deviation from median

Classes	0-10	10-20	20-30	30-40	40-50
Frequency	10	12	18	14	6

29. Explain the various methods of collecting Primary data.
30. The expenditure of 1000 families is as follows

Expenditure (Rs.)	40-60	60-80	80-100	100-120	120-140
No. Of families	50	-	500	-	50

    The median of the distribution is Rs.87.50. Find the missing families.

31. Calculate the Quartile deviation of the following data.

Wages Rs.	12	14	17	21	27	30	36	Total
No. Of workers	4	6	8	7	12	10	4	51

(6 x 4 = 24)

Part D (Essay Questions)

Answer any ***two*** questions. Each question carries 15 marks.

32. Distinguish between sub-divided and percentage bar diagrams. Draw a percentage bar diagram to represent the following data

    Number of students of a college

Year Stream of study→ ↓	Arts	Science	Commerce
1995-96	800	700	500
1996-97	820	710	520
1997-98	850	725	525

33. Explain the different measures of central tendency. Why is arithmetic mean considered to be the best measure of central tendency?
34. Calculate the Mean Deviation from median of the following data.

Class	0-20	20-40	40-60	60-80	Total
Frequency	4	6	8	7	25

35. The expenditure on food per family in two localities are as follows

Expenditure/ family / week		150-300	300-450	450-600	600-750	750-900	900-1050
No. of families	locality A	50	325	428	216	60	21
	locality B	75	310	472	193	97	53

Compare the variations in expenditure in the two localities.

(2 x 15 = 30)

Complementary Course to Sociology

IV Semester- Complementary – Statistics –Course II

STA4ST - Statistical Tools

Hours per week-6

Module I

Random Experiment- sample space, event, -Algebra of events- classical and Statistical definition of probability- simple problems-Addition theorem of two events-statement only-conditional probability- Independence of events-elementary applications- random variables-probability density function- Binomial and normal distributions.

Module II

Testing of hypothesis-Null and alternate hypothesis, significance level, power of the test, Z tests for means and proportion (one sample and two sample).

Module III

Scatter diagram, principle of least squares, fitting of straight lines, Regression lines, correlation between two variables- rank correlation.

Module IV

Index numbers- definition, uses, problems in construction of index numbers, weighted index numbers- Laspeyer's , Paasche 's and Fisher's index numbers, tests for good index numbers, Fixed base and chain base index numbers -conversion.

Core reference:

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

Additional Reference:

1. S.C. Gupta and V.K. Kapoor : Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
2. Fundamentals of Statistics: DN Elhance, Kitab Mahal , Allahabad.

Blue Print

Title of the Course: STA4ST

Course Code: STATISTICAL TOOLS

Module	1Mark 10/10	2Marks 8/12	4 Marks 6/9	15 Marks 2/4
I	4	3	3	1
II	2	3	1	1
III	2	3	3	1
IV	2	3	2	1

MODEL QUESTION PAPER

B.A. DEGREE EXAMINATION

Fourth Semester

Complementary Course (Statistics)

STA4ST – STATISTICAL TOOLS

(For B.A. Sociology)

Time: 3 hours Max.: 80 marks

Use of Scientific calculators and Statistical tables are permitted.

Part A (Short Answer Questions)

Answer ***all*** questions. Each question carries 1 mark.

1. Define a random experiment. Give an example.
2. When are two events said to be mutually exclusive?
3. Find the probability of getting a sum of 5 when two dice are tossed.
4. The mean and variance of a Binomial distribution are 6 and 4 respectively. Find the parameters of the distribution.
5. Define significance level of a test.
6. Define a Null hypothesis.
7. What is the range in which correlation co-efficient of a bivariate data can lie?
8. What is the point of intersection of the two regression lines of a bivariate data?

9. Define Index numbers.
10. If Laspeyer's Index number is 324 and Paasche's Index number is 144, then find Fisher's Index number.

(10 x1 =10 marks)

Part B (Brief Answer Questions)

Answer any ***eight*** questions. Each question carries 2 marks.

11. Define Conditional probability.
12. A box contains 4 white, 2 blue and 3 red balls. A ball is drawn out at random. What is the probability that it is a red or a white ball?
13. State the addition theorem on probability for two events.
14. Define a statistical hypothesis.
15. Distinguish between Type I and Type II errors.
16. Give the test statistic for testing equality of proportions of two Normal populations.
17. What is a Scatter diagram?
18. Mention the properties of regression co-efficients of a bivariate data.
19. If r = - 0.8 and b_{xy} = - 0.79, what is the value of b_{yx}?
20. What is Factor reversal test for Index numbers?
21. Distinguish between simple and weighted Index numbers.
22. If $\Sigma p_0q_0 = 47$, $\Sigma p_0q_k = 51$, $\Sigma p_kq_0 = 67$ and $\Sigma p_kq_k = 84$, find Fisher's Index number.

(8 x 2 = 16 marks)

Part C (Short Essay Questions)

Answer any ***six*** questions. Each question carries 4 marks.

23. The contents of two bags are as follows.
    Bag 1 : 2 white and 3 black balls, Bag 2 : 3 white and 2 black balls. A ball is transferred from bag 1 to bag 2 and then a ball is drawn from bag 2. Find the probability that it is a white ball.
24. The mean and variance of a binomial random variable X are 2 and 1 respectively. Find $P[X \leq 1]$.
25. If A and B are independent events, show that (a) A and B^c are independent,
    (b) A^c and B^c are independent.
26. The mean weight of a sample of 100 students is 50 kgs with a standard deviation of 3 kgs. Can it be claimed that the mean height of all the students is 52 kgs?
27. Distinguish between correlation and regression.

28. Find correlation between X and Y

X	3	5	9	10	12
Y	11	19	35	39	47

29. Find the co-efficient of correlation r, if the regression lines of a bivariate data are $x + 2y - 5 = 0$ and $2x + 3y - 8 = 0$.
30. Examine whether Laspeyer's Index number and Paasche's Index number satisfies factor reversal test.
31. From the Chain base Index numbers given below, construct Fixed base Index numbers.

Year	2004	2005	2006	2007	2008
Chain base IN	90	105	102	95	92

(6 x 4 = 24 marks)

Part D (Essay Questions)

Answer any ***two*** questions. Each question carries 15 marks.

32. A bag contains 5 white and 8 red balls. Two drawings of 3 balls each are made such that (a) the balls are replaced before the second trial, (b) the balls are not replaced before the second trial. Find the probability that the first drawing will give 3 white and the second 3 red balls in each case.
33. Explain the procedure for testing equality of Proportions of two Normal populations.
34. Given the following data, estimate blood pressure when age is 45.

Age	56	42	72	36	63	47	55	49	38	42	68	60
Blood pressure	147	125	160	118	149	128	150	145	115	140	152	155

35. Find Laspeyer's, Paasche's and Fisher's Index numbers from the following data.

Commodity	Base period		Current period	
	Price	Quantity	Price	Quantity
A	42	8	60	7
B	16	12	20	10
C	30	8	40	6
D	100	3	120	2
E	81	5	110	4

(2 x 15 = 30 marks)