1. **OBJECTIVES**

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

*The main objectives of the course is*

- To build the basis for promoting theoretical and application aspects of statistics.
- To underline the statistics as a science of decision making in the real life problems in the context of uncertainty.
- To emphasize the relevance of statistical tools and techniques of analysis in the study of inter-disciplinary sciences.

This syllabus is aimed at preparing the students to cope with the latest developments and compete with students from other universities and put them on the right track.
2. **ELIGIBILITY CONDITION FOR ADMISSION**

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

3. **DURATION OF THE COURSE**

a) Each academic year will be divided into two semesters. The first academic year will comprise the first and second semesters, the second academic year - the third and fourth semesters and the third academic year – the fifth and sixth semesters.

b) The odd semesters will consist of the period from June to November of each year and the even semesters from December to April of each year. There shall be not less than 90 working days for each semester.

4. **COURSE OF STUDY**

The course of study shall comprise instruction in the following subjects according to the syllabus and books prescribed from time to time.

5. **EXAMINATIONS**

The theory examination shall be three hours duration to each paper at the end of each semester. The practical examination shall be three hours duration to each paper at the end of each academic year. The candidate failing in any subject(s) will be permitted to appear for each failed subject(s) in the subsequent examination.
6. **SCHEME OF EXAMINATIONS**

The scheme of examinations for different semesters shall be as follows:

**Course structure under CBCS (Semester-wise Details)**
**Branch II STATISTICS**
(For the students admitted from the year 2017 – 2018 onwards)

<table>
<thead>
<tr>
<th>Sem.</th>
<th>Part</th>
<th>Course</th>
<th>Title</th>
<th>Hrs/week</th>
<th>Credit</th>
<th>Marks</th>
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CIA – Continuous Internal Assessment; UE – University Examination
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CIA – Continuous Internal Assessment; UE – University Examination
NMEC – Non Major Elective Course; SBEC – Skill Based Elective Course
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CIA – Continuous Internal Assessment; UE – University Examination
NMEC – Non Major Elective Course; SBEC – Skill Based Elective Course
**Course Structure - BRANCH: STATISTICS**

Table showing the courses offered with Credits under various parts

CBCS Pattern w.e.f 2017–2018 onwards

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N – No. of courses; H – Hrs/Week ; C – Credit

* There is no university examination for this course.
7. QUESTION PAPER PATTERN AND EVALUATION FOR ALL COURSES.

7.1. Question Paper Pattern for Core/Allied/Elective/SBEC Papers (Theory):

Time: Three hours Maximum Marks: 75

Part - A (10 x 2 = 20)
Answer ALL questions
(Two questions from each unit)

Part - B (5 x 5 = 25)
Answer ALL questions
(One question from each unit with internal choice)

Part - C (3 x 10 = 30)
Answer any THREE questions out of FIVE questions
(One question from each unit)

7.2 Evaluation of Continuous Internal Assessment (CIA)

The components for continuous internal assessment (CIA) are

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<th>Marks</th>
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7.3 Question Paper Pattern for Core and Allied Practical

Time: Three hours Maximum: 60 marks

Answer Any THREE questions out of FIVE questions
(One question from each unit)
### 7.4 Distribution of Marks for Core and Allied Practical:

- University Examination (Written Practical) - 60 marks
- Continuous Internal Assessment (CIA) - 40 marks
  (Including Practical Record)
- Total - 100 marks

**Evaluation of Continuous Internal Assessment (CIA)**

The components for continuous internal assessment (CIA) are

- Record - 25 marks
- Test - 10 marks
- Attendance - 5 marks

**Total** - 40 marks

### 8. PASSING MINIMUM

The candidate shall be declared to have passed the examination if the candidate secure not less than 30 marks out of 75 marks in the University Examination (UE) in each theory paper and 10 marks (out of 25) in the Continuous Internal Assessment (CIA) in each theory paper.

For the Practical paper, a minimum of 24 marks (out of 60) in the University Examination (UE) and 16 marks (out of 40) in the Continuous Internal Assessment (CIA) is required to pass the examination.

The CIA of each practical paper includes evaluation of record. However, submission of record for the University Practical Examination is mandatory.

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<th>Passing minimum</th>
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<tr>
<td>Practical paper</td>
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<td>60</td>
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9. CLASSIFICATION OF SUCCESSFUL CANDIDATES

Candidates who secure not less than 60% of the aggregate marks in the whole examination shall be declared to have passed the examination in the First Class.

All other successful candidates shall be declared to have passed in the Second Class.

Candidates who obtained 75% of the marks in the aggregate shall be deemed to have passed the examination in First Class with Distinction provided they pass all the examinations prescribed for the course at the first appearance.

Candidates who pass all the examinations prescribed for the course in the first instance and within a period of three academic years from the year of admission to the course only are eligible for University Ranking.

1. **Passing Minimum** is 40% of the ESE and also 40% of the minimum of the paper / course

2. **Minimum Credits to be earned:** For THREE year Programme: Best 140 Credits
   (Part I and II: Languages, Part III Major, Elective, Allied, Part –IV Soft Skills and Part V: Extension activities)
3. Marks and Grades:

The following table gives the marks, grade points, letter grades and classification to indicate the performance of the candidate.

**Conversion of Marks to Grade Points and Letter Grade (Performance in a Course/ Paper)**

<table>
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<tr>
<th>Range of Marks</th>
<th>Grade Points</th>
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<tr>
<td>90 – 100</td>
<td>9.0 - 10.0</td>
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<tr>
<td>80 – 89</td>
<td>8.0 - 8.9</td>
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<td>0.0</td>
<td>AAA</td>
<td>ABSENT</td>
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$C_i$ = Credits earned for course $i$ in any semester.

$G_i$ = Grade Point obtained for course $i$ in any semester.

$n$ refers to the semester in which such courses were credited.

For a Semester:

\[
\text{GPA} = \frac{\sum C_i G_i}{\sum C_i}
\]

GRADE POINT AVERAGE [GPA] = $\sum C_i G_i / \sum C_i$

For the entire programme:

\[
\text{CUMULATIVE GRADE POINT AVERAGE [CGPA]} = \frac{\sum \sum C_{ni} G_{ni}}{\sum \sum C_{ni}}
\]

CUMULATIVE GRADE POINT AVERAGE [CGPA] = $\sum \sum C_{ni} G_{ni} / \sum \sum C_{ni}$

CGPA = \[
\frac{\sum \sum C_{ni} G_{ni}}{\sum \sum C_{ni}}
\]

CGPA = Sum of the multiplication of grade points by the credits of the entire programme

Sum of the credits of the courses of the entire programme
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<td>Re-appear</td>
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*The candidates who have passed in the first appearance and within the prescribed semester of the UG Programme (Major, Allied and Elective Courses Alone) are eligible.

10. **MAXIMUM DURATION FOR THE COMPLETION OF THE UG PROGRAMME:**

The maximum duration for completion of the UG Programme shall not exceed twelve semesters.

11. **COMMENCEMENT OF THIS REGULATION:**

The CBCS regulations shall take effect from the academic year 2012-2013 ie. for the students who are admitted to the first year of the course during the academic year 2012-2013 and thereafter.

12. **TRANSITARY PROVISION**

Candidates who were admitted to the UG course of study prior to 2012-2013 shall be permitted to appear for the examination under those regulations for a period of three years ie, up to and inclusive of the examinations of April/May 2015. Thereafter they will be permitted to appear for the examination only under the regulations then in force.
LIST OF COURSES

1. CORE COURSES: (Theory 9 + Elective 3 + Practical 4): 16

(i) CORE THEORY : 9
   1. Descriptive Statistics
   2. Probability Theory
   3. Distribution Theory
   4. Theory of Estimation
   5. Sampling Techniques
   6. Testing of Hypothesis
   7. Statistical Quality Control
   8. Design of Experiments
   9. Applied Statistics

(ii). CORE ELECTIVES: 3
   1. Stochastic Processes
   2. Actuarial Statistics
   3. Numerical Analysis

(iii) CORE PRACTICAL: 4
   1. Major practical – I
      (Based on Core theory papers – 1 & 2)
   2. Major practical – II
      (Based on core theory papers – 3 & 4)
   3. Major practical - III
      (Based on core theory papers – 5,6 & 8)
   4. Major practical - IV
      (Based on core theory papers – 7 & 9)
II. ALLIED COURSES (Theory 4 + Practical 2)

(i). ALLIED THEORY: 4
1. Mathematics – I
2. Mathematics – II
3. Linear Programming and its Applications

(ii). ALLIED PRACTICALS: 2
1. Allied I: Mathematics Practical
2. Allied II: Operations Research (Based on Allied theory papers 3 & 4)

III. SKILLS BASED ELECTIVE COURSES: 4
1. Regression Analysis
2. Statistical Forecasting
3. Non-Parametric Tests
4. Queueing Theory

IV. NON MAJOR ELECTIVE COURSES: 2
1. Matrix Algebra
2. Numerical Methods

V. VALUE EDUCATION: 1
1. Yoga

VI. ENVIRONMENTAL STUDIES: 1

VII. EXTENSION ACTIVITIES: 1
## SEMESTER – I

<table>
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<th>Sem. Part</th>
<th>Course</th>
<th>Title</th>
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<td>Major Practical I*</td>
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<td>Value education (Yoga)</td>
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<td>2</td>
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*Examination at the end of second semester

(For candidates admitted from 2017-18 onwards)
UNIT – I:
Collection and sources of statistical data – Formation of frequency distribution – discrete and continuous – cumulative frequency distribution (O’gives) – Classification and tabulation.
Graphs and Diagrams – Bar diagrams, Histogram, Pie diagram.

UNIT – II:

UNIT – III:
Measures of dispersion (absolute & relative) – Range, Quartile Deviation, Mean Deviation and Standard Deviation – Inter Relationship between Q.D., M.D., and S.D.
Co-efficient of Variation – Lorenz curve

UNIT – IV:

UNIT – V:
Correlation – types of correlation – Scatter diagram — Karl Person’s co-efficient of correlation – properties – Spearman’s Rank correlation co-efficient – Concurrent deviation Method - Correlation co-efficient for grouped data.

Reference Books:
MODEL QUESTION PAPER
PERIYAR UNIVERSITY, SALEM - 11
B.Sc. Degree Examination
Branch – Statistics
(For the candidates admitted from 2017 – 2018 onwards)

SEMESTER - I
CORE THEORY PAPER – 1
DESCRIPTIVE STATISTICS

Time: 3 Hours       Maximum: 75 Marks

Part - A (10 x 2 = 20)
Answer ALL questions

1. What is meant by qualitative data?
2. Define primary data
3. What is tabulation?
4. State any two merits of diagrammatic representation.
5. What is a measure of central tendency?
6. Define relative measure.
7. Define skewness.
8. What do you mean by Kurtosis?
10. What is probable error in correlation?

Part - B (5 x 5 = 25)
Answer ALL Questions

11. (a) Distinguish between primary data and secondary data.
    Or
    (b) Explain any two methods of primary data collection.

12. (a) Explain the four types of classification.
    Or
    (b) Explain the parts of a good table.

13. (a) List the properties of a good average.
    Or
    (b) Obtain Median for the following
    CI: 0-20  20-40  40-60  60-80  80-100
    Frequency:  10  15  26  19  10

14. (a) Explain any two methods of studying skewness.
    Or
    (b) First three moments of a distribution about the value 4 of the variable are –
    1.5, 17 and –30. Find $\mu_2$ and $\mu_3$. 

Core Course - I  
P. Code:
15. (a) Explain the method of studying correlation by scatter diagram method.

Or

(b) Obtain Rank Correlation:

Rank by Judge I:  3  5  4  8  9  7  1  2  6  10
Rank by Judge II:  4  6  3  9  10  7  2  1  5  8

Part – C (3 x 10 = 30)

Answer any THREE questions

16. What are the various methods used for collecting primary data?
17. Explain any four types of Bar Diagrams.
18. Explain the method of drawing Lorenz curve. What are it uses?
19. Obtain the relationship between raw moments and central moments up to 4th order.
20. Show that correlation co-efficient is unaffected by changing origin and scale.
B.Sc. STATISTICS
(For the candidates admitted from 2017 – 2018 onwards)

SEMESTER – I
ALLIED MATHEMATICS – I
(Algebra, Calculus, Fourier series)

Max Marks : 75

(For B.Sc Statistics, Physics, Chemistry, Computer Science, Electronics, BCA and Bio-informatics)

UNIT – I: (Theory of Equations)


UNIT – II: (Matrices)

Definition of Characteristic equation of a matrix – Characteristic roots of a matrix – Eigen values and the corresponding Eigen vectors of matrix – Cayley Hamilton theorem (Statement only) – Verifications of Cayley Hamilton Theorem – Problems only.

UNIT – III: (Radius of Curvature)

Formula of Radius of Curvature in Cartesian Co-ordinates – Parametric coordinates and Polar coordinates (no proof for formulae) – problems only.

UNIT-IV: (Partial Differential Equations)

Formation of Partial Differential Equations by eliminating the arbitrary constant and arbitrary functions – Lagrange’s Linear Partial Differential Equations – Problems only.

UNIT – V: (Integration)

Definite Integral: Simple properties of definite Integrals – Bernoulli’s Formula – Integration by parts – Simple problems – Reduction formula for \( \int_{a}^{b} \sin^n x \, dx \), \( \int_{a}^{b} \cos^n x \, dx \), \( \int_{a}^{\infty} e^{-x} x^n \, dx \), \( \int_{a}^{\infty} e^{-ax} \, dx \), \( \int_{a}^{\infty} e^{ax} \, dx \) – Simple Problems.

TEXT BOOKS:-
1. Dr.P.R. Vittal, Allied Mathematics, Margham publication, Chennai – 17, Reprint 2012.

Reference Books:-

1. Solve the equation \(2x^2 - 7x^2 + 4x + 3 = 0\) given that \(1 + \sqrt{2}\) is root

2. Diminish by 2 the roots of the equation \(x^4 + x^3 - 3x^2 + 2x - 4 = 0\)

3. Find the characteristic roots of a matrix \(A = \begin{pmatrix} 2 & 3 \\ 2 & 3 \end{pmatrix}\)

4. Find sum and product of the eigen values of the matrix \(A = \begin{pmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{pmatrix}\)

5. Write the formula for radius of curvature in cartesian coordinates.

6. Find the radius of curvature at \((1,1)\) of the curve \(x^4 + y^4 = 2\)

7. Form the partial differential equation by eliminating the arbitrary constant from \(z = ax + by + ab\)

8. Form the partial differential equation by eliminating the arbitrary function from \(z = f(z)\)

9. Find the value of \(\int_{0}^{\pi} \sin^6 \theta d\theta\)

10. Evaluate: \(\int xe^{-x^2} dx\)

SECTION – B (5 X 5 = 25 Marks)

Answer ALL Questions

11. (a) Show that the equation \(3x^5 - 2x^3 - 4x + 2 = 0\) has at least two imaginary roots

   (OR)

   (b) Solve the equation \(x^4 + 2x^3 - 5x^2 + 6x + 1 = 0\) given that \(1 + 1\) is a root

12. (a) Find the characteristic roots of the matrix \(A = \begin{pmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{pmatrix}\)

   (OR)

   (b) Find the eigen values and eigen vectors for the matrix \(A = \begin{pmatrix} 4 & 1 \\ 3 & 2 \end{pmatrix}\)

13. (a) Find the radius of curvature at any point \(\theta\) on the curve \(x = a(\theta + \sin \theta)\) and \(y = a(1 - \cos \theta)\)

   (OR)

   (b) Find \(\rho\) for the curve \(r = a(1 + \cos \theta)\)

14. (a) Form the partial differential equation by eliminating the arbitrary constant from \(z = (x+a)^2 + (y+b)^2 + z^2 = 1\)

   (OR)

   (b) Form the partial differential equation by eliminating the arbitrary function from \(I(x+y+z, xyz) = 0\)
15. (a) Evaluate \( \int_{0}^{\infty} \log ax \, dx \) (OR)

(b) If \( I_n = \int_{0}^{\pi} \cos^n x \, dx \), then prove that \( I_n = \frac{n-1}{n} I_{n-2} \)

**SECTION – C (3 X 10 = 30 Marks)**

**Answer any THREE Questions**

16. Remove the second term of the equation \( x^4 - 12x^3 + 40x^2 - 72x + 35 = 0 \) and hence solve it.

17. Verify Cayley Hamilton Theorem for the matrix \( A = \begin{pmatrix} 2 & -2 & 5 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{pmatrix} \)

18. Find the radius of curvature at the point \( \left( \frac{a}{4}, \frac{a}{4} \right) \) of the curve \( \sqrt{x} + \sqrt{y} = \sqrt{a} \)

19. Prove that \( \int_{0}^{\infty} \log \sin \theta \, d\theta - \frac{\pi}{2} \log 2 \)

20. Solve \( (mx - ny)p - (nx - lx)q = ly - mx \)
PERIYAR UNIVERSITY, SALEM - 11
B.Sc., STATISTICS
CBCS PATTERN
STRUCTURE, SYLLABUS AND MODEL QUESTIONS
(For candidates admitted from 2017-2018 onwards)

SEMESTER – II

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CIA | UE | Total
---|----|-------
   |    |       |
UNIT – I:


UNIT – II:

Concept of random variables – Discrete random variable, continuous random variables, probability mass function – Probability density function, Distribution function – Properties of distribution function - Independence of random variable.

UNIT – III:


UNIT – IV:

Moment generating function of a random variable – their properties and its uses – cumulants – Characteristic functions – Properties of characteristic function – simple examples – Inversion theorem (statement only) - Statements and Application of weak law of large numbers.

UNIT – V:

Bivariate distribution – Distribution functions of bivariate random variable and its properties – probability mass and density function, marginal and conditional distributions – Conditional expectation – Concept of regression lines – covariance and correlation

Reference Books


MODEL QUESTION PAPER
PERIYAR UNIVERSITY, SALEM - 11
B.Sc. Degree Examination
Branch – Statistics
(For the candidates admitted from 2017 – 2018 onwards)

SEMESTER - II
PROBABILITY THEORY

Time: 3 Hours       Maximum : 75 marks

Part – A (10 x 2 = 20)
Answer ALL questions

1. What is a random experiment?
2. What do you mean by mutually exclusive events?
3. Define random variable.
4. What do you mean by pair wise independence of events?
5. Define mathematical expectation of a random variable.
6. Define rth order central moment.
7. Define the moment generating function of the random variable.
8. State the weak law of large numbers.
9. Define the marginal distribution function of the random variable X for the given joint distribution function.
10. Define correlation function.

Part – B (5 x 5 = 25)
Answer ALL questions

11. (a) What are the axioms of probability?
    Or
    (b) State and prove the total theorem on probability.

12. (a) Define probability density function and state its properties.
    Or
    (b) Explain the mutually independence of events with an example.

13. (a) State the properties of mathematical expectation.
    Or
    (b) State and prove the Markov’s inequality.

14. (a) State the Inversion theorem on characteristic function.
    Or
    (b) Find the characteristic function of the Poisson random variable.

P. Code:
15. (a) Define the distribution function of the random vector \((X, Y)\) and state its properties.
Or
(b) Define conditional expectation of \(X\) given \(Y\). Also show that \(E\{X/Y\} = E(X)\).

**Part – C (3 x 10 = 30)**

**Answer any THREE questions**

16. State and prove Baye’s theorem on probability.
17. State and prove the properties of distribution function of a random variable \(X\).
18. State and prove Tchebychev’s inequality
19. State and prove the properties of characteristic function of a random variable \(X\).
20. Establish the necessary condition for \(F(x, y)\) to be a distribution function. Obtain the marginal density functions of the Bivariate normal density function.
UNIT – I:
Formation of frequency distribution – Computation of Measures of Central Tendencies

UNIT – II:
Calculation of Measures of dispersion– Skewness and Kurtosis

UNIT – III:
Product Moment correlation – Rank correlation – Regression lines of two variables

UNIT – IV:
Rank of the matrix – Inverse of the matrix – Solution of simultaneous equations of three variables using matrix

UNIT – V:
Bivariate Distributions – Marginal and Conditional Distributions (Discrete and Continuous).

Note:
Total : 100 marks
* University Examination : 60 "
(Written practical)
Continuous Internal Assessment : 40 "
(Including Practical Record)

* 5 questions are to be set without omitting any unit. All questions carry equal marks. Any 3 questions are to be answered in 3 hours duration.
1. Construct a frequency distribution of the marks obtained by 50 students in Statistics as given below:

   42  53  65  63  61  47  58  60  64  45
   55  57  82  42  39  51  65  55  33  70
   50  52  53  45  45  25  36  59  63  39
   65  30  45  35  49  15  54  48  64  26
   75  20  42  41  55  52  46  35  18  40

   Calculate mean and median of the above.

2. Compute Karl Pearson’s Coefficient of Skewness from the following data

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<tr>
<th>Marks</th>
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3. Calculate the co-efficient of rank correlation from the following data:

   \( X \) : 48  33  40  9  16  16  65  24  16  57
   \( Y \) : 13  13  24  6  15  4  20  9  6  19

4. Solve the following equations by matrix inverse method

   \( 2X_1+X_2+X_3 = 4, X_1+X_2+X_3 = 3, 2X_1+X_2+3X_3 = 6 \)

5. Find the characteristic equation, roots and vectors for the following matrix.

   \[ A = \begin{pmatrix} 2 & 4 & 7 \\ 6 & 8 & 9 \\ 4 & 4 & 2 \end{pmatrix} \]
UNIT – I: (Jacobian and Maxima & Minima)  
Jacobian of two variables and three variables – Maxima and Minima of functions of two variables – Problems only.

UNIT – II: (Finite Differences)  
First difference – Higher differences – Construction of difference table - Interpolation of missing value – Newton’s Forward and Newton Backward difference formula (no proof) – Lagrange’s Interpolation formula (no proof) – Simple problems only.

UNIT – III: (Second Order Differential Equations)  
Second Order Differential Equations with constant Coefficients – Complementary function – particular Integral and Solution of the type $e^{ax}$, $x^n$, $\cos ax$ (or) $\sin ax$, $e^{ax}$, $e^{ax}x^{bx}$, $e^{ax}\sin bx$, $e^{ax}\cos bx$ – only.

UNIT-IV: (Laplace Transforms)  

UNIT – V: (Inverse Laplace Transforms)  
Standard formula – Elementary theorems (no proof) – Applications to solutions of second order differential equations with constant coefficients – Simple Problems.

TEXT BOOKS:-  
1. Dr.P.R. Vittal, Allied Mathematics, Margham publication, Chennai – 17, Reprint 2012.

Reference Books:-  
SECTION – A (10 X 2 = 20 Marks)
Answer ALL Questions

1) If \( u = x^2, v = y^2 \) then find \( \frac{\partial (u v)}{\partial (x y)} \)

2) Write the condition for a function to attain maximum

3) Write the Newton’s Forward difference formula

4) Prove that \( \Delta^2 y_1 = y_2 - 2y_2 + y_1 \)

5) Solve \( (D^2 - 4D + 4)y = 0 \)

6) Find the Particular Integral of \( (D^2 + 4)y = 8\sin 2x \)

7) Find \( L[\cos 2t] \)

8) Find \( L[t^2] \)

9) Find \( L^{-1} \left[ \frac{1}{s^2 - 4} \right] \)

10) Find \( L^{-1} \left[ \frac{10}{(s + 2)^2} \right] \)

SECTION – B (5 X 5 = 25 Marks)
Answer ALL Questions

11. (a) If \( x + y = u, y = uv \) then find J(x, y)

   (OR)

   (b) Find the maximum value of \( f(x, y) = x^2 + 5y^2 - 6x + 10y + 12 \)

12. (a) Estimate f(5) from the following data:

   \[
   \begin{array}{cccc}
   \text{X:} & 3 & 4 & 5 & 6 \\
   \text{f(x):} & 4 & 13 & - & 43 \\
   \end{array}
   \]

   (OR)

   (b) Use Newton’s Forward difference formula find y when x = 4, given

   \[
   \begin{array}{cccc}
   \text{X:} & 3 & 5 & 7 & 9 \\
   \text{Y:} & 180 & 150 & 120 & 90 \\
   \end{array}
   \]

13. (a) Solve: \( (D^2 - 8D + 9)y = 8 \sin 2x \)

   (OR)

   (b) Solve: \( (D^2 - 3D + 2)y = e^{2x} + 2 \)

14. (a) Find \( L[\sin^2 2t] \)

   (OR)

   (b) Find \( L[e^{3t} \cos 6t - t^3 + e^t] \)

15. (a) Find \( \int \left[ \frac{-8}{(s^2 + 4)(s - 1)} \right] ds \)

   (OR)

   (b) Find the Inverse Laplace Transform of \( \frac{s^2 - 8}{(s + 1)(s + 2)(s + 3)} \)
SECTION – C (3 X 10 = 30 Marks)

Answer any THREE Questions

16. Find the maximum and minimum values of \( f(x,y) = 2(x^2 - y^2) - x^4 + y^4 \)

17. By Using Lagrange’s formula find \( y \) when \( x = 2 \) from the following:

\[
\begin{array}{cccccc}
X: & 6 & 3 & 5 & 6 & 8 \\
Y: & 276 & 460 & 414 & 343 & 110 \\
\end{array}
\]

18. Solve: \( (D^2 - 5D + 6)y = e^{2\cos 2x} \)

19. Find \( L \left[ \cosh t \cos 2t \right] \)

20. Solve: \( \frac{d^2y}{dx^2} - \frac{dy}{dx} - 2y = 0 \) given \( y(0) = -2, \ y'(0) = 5 \) by using Laplace Transform
UNIT I: (Matrices)

Rank of Matrix – Problems upto (3*3) Matrix - Characteristic Equation of a Matrix – Cayley Hamilton Theorem (Statement Only) – Problems to verify Cayley Hamilton Theorem.

Unit – II: (Leibnitz formula for $n^{th}$ derivative)

Leibnitz formula (without proof) for $n^{th}$ derivative – Problems (Page no. 8.32 to 8.39 of the Text Book).

Unit III: (Partial Differentiation)

Euler’s theorem on homogenous function (without proof) – Problems to verify Euler’s theorem - Partial derivative – Problems (Page no. 9.1 to 9.13 to 9.18 to 9.27 of the Text Book).

Unit IV: (Scalar and Vector point function)

Scalar Point functions – Gradient of Scalar Point Function - Vector Point functions – Problems Only.

Unit V: (Divergence and Curl of Vector point functions)

Divergence of vector point functions – Curl of vector point functions – Solinodial of vector – Irrotational of vector – Problems only.

TEXT BOOKS:-
1. Dr.P.R. Vittal, Allied Mathematics, Margham publication, Chennai – 17, Reprint 2012.

Reference Books:-

Note:
1) University Examination will be conducted at the end of Second Semester / Fourth Semester.
2) Two Teaching Hours for Unit – I, II and III in the First Semester / Third Semester and two hours for Unit – IV and V in the Second Semester / Fourth Semester.
1) Find the characteristic equation and Verify Cayley Hamilton Theorem for the matrix 
\[ A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix} \]

2) (a) If \( y = a \cos(\log x) + b \sin(\log x) \) then Prove that \( x^2y_2 + xy_1 + y = 0 \) 
(b) If \( Y = e^s \sin^{n-1}n \), prove that \( (1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - (n^2 + a^2)y_n = 0 \)

3) (a) Verify Euler’s theorem for \( u = x^3 + y^3 + z^3 - 3xyz \) 
(b) If \( u = \tan^{-1}\frac{xy}{x^2 + y^2} \) then show that \( x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \frac{1}{2} \sin 2u \)

4) (a) If \( \vec{r} = \vec{x} + \vec{y} + \vec{z} \) then Prove that \( \vec{\nabla} = \frac{1}{r} \vec{r} \) 
(b) Find the directional derivative of \( \phi = x^2 + y^2 + z^2 \) at the point \( (1, 1, 1) \) in the direction \( \vec{t} + \vec{j} + \vec{k} \)

5) (a) If \( \vec{F} = x^2\vec{i} - 2y^2\vec{j} + xy^2\vec{k} \) then find \( \text{div} \vec{F} \) and \( \text{Curl} \vec{F} \) at the point \( (1, -1, 1) \). 
(b) Prove that the vector \( \vec{F} = 3x^2y\vec{i} - 4xy^2\vec{j} + 2xyz\vec{k} \)
# SEMESTER – III

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**Examination at the end of fourth semester**
B.Sc. STATISTICS
(For the candidates admitted from 2017 – 2018 onwards)

SEMESTER – III
DISTRIBUTION THEORY

Unit – I:
Univariate discrete distributions – their properties – Uniform, Bernoulli, Binomial, Poisson, Geometric, Hyper geometric and Negative binomial distributions – Limiting form of binomial and Poisson distribution

Unit – II:
Continuous univariate distributions – Uniform – Normal – Exponential-Cauchy - Gamma – Beta distribution – Concepts of lognormal, Pareto, Weibull distributions – their simple applications

Unit – III:

Unit – IV:

Unit – V:

Reference Books:
MODEL QUESTION PAPER
PERIYAR UNIVERSITY, SALEM - 11
B.Sc. Degree Examination
Branch – Statistics
(For the candidates admitted from 2017 – 2018 onwards)
SEMESTER – III
DISTRIBUTION THEORY
Time: 3 Hours       Maximum: 75 marks

Part – A (10 x 2 = 20)
Answer ALL questions

1. What is the range of binomial variable?
2. Write the MGF of Poisson random variable.
3. State the condition for F (x) to be a distribution function.
4. What is the meant by Cauchy distribution?
5. What is sampling distribution?
6. What is standard error?
7. Define chi-square random variable.
8. State any two uses of ‘F’ statistic.
9. Define order statistics
10. Write down any two uses order statistics

Part – B (5 x 5 = 25)
Answer ALL questions

11. a) Show that mean and variance of the Poisson distribution are equal.
    Or
    b) Obtain the moment generating function of binomial random variable.

12. a) Find the mean and variance of exponential distribution.
    Or
    b) Find the MGF of normal distribution.

13. a) Obtain the marginal and conditional distribution function of bivariate normal distribution.
    Or
    b) State the uses of ‘t’ statistics.

14. a) State the properties of chi-square distribution.
    Or
    b) What is ‘F’ random variable? Explain how it is related to ‘t’ and chi-square variables.

15. a) Prove that the pdf of first order statistics of an exponential distribution is also exponential.
    Or
    b) Obtain the mean of the distribution of sample median for U (0,1) population.
Part – C (3 x 10 = 30)

Answer any THREE questions

17. Determine the characteristic function of normal distribution and hence find mean and variance.
18. Derive the students’ t’ distribution function
19. Drive the chi square distribution function.
20. Derive the p.d.f. of $r^{th}$ order statistics.
B.Sc. STATISTICS
(For the candidates admitted from 2017 – 2018 onwards)

SEMESTER – III
LINEAR PROGRAMMING AND ITS APPLICATIONS - I

Unit – I:

Unit – II:

Unit – III:

Unit – IV:

Unit – V:

Reference Books:
MODEL QUESTION PAPER  
PERIYAR UNIVERSITY, SALEM - 11  
B.Sc. Degree Examination  
Branch – Statistics  
(For the candidates admitted from 2017 – 2018 onwards)  
SEMESTER - III  
LINEAR PROGRAMMING AND ITS APPLICATIONS -I  
Time: 3 Hours  
Maximum: 75 Marks  

Part – A (10 x 2 = 20)  
Answer ALL questions  

2. State the canonical form of the L.P.P.  
3. State the role of artificial variable in solving a L.P.P.  
4. Define degenerate solution of L.P.P.  
5. Explain the duality in L.P.P.  
6. Write the formulation of Dual L.P.P.  
7. State the mathematical form of a transportation problem?  
8. What is meant by an unbalanced transportation problem?  
9. What is an Assignment Problem?  
10. What is meant by balanced and unbalanced Assignment Problem?  

Part – B (5 x 5 = 25)  
Answer ALL questions  

11. a) State some feature of O.R?  
   Or  
   b) What are the characteristics of a good model for O.R?  

12. a) Explain feasible solution and optimum solution of a L.P.P.  
   Or  
   b) State the two basic conditions on which the simplex method is based.  

13. a) State and explain dual L.P.P.  
   Or  
   b) Write the dual of the primal problem given below:  
   Minimize \( Z = 7x_1 + 3x_2 + 8x_3 \)  
   Subject to the constraints,  
   \( 8x_1 + 2x_2 + x_3 \geq 3, \ 3x_1 + 6x_2 + 4x_3 \geq 4, \ 4x_1 + x_2 + 5x_3 \geq 1 \)  
   \( x_1 + 5x_2 + 2x_3 \geq 7 \) and \( x_1, x_2, x_3 \geq 0 \)
14. a) Explain VAM of finding Initial basic feasible solution of a transportation problem.
   
   Or
   
   b) Explain the degeneracy in transportation problem.

15. a) Explain Hungarian Method of solving a Assignment Problem.
   
   Or
   
   b) Explain the degeneracy in Assignment Problem.

**Part – C (3 x 10 = 30)**

**Answer any THREE questions**

16. Explain the applications and use of OR.
17. Explain simplex Algorithm.
18. Prove the theorem “The dual of the dual is the Primal”
20. Explain the procedure of maximization and minimization of Assignment problem
B.Sc. STATISTICS
(For the candidates admitted from 2017 – 2018 onwards)

SEMESTER – III
NON MAJOR ELECTIVE COURSES – I
MATRIX ALGEBRA

Unit- I:
Definition of Matrices – Addition, Subtraction and Multiplication of Matrices – Problems Only.

Unit-II:
Transpose of a Matrix – Adjoint of a Matrix – Inverse of a Matrix – Problems Only.

Unit-III:
Definitions of Symmetric, Skew symmetric, Hermitian and Skew Hermitian Matrices – Problems Only.

Unit-IV:
Rank of a Matrix - Definition – Finding the Rank of a Matrix – Problems up to 3x3 Matrix Only.

Unit-V:
Characteristic equation of matrix - Cayley Hamilton Theorem (Statement only) – Verification of Cayley Hamilton Theorem – Simple Problems only

Text Books:

Reference Book:
B.Sc. STATISTICS
(For the candidates admitted from 2012 – 2013 onwards)

SEMESTER – III
REGRESSION ANALYSIS

Unit-I:
Concept of correlation and its types – methods of correlation – Rank Correlation – equal and unequal rank

Unit-II:
Concept of regression – Liner, Non liner regression – Regression line – Regression Coefficient – properties of regression coefficient

Unit-III:
Curve fitting- methods – liner equations – methods of least square.

Unit-IV:
Regression curves – conversion of data into linear form (Power curve, Exponential curves).

Unit-V:
Growth curve fittings – exponential, Gompertz and logistic curves

Reference Books:

Note: Question paper may be set irrespective of the units
SECTION A – (10x2=20 Marks)

Answer ALL questions

1. What are the types of correlation?

2. x: 1 2 3 4 5  
   y: 10 15 20 25 30  
   Are x and y positively correlated or negatively correlated?

3. What do you mean by “Regression”?

4. State the relationship between correlation coefficient and regression coefficients.

5. Transform the curve of the form \( y = a e^{bx} \) into linear equation.

6. Find normal equation for fitting a curve of the form \( y = ax + bx^2 \).

7. What is meant by linear regression?

8. Give one example for linear regression and one example for non-linear regression.

9. State any two uses of curve fitting.

10. State the advantage of principle of least squares method of curve fitting.

SECTION B – (5x5=25 Marks)

Answer ALL questions

11. (a) Explain Scatter diagram method of studying correlation.  
   Or  
   (b) Explain Spearman’s method of finding correlation.

12. (a) State the two-variable regression model and its assumptions.  
   Or  
   (b) State and two properties regression coefficient and prove one of them.

13. (a) What is meant by curve fitting? Give example.  
   Or  
   (b) Explain the least squares method of curve fitting.

14. (a) Explain the method of fitting \( y = a + bx \) to the data \((x_i, y_i)\) \( i=1,2,\ldots,n \).  
   Or  
   (b) Show that linear regression equation of \( y \) on \( x \) and the least squares method of fitting equation of the form \( y = a + bx \) are one and the same.

15. (a) What are exponential curves? How do reduce them to linear equation?
(b) What are non-linear regression? What method will you use to fit non-linear regression?

**SECTION C – (3x10=30 Marks)**

**Answer any THREE questions**

16. Find Karl-Pearson coefficient of correlation and Spearman’s coefficient of correlation for the following data and comment on the results.

   \begin{align*}
   x: & \quad 10 \quad 15 \quad 20 \quad 25 \quad 30 \quad 28 \quad 23 \quad 18 \quad 17 \quad 14 \\
   y: & \quad 22 \quad 24 \quad 26 \quad 28 \quad 30 \quad 29 \quad 25 \quad 20 \quad 23 \quad 19
   \end{align*}

17. If the regression of y on x is linear, show that \( E(Y/X=x) = \mu_y + \rho \frac{\sigma_y}{\sigma_x} (x - \mu_x) \)

   Where \( E(X) = \mu_x, E(Y) = \mu_y, \rho = \text{correlation coefficient} \ V(X) = \sigma_x^2 \) & \( V(Y) = \sigma_y^2 \).

18. Explain the method of fitting an equation of the form

   \[ y = c + a_1 x + a_2 x^2 + a_3 x^3 + \ldots + a_n x^n, \]

   using the principle of least squares.

19. Fit \( y = a + bx + cx^2 \) to the following data and estimate the value of y when \( x=1996 \).

   \begin{align*}
   x: & \quad 1990 \quad 1991 \quad 1992 \quad 1993 \quad 1994 \quad 1995 \\
   y: & \quad 10 \quad 20 \quad 40 \quad 65 \quad 45 \quad 40
   \end{align*}

20. Fit a curve of the form \( y = a e^{bx} \) to the following data:

   \begin{align*}
   x: & \quad 0 \quad 2 \quad 4 \\
   y: & \quad 5.012 \quad 10 \quad 31.62
   \end{align*}
PERIYAR UNIVERSITY, SALEM - 11  
B.Sc., STATISTICS  
CBCS PATTERN  
STRUCTURE, SYLLABUS AND MODEL QUESTIONS  
(For candidates admitted from 2017- 2018 onwards)

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No. of courses - 8  800
B.Sc. STATISTICS
(For the candidates admitted from 2017 – 2018 onwards)

Core Course - IV

SEMESTER – IV

THEORY OF ESTIMATION

P. Code:

Unit – I:

Unit – II:

UNIT – III:
Sufficient statistic and its properties – Concept of complete sufficient statistics – Simple illustrations – Minimum Variance Bound Estimator (MVBE) – Concept of Blackwellisation – Statement and proof of Rao – Blackwell theorem

Unit – IV:
Methods of estimation – Maximum likelihood estimator (MLE. and their properties – Simple problems on MLE – Method of moments – Simple illustrations – Methods of minimum chi-square and modified minimum chi-square

Unit – V:
Interval estimation – Distinction between point estimation and interval estimation - Confidence interval and confidence limits – Construction of confidence intervals for parameters of Binomial, Poisson, Normal and Exponential distribution.

Reference Books:
1. Define an estimator and estimate
2. State Neyman – Factorization theorem
3. Define MVUE
4. What is asymptotic efficiency?
5. Define complete sufficient statistic
6. What is MVBE?
7. Under what condition least square estimator coincides with MLE?
8. Define maximum likelihood estimator.
9. Outline the need for interval estimation.
10. Define confidence limits.

11. a) Let \( x_1, x_2, \ldots, x_n \) be a random sample from the normal population \( N (\mu, 1) \). Show that 
\[
T = \frac{1}{n} \sum_{i=1}^{n} x_i^2
\]
is an unbiased estimate of \( 1 + \mu^2 \).
(Or)
b) Let \( x, \ldots, x_n \) be a random sample from a population with p.d.f. \( f (x; \theta) = \theta x^{\theta-1}, 0 \leq x < 1 \). Prove that 
\[
T = \prod_{i=1}^{n} x_i
\]
is sufficient for the parameter \( \theta \).

12. a) Prove that MVUE is unique
(Or)
b) Obtain C-R lower bound for the Cauchy population.

13. a) Define sufficient statistic and state its optimal properties.
(Or)
b) Explain the concept of Blackwellization.

14. a) Explain the method of moments
(Or)
45
b) State the properties of MLE.

15. a) Distinguish between point estimation and interval estimation.
    Or
    b) Explain the concept of confidence interval with suitable example.

    PART – C (3 X 10 = 30)

    Answer any THREE questions

16. Discuss the desirable properties of a good estimator.
17. State and establish Cramer – Rao inequality
18. State and prove Rao – Blackwell theorem
19. i) Explain the procedure of minimum \( \chi^2 \) chi-square method of estimation.
    ii) If X has uniform distribution \((a, b)\) find the estimates for ‘a’ and ‘b’ by the method of moments
20. Explain the procedure of finding confidence interval stating clearly the assumptions and give illustration
B.Sc. STATISTICS
(For the candidates admitted from 2017 – 2018 onwards)

SEMESTER - IV

DEcision Theory and Its applications

Unit – I:
Game Theory – Introduction – Two person zero sum game: - Maximin – Minimax principle – Game’s with saddle points - Game’s without saddle points – Dominance property – Graphical solutions of 2 x n and n x 2 Games – Reducing Game problem by LPP.

Unit – II:

Unit – III:
Sequencing problem – Problems with n-jobs on two machines – problems with n-jobs on three machines – problems with n-jobs on m-machines

Unit – IV:
Replacement problem – Replacement of items that deteriorate with time – Replacement of items whose maintenance cost increases with time & the values of money remain same during the period and the value of money also changes with time – selection of best machine amongst two.

Unit – V:
Network analysis – Basic concepts – Constraints in network – Construction of network – Critical path method (CPM) - Program Evaluation Review Technique (PERT)

Reference Books:
MODEL QUESTION PAPER
PERIYAR UNIVERSITY, SALEM - 11

B.Sc. Degree Examination
Branch – Statistics
(For the candidates admitted from 2017 – 2018 onwards)
SEMESTER - IV
DECISION THEORY AND ITS APPLICATION

Time: 3 Hours       Maximum: 75 Marks

Part – A (10 x 2 = 20)
Answer ALL questions

1. What do you mean by two person zero sum game?
2. What is a mixed strategy problem in a game theory?
3. Define expected opportunity Loss.
4. What is expected value of perfect information?
5. State any two assumptions in a sequencing problem.
6. Write the conditions to be satisfied in n-jobs on three machine sequencing problem.
7. What is a replacement problem?
8. Write the condition for the replacement of item when money value remains constant.
10. What is (a) Event (b) Node in a network?

Part – B (5 x 5= 25)
Answer ALL questions

11. a) Solve the following game

\[
\begin{array}{c|cccc}
B & 1 & 2 & 3 & 4 \\
\hline
I & 20 & 15 & 12 & 35 \\
A & II & 25 & 14 & 8 & 10 \\
& III & 40 & 2 & 10 & 5 \\
& IV & -5 & 4 & 11 & 0 \\
\end{array}
\]

Or

b) Solve the following 2 x 2 game

\[
\begin{array}{c|cc}
B & B_1 & B_2 \\
\hline
A & A_1 & 1 & -1/2 \\
& A_2 & -1/2 & 0 \\
\end{array}
\]

12. a) What is Maximax, Minimax criterion in a decision theory problem?
b) The conditional pay offs for each action-event combination are given below. Determine which alternative the businessman should choose, if he adopts the Hurwitz criterion with his degree of optimism being 0.7.

<table>
<thead>
<tr>
<th>Event</th>
<th>Alternative</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>8</td>
<td>0</td>
<td>-10</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>-4</td>
<td>12</td>
<td>18</td>
<td>-2</td>
<td></td>
</tr>
<tr>
<td>Z</td>
<td>14</td>
<td>6</td>
<td>0</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

13. a) Explain the procedures of solving the sequencing problems with n-jobs or three machines.

Or

b) Solve the following sequencing problem

<table>
<thead>
<tr>
<th>Job</th>
<th>Job 2</th>
<th>Job 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine 1</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Machine 2</td>
<td>8</td>
<td>3</td>
</tr>
</tbody>
</table>

14 a) Discuss the replacement of items problem when maintenance cost increases with time and the value of money remains the same.

Or

b). a firm is considering replacement of a machine, shows cost price is Rs.12,200 and the scrap value Rs.200. The running costs are found to be as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Running Cost (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>200</td>
</tr>
<tr>
<td>2</td>
<td>500</td>
</tr>
<tr>
<td>3</td>
<td>800</td>
</tr>
<tr>
<td>4</td>
<td>1200</td>
</tr>
<tr>
<td>5</td>
<td>1800</td>
</tr>
<tr>
<td>6</td>
<td>2500</td>
</tr>
<tr>
<td>7</td>
<td>3200</td>
</tr>
<tr>
<td>8</td>
<td>4000</td>
</tr>
</tbody>
</table>

15. a) Construct the network diagram for the following constraints

A <D, E; B,D <F; C<G; B, G<H; F, G < I

Where A, B, C, D, E, F, G, H, I are the activities.

Or

b) Calculate earliest starting and finishing time for each activity in the following network problem:

<table>
<thead>
<tr>
<th>Activity</th>
<th>1 - 2</th>
<th>1 - 3</th>
<th>2 - 4</th>
<th>3 - 4</th>
<th>3 - 5</th>
<th>4 - 9</th>
<th>5 – 6</th>
<th>5 - 7</th>
<th>6 - 8</th>
<th>7- 8</th>
<th>8 - 10</th>
<th>9 - 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>8</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>
16. Explain the procedure of solving a game problem by L.P.P.

17. The probability of the demand for Lorries for hiring on any day in a given district is as follows:

<table>
<thead>
<tr>
<th>No. of Lorries demanded:</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
<td>0.2</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Lorries have a fixed cost of Rs.90 each day and to keep the daily hire charges is Rs.200. If lorry-hire Company owns 4 Lorries, what is its daily expectation? If the company is about to go into business and currently has no Lorries, how many Lorries should it buy?

18. Explain the procedure of solving n jobs on m-machines

19. Explain the procedures of solving replacement problem whose maintenance cost increases with time and the value of money also changes with time.

20. A project is represented by the network shown below and has the following data.

<table>
<thead>
<tr>
<th>Task</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Least Time</td>
<td>5</td>
<td>18</td>
<td>26</td>
<td>16</td>
<td>15</td>
<td>6</td>
<td>7</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Greatest Time</td>
<td>10</td>
<td>22</td>
<td>40</td>
<td>20</td>
<td>25</td>
<td>12</td>
<td>12</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Most likely time</td>
<td>8</td>
<td>20</td>
<td>33</td>
<td>18</td>
<td>20</td>
<td>9</td>
<td>10</td>
<td>8</td>
<td>4</td>
</tr>
</tbody>
</table>

**Calculate**
1) Expected task times and their variances.
2) The probability of a node occurring at the proposed completion date if the original contract time of completing the project is 41.5 weeks.
B.Sc. STATISTICS
(For the candidates admitted from 2017 – 2018 onwards)

SEMESTER - IV
MAJOR PRACTICAL – II

Unit – I:
Fitting of Binomial, Poisson and Normal distribution. (Not testing the goodness of fit)

Unit – II:
Fitting of curves by the least square method up to polynomial of degree two, \( ax^b \), \( ae^{bx} \) and \( ab^x \)

Unit – III:
Multiple correlation and Partial correlation – Multiple Regression equations of three variables.

Unit – IV:
Estimation of parameters of statistical model (Multinomial distribution, exponential, normal, binomial and Poisson distributions) – Construction of confidence intervals for mean and variance

Unit – V:
Method of maximum likelihood and Method of moments – Fitting of Binomial, Poisson, Normal, Exponential distributions.

Note:
Total : 100 marks
* University Examination : 60 ”
  (Written practical)
Continuous Internal Assessment : 40 ”
  (Including Practical Record)

* 5 questions are to be set without omitting any unit. All questions carry equal marks. Any 3 questions are to be answered in 3 hours duration.
MODEL QUESTION PAPER
PERIYAR UNIVERSITY, SALEM - 11

B.Sc. Degree Examination
Branch – Statistics

(For the candidates admitted from 2017 – 2018 onwards)
SEMESTER – IV
MAJOR PRACTICAL – II

Time: 3 hours       Maximum: 60 marks

Answer any THREE questions
All questions carry EQUAL marks

1. In a population of size $N = 5$, values of $Y$ are 2,4,6,8,10. Select samples of size 3 and find the sample mean and variance. Prove that sample mean and variance are unbiased estimate of population mean and variance. Further show that variance of the estimate $y$ from sampling without replacement is less than that obtained from sampling with replacement.

2. The following table gives the measure value of timber ($y$) and they occurred ($x$) on 15 plot’s are selected using SRSWOR. The total cultivated area of the timber is 5124 acres and the total value of the timber is 61,10,000 ($x$). Obtain the ratio and regression estimate of the total value of the timber on the basis of the sample data given below:

<table>
<thead>
<tr>
<th>X</th>
<th>170</th>
<th>47</th>
<th>69</th>
<th>91</th>
<th>126</th>
<th>87</th>
<th>195</th>
<th>255</th>
<th>135</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>146</td>
<td>154</td>
<td>146</td>
<td>110</td>
<td>112</td>
<td>153</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>102</td>
<td>14</td>
<td>15</td>
<td>70</td>
<td>95</td>
<td>110</td>
<td>208</td>
<td>110</td>
<td>110</td>
</tr>
<tr>
<td></td>
<td>120</td>
<td>130</td>
<td>79</td>
<td>92</td>
<td>110</td>
<td>128</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. The weights of a calf taken at weekly intervals are given below. Fit a straight line using the method of least squares and calculate the average rate of growth per week.

<table>
<thead>
<tr>
<th>Age (X)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (Y):</td>
<td>52.5</td>
<td>58.7</td>
<td>65.0</td>
<td>70.2</td>
<td>75.4</td>
<td>81.1</td>
<td>87.2</td>
<td>5.5</td>
<td>101.2</td>
</tr>
</tbody>
</table>
4. The data given below represents the frequency of off-spring of classes.

<table>
<thead>
<tr>
<th>Classes</th>
<th>AB</th>
<th>Aβ</th>
<th>αB</th>
<th>αβ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>299</td>
<td>138</td>
<td>185</td>
<td>118</td>
</tr>
<tr>
<td>Probability</td>
<td>(2+θ)</td>
<td>(1- θ)</td>
<td>(1- θ)</td>
<td>θ</td>
</tr>
</tbody>
</table>

Estimate the parameter θ, by the method of maximum likelihood and also find out it’s S.E.

5. Fit a Poisson distribution for the following data and test the goodness of fit.

<table>
<thead>
<tr>
<th>X</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>f:</td>
<td>210</td>
<td>180</td>
<td>160</td>
<td>93</td>
<td>40</td>
<td>21</td>
<td>8</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>
 OPERATIONS RESEARCH

Unit – I:
Linear programming problem – Graphical Method – Simplex Method – Big – Method – Two phase method (Not more than three constraints)

Unit – II:

Unit – III:
Game Theory – Pure and Mixed Strategy situation with and without saddle point – Dominance rule – Graphical method for 2 x n and n x 2 Game.

Unit – IV:
Decision theory - Decision making under deterministic & probabilistic situations – EMV. Sequencing problem n jobs on two machines and n jobs on three machines

Unit – V:
Replacement problem – Items that deteriorate gradually and money value constant with time – Money value changing with time. Network analysis – Critical Path Method (CPM and PERT)

Note:
Total : 100 marks
* University Examination : 60 ”
(Written practical)
Continuous Internal Assessment : 40 ”
(Including Practical Record)
* 5 questions are to be set without omitting any unit. All questions carry equal marks. Any 3 questions are to be answered in 3 hours duration.
MODEL QUESTION PAPER
PERIYAR UNIVERSITY
B.Sc. Degree Examination
Branch – Statistics
(For the candidates admitted from 2017 – 2018 onwards)

SEMESTER – IV
SECOND ALLIED PRACTICAL
OPERATION RESEARCH

Time: 3 Hours       Maximum: 60 Marks

Answer any THREE questions
All questions carry EQUAL marks

1. Use penalty method to solve the following LPP.
   Maximize \( z = 2x_1 + x_2 + x_3 \)
   Subject to
   \[
   4x_1 + 6x_2 + 3x_3 \leq 8 \\
   3x_1 - 6x_2 - 4x_3 \leq 1 \\
   2x_1 + 3x_2 - 5x_3 \geq 4
   \]
   and \( x_1, x_2, x_3 \geq 0 \)

2. Obtain the optimum solution to the following transportation problem

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Demand</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

3. Use the notion of dominance to simplify the rectangular game with the following pay off and solve it graphically.

<table>
<thead>
<tr>
<th>Player B</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Player A</td>
<td>1</td>
<td>18</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>6</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>11</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>7</td>
<td>6</td>
<td>12</td>
</tr>
</tbody>
</table>

4. A newspaper boy has the following probabilities of selling a magazine
No. of copies sold 10 11 12 13 14
Probability 0.10 0.15 0.20 0.25 0.30

Cost of a copy is 30 paise and sale price 50 paise. He cannot return unsold copies.
How many copies should be ordered?

5. A capital equipment costs initially Rs. 18,000. Its annual operating costs and the fall in its resale value over the years are given below. Find out the optimum replacement period and the average annual cost for the replacement period.

<table>
<thead>
<tr>
<th>Year</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resale value (Rs.)</td>
<td>16000</td>
<td>14300</td>
<td>12850</td>
<td>11600</td>
<td>10500</td>
<td>9500</td>
<td>8550</td>
</tr>
<tr>
<td>Running cost (Rs)</td>
<td>800</td>
<td>950</td>
<td>1150</td>
<td>1400</td>
<td>1700</td>
<td>2100</td>
<td>2600</td>
</tr>
</tbody>
</table>
B.Sc. STATISTICS
(For the candidates admitted from 2017 – 2018 onwards)

SEMESTER - IV
NUMERICAL METHODS

NMEC- II
P. Code: 17UMAN05

Unit- I:
Solution of Algebraic equations only: By i) Bisection Method (no proof) and ii) Newton Raphson’s Method (no proof) – Simple Problems only.

Unit-II:
Finite difference – Definition – First difference – Higher differences – Construction of difference table – Operator $\Delta$, and $E$ only – Interpolation of missing value – Expression of any value of $y$ in terms of the initial value $y_0$ – Simple Problems.

Unit-III:
Newton’s Forward difference Formula (without proof) – Construction of difference Table - Simple Problems Only.

Unit-IV:
Newton’s Backward difference Formula (without proof) – Construction of difference Table - Simple Problems only.

Unit-V:
Central differences Formula: Gauss’s Forward and Gauss’s Backward difference formula (without proof) – Stirling formula (without proof) – Simple problems Only.

Text Books:

Reference Book:
Unit – I:
Concept of partial correlation – simple application

Unit – II:
Concept of multiple correlation – simple illustration

Unit – III:
Regression coefficients and its properties

Unit – IV:
Concept of multiple regression – simple problem

Unit – V:
Fitting of multiple regression lines and estimations (three variables only)

Reference Books:


Note: Question paper may be set irrespective of the units
1. Mention the use of studying partial correlation.

2. Write the formula for $r_{23,1}$.

3. Define multiple correlation.

4. If $r_{12} = 0.77$, $r_{13} = 0.72$ and $r_{23} = 0.52$. Calculate $R_{123}^2$.

5. Write the two regression equation.

6. If regression coefficient of X on Y and Y on X are -0.48 and -0.9 respectively. Calculate correlation coefficient of X and Y.

7. Write the formula for $b_{12,34...n} \Delta b_{21,34...n}$.

8. What is primary and secondary subscript?

9. Write the equation of plane of regression of $X_1$ on $X_2$ and $X_3$.

10. Write the error of estimate of trivariate distribution.

Section – B (5x5=25 marks)

Answer All Questions

11. (a) For a trivariate distribution prove that

$$R_{123} = \frac{r_{12} - r_{13}r_{23}}{\sqrt{1-r_{13}^2}\sqrt{1-r_{23}^2}}$$

Or

(b) From the heights ($X_1$), weights ($X_2$), and ages ($X_3$) of a group of students the following correlation coefficient were obtained $r_{12} = 0.75$, $r_{23} = 0.54$, $r_{31} = 0.43$. Calculate partial correlation coefficient.

12. (a) Express multiple correlation in terms of total and partial correlations.

Or

(b) Derive the multiple correlation coefficient of $X_1$ on $X_2$ and $X_3$.

13. (a) Write short notes on regression equation.

Or

(b) State the properties of regression coefficient.

14. (a) State the properties of residuals.

Or

(b) Explain the multiple regression of variables.
15. (a) Prove the identity
\[ b_{12.3} b_{23.1} b_{31.2} = r_{12.3} r_{23.1} r_{31.2} \]
Or

(b) Given the values
\[ \sigma_1 = 2, \sigma_2 = \sigma_3, r_{12} = 0.7, r_{23} = r_{31} = 0.5 \]
find \( b_{12.3} \) and \( b_{13.2} \).

**SECTION C – (3 x 10 = 30 marks)**

**Answer any THREE questions.**

16. Show that the correlation between the residuals \( X_{1.23} \) and \( X_{2.13} \) is equal and opposite that between \( X_{1.3} \) and \( X_{2.3} \).

17. If
\[ 1 - R^2_{1.23} = -(1 - r^2_{12})(1 - r^2_{13.2}) \]
deduce

(a) \( R_{1.23} \geq r_{12} \)

(b) \( R^2_{1.23} = r^2_{12} + r^2_{13} \) if \( r_{23} = 0 \)

(c) \[ 1 - R^2_{1.23} = \frac{(1 - \rho)(1 + 2\rho)}{(1 + \rho)} \]
provided all coefficient of few order are equal to \( \rho \).

18. Calculate the correlation coefficient and find the two lines of regression from the following data. Find the estimate of \( Y \) when \( X = 66 \).

<table>
<thead>
<tr>
<th>X</th>
<th>57</th>
<th>58</th>
<th>59</th>
<th>59</th>
<th>60</th>
<th>61</th>
<th>62</th>
<th>64</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>67</td>
<td>68</td>
<td>65</td>
<td>68</td>
<td>72</td>
<td>72</td>
<td>69</td>
<td>71</td>
</tr>
</tbody>
</table>

19. Obtain the equation of the plane of regression of \( X_1 \) on \( X_2 \) \( X_3 \) … \( X_n \).

20. Find the regression equation of \( X_1 \) on \( X_2 \) and \( X_3 \) given the following results.

\[ \bar{X}_1 = 28.02, \bar{X}_2 = 4.91, \bar{X}_3 = 594, \quad \sigma_1 = 4.42, \sigma_2 = 1.1, \sigma_3 = 85 \]

\[ r_{12} = 0.8, r_{23} = -0.56, r_{31} = -0.4. \]
PERIYAR UNIVERSITY, SALEM - 11

B.Sc., STATISTICS

CBCS PATTERN

STRUCTURE, SYLLABUS AND MODEL QUESTIONS

(For candidates admitted from 2017-2018 onwards)

SEMMESTER – V

<table>
<thead>
<tr>
<th>Sem.</th>
<th>Part</th>
<th>Course</th>
<th>Title</th>
<th>Hrs/week</th>
<th>Credit</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Core Theory Paper V</td>
<td>Sampling Techniques</td>
<td>6</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Core Theory Paper VI</td>
<td>Testing of Hypothesis</td>
<td>6</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Core Theory Paper VII</td>
<td>Statistical Quality Control</td>
<td>5</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Core Practical III</td>
<td>Major Practical III***</td>
<td>3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Core Practical IV</td>
<td>Major Practical IV***</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Core Elective I</td>
<td>Stochastic Processes</td>
<td>5</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>V</td>
<td>III</td>
<td>SBEC-III</td>
<td>Non – Parametric Test</td>
<td>3</td>
<td>3</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td></td>
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**Examination at the end of sixth semester**

**No of course - 5**
B.Sc. STATISTICS  
(For the candidates admitted from 2017 – 2018 onwards)

SEMESTER – V  
SAMPLING TECHNIQUES

Unit – I:
Concept of sampling and population: Need for sampling – Design, Organization and execution of sample survey – Principal steps in sample surveys – preparation of questionnaire and schedules – Pilot survey – Sampling and Non-sampling Errors – Limitations of sampling.

Unit – II:

Unit – III:
Stratified Random Sampling: Concept of stratifying factor - Unbiased estimate of the mean and variance of the estimated mean – Proportional and optimum allocation – Relative precision of stratified random sampling and simple random sampling

Unit – IV:
Ratio and regression estimators (based on simple random sampling only) – concept of Auxiliary variate – Ratio estimators – Bias of Ratio estimates – Variance of the ratio estimates – comparison of Ratio estimator with mean per unit. 

Regression Estimators: Linear regression estimate, Regression estimate with pre assigned ‘b’ and regression estimates computed from sample.

Unit – V:
Systematic sampling: Estimation of the mean and variance of the estimated mean – comparison of simple, stratified and systematic sampling – circular systematic sampling.

NSSO and its functions – Other agencies undertaking sample surveys.

Reference Books

MODEL QUESTION PAPER
PERIYAR UNIVERSITY, SALEM - 11
B.Sc. Degree Examination
Branch – Statistics
(For the candidates admitted from 2017 – 2018 onwards)
SEMESTER - V
SAMPLING TECHNIQUES

Time: 3 Hours        Maximum: 75 marks

Part – A (10 x 2 = 20)
Answer ALL questions

2. Define: Sampling error.
3. What is meant by a SRSWOR?
4. Compare the variances of SRSWR Vs SRSWOR.
5. What is meant by stratified random sampling?
6. State any two advantages of stratified random sampling.
7. Define the confidence limits of Y and R.
8. Define V( \hat{R} ).
9. State any two merits of systematic sampling.
10. The systematic sampling gives more precise estimate of the population mean as compared with SRSWOR if and only if ________

Part – B (5 x 5 = 25)
Answer ALL questions

11. a) Explain any two non-sampling errors.
Or
b) State the limitations of sampling.
12. a) Explain random number method of selecting SRS
Or
b) Explain the merits of SRS
13. a) Prove \( E(\bar{y}_a) = \bar{Y} \)
Or
b) Find \( V(\bar{y}_a) \) prop.
14. a) Explain the conditions under which the ratio estimator is a best linear unbiased estimator
Or
b) Derive \( V(\bar{Y}_l) \)
15. a) Explain the method of selecting a systematic sample.
   Or
   b) Distinguish between stratified random sampling and systematic random sampling.

Part – C (3 x 10 = 30)

Answer any THREE questions

16. Explain the principal steps involved in a sample survey.

17. Prove that in SRSWOR, the variance of the sample mean is given by,

\[ V(\bar{Y}_n) = \frac{S^2(N-n)}{nN} \]

18. Discuss proportional and optimum allocation in stratified random sampling.

19. Discuss the bias of the ratio estimate.

20. Prove \( \text{var} (\bar{y}_{st}) \leq \text{var} (\bar{y}_{sys}) \leq \text{var} (\bar{y}_n) \)
UNIT – I:


UNIT – II:

Testing of Significance – Large sample and small sample tests – Normal test for mean, variance, proportion and coefficient of correlation – Small sample tests based on t, F for testing mean and variance – Paired t test.

UNIT – III:

Likelihood Ratio (LR) test – Procedure and simple applications – Properties and use of LR test – Relationship between testing of hypothesis and confidence interval.

UNIT – IV:

Analysis of variance (ANOVA) – concept and example – Explanation ANOVA for one way and two – Classifications – Procedures and inference – Chi Square test for Variance, Goodness of fit and independence of attributes.

UNIT – V:

Sequential analysis – Need for Sequential rules – Wald’s sequential Probability Ratio Test (SPRT) – Average Sample Number (ASN. and Operating Characteristic (OC) functions – Simple illustrations.

References Books:

TESTING OF HYPOTHESIS

Part – A (10 x 2 = 20)

Answer ALL question

1. Define a statistical hypothesis?
2. What do you mean by Critical Region?
3. Distinguish between small sample and large sample test
4. What is the importance of paired t-test?
5. Define LR test
6. State any two uses of LR test?
7. Define analysis of variance
8. What is contingency table?
9. What is meant by sequential analysis?
10. Define an OC function of a SPRT.

Part – B (5 x 5 = 25)

Answer ALL questions

11. a) Explain the two types of errors in hypothesis testing.
Or
b) Distinguish between MP test and UMP test.

12. a) Describe the t-test procedure for the testing the equality of mean of two normal Populations
Or
b) Discuss the F-test for testing the equality of variances of two normal populations.

13. a) State the properties of LR test
Or
b) Explain paired t-test procedure.

14. a) Outline the procedure of ANOVA of one-way classification
Or
b) Explain the $\chi^2$ test procedure for testing the independence of attributes

15. a) What is average sample number? What purpose does this serve in SPRT?
Or
b) Explain the need for sequential rules.
Part – C (3 x 10 = 30)

Answer any THREE questions


17. Explain the large sample test procedure for testing the equality of proportions for unequal sample size from two populations.

18. Explain the relationship, between testing of hypothesis and confidence interval giving example.

19. Derive the analyse of variance for two way classification stating clearly its assumptions.

20. Explain the procedure of SPRT and state its OC and ASN functions. Mention the importance of SPRT.
Unit – I:
Basic concepts of quality – Meaning of quality – Quality of design – Quality of conformance – Specification of quality concepts of S.Q.C. – Causes of variation

Unit – II:
Process control – Control chart – Basis of control chart – uses - Rational subgroups – Control charts for variables (\(\overline{X}, R\) and S – Charts) – Sloping control Charts – Uses of Control Chart.

Unit – III:
Control charts for Attributes (P, np, c for fixed and varying sample sizes) – comparison of control charts for variable and attributes – Applications of theory of runs in quality control.

Unit – IV:
Product control – Acceptance sampling – Sampling inspection by attributes – Producer’s and consumer’s risk, AQL, LTPD, IQL – Single, Double sampling plan procedure, OC, AOQ, AOQL, ASN and ATI curves

Unit – V:
Sequential sampling plan procedure – estimation of parameters – OC, AOQ, ASN curves, multiple sampling, comparison between single, double and multiple sampling

Reference Books:
PART – A (10 x 2 = 20)

1) What are the objectives in quality control?
2) Write a note on process specification?
3) Define process control in manufacturing product
4) What are the factors needed while selecting a sub group?
5) Write two applications of C-Chart
6) Write the 3 σ - control limits for number of defective charts.
7) Define producer’s risk.
8) What do you mean by a double sampling plan?
9) Define OC-function of a sequential sampling plan.
10) Mention the ASN function for sequential sampling plan.

PART – B (5 x 5 = 25)

11. a) Explain the various steps in quality control programme.
Or
b) Explain the following terms
   i) Standard specification
   ii) Customer specification

12. a) What do you understand by control charts in statistical quality control.
Or
b) Explain briefly about detecting lack of control in X & R – Charts.

13. a) Explain the construction of control limits for P-Chart.
Or
b) Distinguish between control chart for variables and attributes.
14. a) Write short note on the following
   i. a Q L, (ii)LTPD in an acceptance sampling procedure.
   Or
   b) How to determine the consumer’s risk in single sampling plan?

15. a) Explain briefly the sequential sampling inspection plan.
   Or
   b) How to form the OC-function of a sequential sampling plan?

Part – C (3 x 10 = 30)
Answer any THREE questions

17) Explain the concept of sloping control chart and how to estimate tolerance spread in machining operations.
18) Explain in details the theory of runs in quality control
19) Discuss the double sampling procedure and how to obtain OC-curve in this plan.
20) Obtain the OC & AOQ curves for sequential sampling plan.
Unit – I:
Definition of Stochastic Processes – Classification of Stochastic Processes according to time parameter space and state space – Examples of Stochastic Processes

Unit – II:
Markov Chains – Definitions and examples – Higher transition probabilities – Chapman - Kolmogorov equation – Classification of States – Limiting behaviour (concept and applications only)

Unit – III:
Stationary processes and time series – Strict and wide Sense stationary models of time series – Concept of spectrum of time series

Unit – IV:
Poisson Processes – Poisson process and related distributions – Birth-death processes – Simple examples

Unit – V:

Note: Emphasis should be only on the concepts, Statement and Applications of major theorems and results on the topics mentioned in the syllabus.

Reference Books:
MODEL QUESTION PAPER
PERIYAR UNIVERSITY, SALEM - 11
B.Sc. Degree Examination
Branch – Statistics
(For the candidates admitted from 2017 – 2018 onwards)
SEMESTER – V
STOCHASTIC PROCESSES
Time: 3 Hours       Maximum: 75 marks

Part – A (10 x 2 = 20)
Answer ALL questions

1. What is a random variable?
2. Define a stochastic process.
3. State the markov property.
4. Define (i. absorbing state (ii) Transient state.
5. Define a stationary process.
6. What is a wide sense stationary?
7. Define a birth process.
8. State any two postulates of poison process.
9. Define Brownian movement
10. What is Wiener process?

Part – B (5 x 5 = 25)
Answer ALL questions

11. a) Explain state space and parametric space with an example.  
Or
b) Explain how you classify the stochastic process w.r.t. state and parametric 
spaces.

12. a) Define markov chain and give an example.  
Or
b) What do you mean by stochastic matrix?

13. a) Show that poison process is not stationary process.  
Or
b) Show that first order markov process is a co-variance stationary.

14. a) What are the properties of Poisson process?  
Or
b) Show that the interval between two successive occurrences of a Poisson process
{N(t)} having parameter \( \lambda \) has a negative exponential distribution with mean \( 1/\lambda \).
15. a) Write a note on Markov process with continuous states space
   Or
   b) Describe first passage time distribution for Wiener process

   Part – C (3 x 10 = 30)
   Answer any THREE questions

16. Explain the stochastic process with
   (i) Discrete valued continuous time parametric space
   (ii) Continuous valued discrete time parametric space, giving suitable example for each.

17. State and prove Chapman-Kolmogorov equation.

18. Show that moving average process is co-variance stationary.

19. Derive the differential equations satisfied by a Birth-Death process.

20. Obtain the Kolmogorov equation
Unit – I:
Introduction of non-parametric test – its comparison with parametric test – Advantage and limitations of non-parametric tests

Unit – II:
Test for randomness – Run test – Test for rank correlation coefficient – Sign test.

Unit – III:
Comparison of two populations: median test – Mann Whitney U test – Wilcoxon signed rank test for paired observations.

Unit – IV:
Comparison of several populations: Median test for several samples – Kruskal Walli’s test – Friedman ANOVA.

Unit – V:

References Books:

Note: Question paper may be set irrespective of the units
1. What do you mean by non–parametric test?
2. When do you apply non–parametric test?
3. Define a run?
4. Write the rank correlation coefficient formula.
5. What is meant by two–sample problem?
6. For paired observations, what are the non–parametric tests available?
7. What are the non–parametric tests that are used to compare three or more populations?
8. Write down the formula for H–statistic.
9. What is the purpose of Smirnov test?
10. Give to applications of Chi square distribution one for parametric test and another for non–parametric test.

SECTION B – (5x5=25 Marks)
Answer ALL questions

11. (a) State the assumptions of Non-Parametric tests.  
   Or  
   (b) What are the limitations of Non-parametric tests  
12. (a) Explain the run test for randomness.  
   Or  
   (b) Compare t-test and sign test.  
13. (a) Explain the median test.  
   Or  
   (b) Distinguish between U-test and Wilcoxon signed rank test.  
14. (a) Explain the role of ranks in non-parametric tests.  
   Or  
   (b) Explain median test for K samples and compare it with median test for 2 samples.  
15. (a) Explain goodness of fit test by Kolmogorov - Simonov.  
   Or
(b) What are distribution free tests?

SECTION C – (3x10=30 Marks)
Answer any THREE questions

16. Distinguish between parametric and non-parametric tests.

17. Explain the test for rank correlation coefficient.

18. Discuss the Mann-Whitney U test and its importance.

19. The following are the final examination grades of sample from three groups of students who were taught German by three different methods.
   Method I: 94, 88, 91, 74, 87, 97
   Method II: 85, 82, 79, 84, 61, 72, 80
   Method III: 89, 67, 72, 76, 68
   Apply suitable non-parametric test for testing the null hypothesis that the three methods are equally effective.

20. Explain Chi square test for K proportions.
### B.Sc., STATISTICS

**CBCS PATTERN**

**STRUCTURE, SYLLABUS AND MODEL QUESTIONS**

(For candidates admitted from 2017 - 2018 onwards)

#### SEMESTER – VI

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UNIT – I:
Basic principles of experimental design – Replication Randomization and local control – Transformation of data and its need.

UNIT – II:
Uniformity trials – LSD test – SNK test – Duncan’s multiple range test – Turkeys (HSD) test – Basic designs – Completely Randomized design (CRD. and its Analysis.

UNIT – III:
Randomized Block Design (RBD. and their analysis – Missing plot technique for RBD (one and two missing values) – Latin Square Design (LSD. and its analysis – Missing plot technique

UNIT – IV:
Factorial Experiments: Concept of main effects and interactions pxq, 2², 2³ and principle of confounding. (Concepts Only)

UNIT – V:
3² Factorial Experiment – Need and analysis of split – plot design (two factors only – main plot treatments with RBD layout)

Reference Books:
answer all questions

1) State the basic principles of experimental design
2) Define local control
3) What is Turkey’s test
4) What are uniformity trials?
5) Define Randomized block design
6) Write down the formula for estimating a missing value in RBD.
7) State any two advantages of factorial experiments.
8) What do you mean by confounding?
9) Define split plot design
10) What is $3^2$ factorial experiment

Answer ALL Questions

11. a) Explain the need for transformation of data
Or
b) Describe Randomization

12. a) Explain least significant difference test
Or
b) State any five advantages of CRD.

13. a) Explain the analysis of RBD
Or
b) Explain how the randomization principle is done in the construction of LSD with an example.

14. a) Define main effect and interaction effect in $2^2$ factorial experiment.
Or
b) Distinguish between partial and total confounding.
15. a) Explain strip-plot design with two factors.

Or

b) Define main effect & interaction effect in a $3^2$ factorial experiment.

Part – C (3 x 10 = 30)

Answer any THREE questions

16) Discuss square root and Angular transformations of data
17). Describe the analysis of Completely Randomized Design
18) Describe the analysis of RBD with one missing observation.
19) Sketch the analysis of $2^3$ factorial experiments.
20) Explain, in detail, the analysis of $3^2$ factorial experiment.
Unit – I:

Unit – II:

Unit – III:
Basis of Index Numbers – Definition – uses - Problems in the construction – Different types of Index Numbers – Simple Index Numbers – Weighted Index Numbers – Laspeyre’s Index Numbers – Paasche’s Index Numbers – Fisher’s Index Numbers – Marshall & Edge worth Index Numbers – Dorbish & Bowley’s Index Numbers

Unit – IV:
Optimum tests of Index Numbers – Time reversal test – Factor Reversal Test – Circular Test – Chain base Index Number – Conversion of FBI into CBI and Vice versa – Uses of Index Numbers - Wholesale price Index Numbers (Concept only)

Unit – V:
Cost of living Index Numbers – Methods of construction – Aggregate method – Family budget method – splicing and deflating – Base shifting – Uses of cost of living Index Numbers.

Reference Books:
MODEL QUESTION PAPER
PERIYAR UNIVERSITY, SALEM - 11
B.Sc. Degree Examination
Branch – Statistics
(For the candidates admitted from 2017 – 2018 onwards)
SEMESTER – VI
APPLIED STATISTICS
Time: 3 Hours       Maximum 75 Marks.
Part – A (10 x 2 = 20)
Answer ALL questions

1) What do you mean by time series Analysis?
2) State the models used in a time series data
3) Define Auto Correlation.
4) What do you mean by periodogram?
5) Give the definition of an Index Number.
6) What are weighted Index Numbers?
7) Define circular test
8) Explain how the base year for the construction of Index Number is selected?
9) What do you mean by ‘Base Shifting’?
10) State the errors involved in the construction of cost of living Index Number.

Part – B (5 x 5 = 25)
Answer ALL questions

11. a) Explain the Semi-Average method for fitting a trend line
    Or
    b) Explain the procedure of deciding about the type of the trend line or curve
       suitable for a given time series data.

12. a) Obtain the value of $r_k$ for the first order auto-regressive series.
    Or
    b) Explain briefly the periodogram analysis.

13. a) Prove that Fisher’s Index Number lies between Laspeyre’s and Paasche’s index
      numbers.
    Or
    b) Explain the sampling error of an Index Number.

14. a) Explain Time Reversal and Factor Reversal Tests with an example.
b) State the uses of Index Numbers.

15. a) What do you mean by splicing and deflating of Index Numbers.
   Or
   b) Outline the uses of Cost of Living Index Numbers.

**Part – C (3 x 10 = 30)**

**Answer any THREE questions**

16) Explain briefly the component of a time series data.

17) Describe variate difference method.

18) Explain briefly the problems involved in the construction of Index Number

19) The following table gives the average wholesale prices of four groups of commodities for the year 1999 to 2003. Compute chain base Index Numbers

<table>
<thead>
<tr>
<th>Commodity</th>
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<th>2000</th>
<th>2001</th>
<th>2002</th>
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<td>4</td>
<td>3</td>
</tr>
<tr>
<td>C</td>
<td>4</td>
<td>12</td>
<td>20</td>
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<td>5</td>
<td>7</td>
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</table>

20) Explain the problems in the constructions of cost of Living Index Numbers and state its uses.
B.Sc. STATISTICS  
(For the candidates admitted from 2017 – 2018 onwards)  
SEMESTER – VI  
ACTUARIAL STATISTICS  

UNIT - I: 
Present value and accumulated value at fixed rate and varying rates of interest – effective rate of interest corresponding to a nominal rate of interest and vice-versa – Simple problems – annuity – types of annuities excluding perpetuity – derivation of the formula for $a_n\%, s_n\%, a_{-n/0}^\%$ and $s_{-p/0}^\%$ simple problems.

Unit – II:  
Derivation of the formula for $a^{(p)}\%, s^{(p)}\%, a_{-n/0}^{(p)}^\%$ and $s_{-p/0}^{(p)}%$ simple problems – redemption of loan by uniform early payment – definitions of sinking fund – redemption of loan by a sinking fund (uniform early payment) simple problems.

Unit – III:  

Unit – IV:  
Principles of Insurance – Types of assurance – temporary assurance, pure endowment assurance, endowment assurance and whole life assurance – Expressions for present values of assurance benefits under temporary assurance, pure endowment assurance, endowment assurance and whole life assurance plans – simple problems

Unit – V:  
Definitions of premium, Natural premium level, Annual Premium, Net Premium and Office Premium – Expressions for level annual premium under temporary assurance, pure endowment assurance, endowment assurance and whole life assurance plans – simple problem involving the calculations of level annual present annual premium, office premium and the four types of plans only.

Reference Books:  
1. Mathematics Basis of Life Insurance – Insurance Institute of India.  
MODEL QUESTION PAPER
PERIYAR UNIVERSITY, SALEM - 11
B.Sc. Degree Examination
Branch – Statistics
(For the candidates admitted from 2017 – 2018 onwards)
SEMESTER – V
ACTUARIAL STATISTICS

Time: 3 Hours       Maximum: 75 marks

Section – A (10 x 2 = 20)
Answer ALL questions

1. Define immediate annuity.
2. What is an effective rate of interest?
3. What is sinking fund?
4. What is Redemption of Loan?
5. What is the difference between complete and curtate expectation of life?
8. What is meant by whole life Assurance?
10. What is office premium?

Section – B (5 x 5 = 25)
Answer ALL questions

11. a) The compound interest on Rs.8,000/- in two years at a certain rate is Rs.820/- and in 3 years it is Rs.1261 at the same rate. Find the rate of interest.

Or

b) Derive the relation between effective rate and nominal rate and vice versa.

12. a) Find the present value of an immediate annuity of Rs.600/- p. a. payable half-yearly for 20 years on the basis of the effective rate of 6% p. a.

Or

b. a sinking fund is set up by uniform payments made at the end of each year, to provide a capital of Rs.3,500/- at the end of 20 years, money in the fund accumulating at 10% p. a. What is the uniform payment required? What is the position of the fund at the end of 8 years?
13. a) Fill in the blanks in a portion of life table given below:

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<th>(d_x)</th>
<th>(p_x)</th>
<th>(q_x)</th>
<th>(L_x)</th>
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<td>?</td>
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Or

b) Fill up the blanks in the following portion of a life table.

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<tr>
<th>Age (x)</th>
<th>(L_x)</th>
<th>(d_x)</th>
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14. a) Express the present value of temporary assurance in term of commutation functions.

Or

b) What is the principle of insurance?

15. a) What are natural premiums?

Or

b) What are the consequences of level premium system?

Section – C (3 x 10 = 30)

Answer any THREE questions

16. Explain in detail, different types of Annuities.

17. A loan of Rs.7500/- is made subject to repayment by 15 level annual payments, the first to be made at the end of 6 years. If rate of interest of 10% is to be earned, find the level annual payment. What is the principal contained in the (i) 1\(^{st}\) payment and (ii) 5\(^{th}\) payment?

18. Describe the method of construction of mortality table.

19. Drive the expression for Endowment Assurance in terms of communication functions.

20. Explain any three types of Life Assurance plans
UNIT - I:

UNIT – II:

UNIT – III:
Interpolation with equal and unequal intervals: Newton – Gregory forward Interpolation and Backward Interpolation formula for equal intervals – Lagrange Interpolation formula for unequal intervals.

UNIT – IV:

Unit – V:

Reference Books:
1. G.Shanker Rao, Numerical Analysis (New Age International Publications)
3. K.E. Aitkinson, An introduction to Numerical Analysis (John Wiley and sons)
5. P.Scheild, (1968), Numerical Analysis (Schaum Series).
NUMERICAL ANALYSIS

Part – A (10 x 2 = 20)

1) Define polynomial of degree ‘n’ in x?
2) Define Bisection method?
3) What is meant by shift operator?
4) Write any two properties of the operators E and Δ.
5) What are the methods involving equispaced arguments in interpolation?
6) What are the assumptions of Lagrange’s interpolation technique?
7) Under what situations Newton-Gregory forward and backward formula is used?
8) Write the formula for Newton’s backward formula.
9) What is mean by Trapezoidal Rule?
10) Define the term error of approximation.

Part – B (5 x 5 = 25)

Answer ALL questions

11. a) Describe the method of Regula-Falsi position to solve an equation f(x) = 0
Or
b. apply Newton Raphson’s formula to find the root of x₄ – x = 10 which is nearer to x = 2.

12. a) Discuss briefly the shift operator.
Or
b) If f(x) is a rational integral (or polynomial) function of degree n in x, then prove that nth difference of this polynomial is constant.

13. a) Show that Lagrange’s formula can be evolved by equating (n+1)th divided difference of f(x) to zero if f (x) is a polynomial of degree n.
Or
b) Interpolate f (2) from the following data.

<table>
<thead>
<tr>
<th>x</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>f(x)</td>
<td>7</td>
<td>?</td>
<td>13</td>
<td>21</td>
<td>37</td>
</tr>
</tbody>
</table>

14. a) Find the first derivative of the function given below at the point x = 1.2.
b) Derive the formula for differentiation of Newton’s forward difference upto first derivative only.

15. a) Derive the expression for Simpson’s one-third rule
Or
b) Explain the concept of general quadrature for equidistant ordinate.

Part – C (3 x 10 = 30)

Answer any THREE questions

16) Derive the formula for Newton-Raphson method for the solution of Algebraic equations.

17) Find the function whose first difference is
   (i. ax + b, (ii) e^x, (iii) e^{a+bx}

18) Derive the formula for Newton-Gregory Backward interpolation formula for equal intervals.

19) Given the following pairs of values of x and y = f(x)
   
   \[
   \begin{array}{cccccc}
   x & : & 1 & 2 & 4 & 8 & 10 \\
   y = f(x) & : & 0 & 1 & 5 & 21 & 27 \\
   \end{array}
   \]
   Determine numerically the first derivative at x = 4

20. Calculate by Simpson’s 1/3rd rule an approximate value of \( \int_{-3}^{3} x^4 \, dx \) by taking seven equidistant ordinates.
UNIT – I:
Queuing system – Kendal’s terminology – Classification of States - Poisson axioms.

UNIT – II:
Distribution of arrival and departure under Poisson queues.

UNIT – III:
Pure Birth – Death process – transient state and steady state solution

UNIT – IV:
M/M/1; ∞/FIFO queuing Model – steady state solution – Averages – Little’s formula

UNIT – V:
M/M/1;N/FIFO queuing model – steady state solution – Averages – Simple problems.

Reference Books:
Note: Question paper may be set irrespective of the units.
B.Sc. STATISTICS
(For the candidates admitted from 2017 – 2018 onwards)

SEMESTER – VI
MAJOR PRACTICAL – III

Unit – I:
Simple random Sampling – Drawing sample from the population with and without replacement – Estimation of population mean, total, variance, and its S.E. – Stratified random Sampling : Allocation, Estimation of mean, variance of the population mean – Variance of the estimator of mean under proportional and optimal allocations.

Unit – II:
Test of significance: Large sample - Single proportion- difference of proportions – Single mean – difference of two means – correlation coefficient – Chi square test for independence of attributes

Unit – III:
Test of significance: Small sample test – t test for single mean – difference of two means – paired t test – F test for equality of two variances

Unit – IV:
Analysis of CRD, RBD and LSD - Missing plot techniques in RBD and LSD with one missing observation

Unit – V:
Analysis of factorial experiments $2^2$ and $2^3$ using Yates Algorithm – Analysis of $3^2$ factorial experiments

Note :
Total : 100 marks
* University Examination : 60 ”
   (Written practical)
Continuous Internal Assessment : 40 ”
   (Including Practical Record)
* 5 questions are to be set without omitting any unit. All questions carry equal marks. Any 3 questions are to be answered in 3 hours duration.
1. Let x have a pdf of the form \( f(x, \theta) = \frac{1}{\theta} e^{-x/\theta}, \quad 0 < x < \infty, \theta > 0 \)

To test \( H_0: \theta = 2 \) Vs \( H_1: \theta = 1 \) use the random sample \( x_1, x_2 \) of size 2 and define a critical region: \( w : \{(x_1, x_2) : 9.5 \leq x_1 + x_2\} \)

Find (i) Power of the test
(ii) Significance level of the test

2. The following table gives the number of good and bad parts produced by each of three shifts in a factory:

<table>
<thead>
<tr>
<th>Shift</th>
<th>Good</th>
<th>Bad</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day</td>
<td>900</td>
<td>130</td>
<td>1030</td>
</tr>
<tr>
<td>Evening</td>
<td>700</td>
<td>170</td>
<td>870</td>
</tr>
<tr>
<td>Night</td>
<td>400</td>
<td>200</td>
<td>600</td>
</tr>
<tr>
<td>Total</td>
<td>2000</td>
<td>500</td>
<td>2500</td>
</tr>
</tbody>
</table>

Is there any association between the shift and the quality of parts produced?

3. The sales data of an item in six shops before and after a special promotional campaign are as under:

<table>
<thead>
<tr>
<th>Shops</th>
<th>Before Campaign</th>
<th>After Campaign</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>53</td>
<td>58</td>
</tr>
<tr>
<td>2</td>
<td>28</td>
<td>29</td>
</tr>
<tr>
<td>3</td>
<td>31</td>
<td>30</td>
</tr>
<tr>
<td>4</td>
<td>48</td>
<td>55</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
<td>56</td>
</tr>
<tr>
<td>6</td>
<td>42</td>
<td>45</td>
</tr>
</tbody>
</table>

Can the campaign be judged to be a success? Test at 5% level of significance.
4. The yields of 6 varieties in 4 replicate experiments, for which one value is missing is given below. Estimate the missing value and analyze the data

<table>
<thead>
<tr>
<th>Blocks</th>
<th>Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 5 6</td>
</tr>
<tr>
<td>1</td>
<td>18.5 15.7 16.2 14.1 13.0 13.6</td>
</tr>
<tr>
<td>2</td>
<td>11.7 - 12.9 14.4 16.9 12.5</td>
</tr>
<tr>
<td>3</td>
<td>15.4 1.6 15.5 20.3 18.4 21.5</td>
</tr>
<tr>
<td>4</td>
<td>16.5 18.6 12.7 15.7 16.5 18.0</td>
</tr>
</tbody>
</table>

5. Analyze the following $2^2$ factorials experiments and give your inference.

<table>
<thead>
<tr>
<th>Blocks</th>
<th>Yields</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 k P kp</td>
</tr>
<tr>
<td>I</td>
<td>23 25 22 38</td>
</tr>
<tr>
<td>II</td>
<td>p 1 K kp</td>
</tr>
<tr>
<td></td>
<td>40 26 36 38</td>
</tr>
<tr>
<td>III</td>
<td>1 k Kp p</td>
</tr>
<tr>
<td></td>
<td>29 20 30 20</td>
</tr>
<tr>
<td>IV</td>
<td>kp k P 1</td>
</tr>
<tr>
<td></td>
<td>34 31 24 28</td>
</tr>
</tbody>
</table>
B.Sc. STATISTICS
(For the candidates admitted from 2017 – 2018 onwards)

MAJOR PRACTICAL – IV

Unit – I:
Construction of control charts for variables: $\bar{X}$, R and S charts. Control charts for attributes of fixed and varying sample size – p, np and C charts.

Unit – II:
Acceptance sampling plan for attributes: single sampling plan – OC, AOQ, ASN and ATI curves; Double sampling plan – OC, AOQ, ASN and ATI curves

Unit – III:
Estimation of trend by moving averages, least square methods – First degree and second degree polynomials - Computation of quarterly and monthly trends

Unit – IV:
Estimation of seasonal indices by simple average method - Ratio-to-trend, Ratio-to-moving Average and link relative methods

Unit – V:
Cost of living index Number – Family budget method – Aggregate expenditure method

Note:
Total : 100 marks
* University Examination : 60 ”
(Written practical)
Continuous Internal Assessment : 40 ”
(Including Practical Record)
* 5 questions are to be set without omitting any unit. All questions carry equal marks. Any 3 questions are to be answered in 3 hours duration.
1. The following are the figures of defectives in 22 lot each containing 2,000 rubber belts. Draw p-chart and comment on state of control of the process.


2. For the single sampling plan \( N = 2000, n = 100, c = 2 \)

Obtain OC curve, AOQ curve and ATI curve. Also find AOQL.

3. Fit a straight line trend by the method of Least square. Calculate the trend values.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>23</td>
<td>38</td>
<td>50</td>
<td>68</td>
<td>100</td>
<td>125</td>
<td>140</td>
</tr>
</tbody>
</table>

Also estimate the value for 2005.

4. Calculate the seasonal indices for the following data by the method of Ratio-to-moving average.

<table>
<thead>
<tr>
<th>Year</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>12</td>
<td>15</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>1999</td>
<td>15</td>
<td>18</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>2000</td>
<td>20</td>
<td>23</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td>2001</td>
<td>22</td>
<td>25</td>
<td>27</td>
<td>30</td>
</tr>
</tbody>
</table>

5. Find Fisher’s index number from the following data. Show that Fisher’s Index satisfies i) TRT and ii) FRT.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>2003</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Price</td>
<td>Quantity</td>
</tr>
<tr>
<td>A</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>B</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>C</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>D</td>
<td>10</td>
<td>13</td>
</tr>
</tbody>
</table>
(For the candidates admitted from 2017 – 2018 onwards)

SUBJECT CODES

I. CORE COURSES (Theory 9 + Elective 3 + Practical 4 = 16)

i. CORE THEORY PAPERS: 9

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>TITLE</th>
<th>SUBJECT CODE</th>
<th>SEMESTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Descriptive Statistics</td>
<td></td>
<td>I</td>
</tr>
<tr>
<td>2.</td>
<td>Probability Theory</td>
<td></td>
<td>II</td>
</tr>
<tr>
<td>3.</td>
<td>Distribution Theory</td>
<td></td>
<td>III</td>
</tr>
<tr>
<td>4.</td>
<td>Theory of Estimation</td>
<td></td>
<td>III</td>
</tr>
<tr>
<td>5.</td>
<td>Sampling Techniques</td>
<td></td>
<td>IV</td>
</tr>
<tr>
<td>6.</td>
<td>Testing of Hypothesis</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>7.</td>
<td>Statistical Quality Control</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>8.</td>
<td>Design of Experiments</td>
<td></td>
<td>VI</td>
</tr>
<tr>
<td>9.</td>
<td>Applied Statistics</td>
<td></td>
<td>VI</td>
</tr>
</tbody>
</table>

ii. CORE ELECTIVES PAPERS: 3

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>TITLE</th>
<th>SUBJECT CODE</th>
<th>SEMESTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Stochastic Processes</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>2.</td>
<td>Actuarial Statistics</td>
<td></td>
<td>VI</td>
</tr>
<tr>
<td>3.</td>
<td>Numerical Analysis</td>
<td></td>
<td>VI</td>
</tr>
</tbody>
</table>

iii. CORE PRACTICAL PAPERS :4

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>TITLE</th>
<th>SUBJECT CODE</th>
<th>SEMESTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Major Practical-I (Based on core theory papers -1 &amp; 2)</td>
<td></td>
<td>II</td>
</tr>
<tr>
<td>2.</td>
<td>Major Practical-II (Based on core theory papers -3 &amp;4)</td>
<td></td>
<td>IV</td>
</tr>
<tr>
<td>3.</td>
<td>Major Practical-III (Based on core theory papers -5, 6 &amp;8)</td>
<td></td>
<td>VI</td>
</tr>
<tr>
<td>4.</td>
<td>Major Practical-IV (Based on core theory papers – 7 &amp; 9)</td>
<td></td>
<td>VI</td>
</tr>
</tbody>
</table>
II. ALLIED COURSES (Theory 4 + Practical 2 = 6)

i. ALLIED THEORY PAPERS: 4

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>TITLE</th>
<th>SUBJECT CODE</th>
<th>SEMESTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mathematics-I</td>
<td></td>
<td>I</td>
</tr>
<tr>
<td>2.</td>
<td>Mathematics-II</td>
<td></td>
<td>II</td>
</tr>
<tr>
<td>3.</td>
<td>Linear Programming And Its Applications</td>
<td></td>
<td>III</td>
</tr>
<tr>
<td>4.</td>
<td>Decision Theory And Its Applications</td>
<td></td>
<td>IV</td>
</tr>
</tbody>
</table>

ii. ALLIED PRACTICAL: 1+1

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>TITLE</th>
<th>SUBJECT CODE</th>
<th>SEMESTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Allied I: Mathematics Practical - 1</td>
<td></td>
<td>II</td>
</tr>
<tr>
<td>2.</td>
<td>Allied II: Operations Research - 2 (Based On Allied II: Theory Papers 1 &amp; 2)</td>
<td></td>
<td>IV</td>
</tr>
</tbody>
</table>

III. SKILL BASED ELECTIVE COURSES: 4

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>TITLE</th>
<th>SUBJECT CODE</th>
<th>SEMESTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Regression Analysis</td>
<td></td>
<td>III</td>
</tr>
<tr>
<td>2.</td>
<td>Statistical Forecasting</td>
<td></td>
<td>IV</td>
</tr>
<tr>
<td>3.</td>
<td>Non – Parametric Test</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>4.</td>
<td>Queuing Theory</td>
<td></td>
<td>VI</td>
</tr>
</tbody>
</table>

VI. NON-MAJOR ELECTIVE COURSES: 2

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>TITLE</th>
<th>SUBJECT CODE</th>
<th>SEMESTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Matrix Algebra</td>
<td></td>
<td>III</td>
</tr>
<tr>
<td>2.</td>
<td>Numerical Methods</td>
<td></td>
<td>IV</td>
</tr>
</tbody>
</table>

V. VALUE EDUCATION: 1                                   I - SEMESTER

VI. ENVIRONMENTAL STUDIES: 1                           II- SEMESTER

VII. EXTENSION ACTIVITIES: 1                           VI – SEMESTER
UNIT - I:


Unit – II:

Mathematical Expectation – Moment Generating Function and Characteristic Function (Concept only) – Tchebychev’s Inequality (Simple problems).

Unit – III:

Continuous Distribution - Normal Distribution - Derivations, Properties and Applications – Simple Problems.
Exact Sampling Distributions- t, F and $\chi^2$ distribution (Concepts only).

Unit – IV:

Correlation and Regression: Karl – Pearson Correlation Coefficient and Spearman Rank Correlation Coefficient – Regression lines and Regression Coefficients – Properties.

Unit – V:


Reference Books:

ALLIED STATISTICS
FOR B.Sc., (MATHS) / B.Sc., (MATHS) C.A.
(For the candidates admitted from 2017 – 2018 onwards)
SEMESTER II or IV: Allied I or II
Paper II: Inferential Statistics

Unit – I:
Population and Sample; Parameter and Statistic – Point and Interval Estimation – Consistency, Unbiasedness, Efficiency (Cramer – Rao Inequality) and Sufficiency (Rao – Blackwell Theorem)

Unit – II:
Method of Estimation – Maximum Likelihood and Methods of Moments – properties of these estimators – Interval Estimation (Concept only)

Unit – III:

Unit – IV:
Test of Significance – Sampling distribution – Standard Error – Large Sample Tests with regard to Mean, Difference of Means, Proportions and Difference of Proportions – Simple Problems.

Unit – V:
Test of Significance – Exact sample test based on t and F distributions with regard to Means, Variance and Correlation Coefficient – Chi-square tests for single Variance, Goodness of fit and Independence of attributes.

Reference Books:
Unit – I:

Computation of Measures of Location and Dispersion (absolute and relative) Coefficient of Skewness.

Unit – II:

Fitting of Binomial, Poisson and Normal Distribution – Testing the Goodness of fit.

Unit – III:

Curve fitting – Fitting of a Straight Line ($Y=a+bx$), Second Degree Parabola $Y=a+bx+cx^2$, $Y=ae^{bx}$, $y=ab^x$ and $y=ax^b$

Unit – IV:

Computation of Correlation Co-efficient – Rank Correlation Coefficient – Regression Lines.

Unit – V:

Asymptotic and exact tests with regard to Mean, Variance, difference between means and Paired ‘t’ Test – Tests for Independence of attributes.

Note:

Total: 100 marks

* University Examination (Written practical) : 60 Marks
* Continuous Internal Assessment (Including Practical Record) : 40 Marks

- 5 questions are to be set without omitting any unit. All questions carry equal marks. Any 3 questions are to be answered in 3 hours duration.
ALLIED STATISTICS
FOR B. Sc (Computer Science)
(Common to B.Sc (Information Science) and B.C.A)
(For the candidates admitted from 2017 – 2018 onwards)
SEMESTER I or II I: Allied Statistics
Paper - I: Statistical methods

Unit – I:

Nature and scope of statistical methods – Limitations – types of data – Classification and Tabulation of data – Diagrammatic and Graphical representation of data.

Unit – II:

Formation of frequency distribution – Measures of Central Tendency – Mean, Median, and Mode – Merits and demerits.

Unit – III:

Measures of dispersion – Range, Quartile Deviation, Mean Deviation, Standard deviation – Co-efficient of variation.

Unit – IV:


Unit – V:

Sampling – Merits and Demerits of Sampling – Simple, Stratified and systematic sampling methods (Concept only) – Concept of Sampling and non-Sampling errors.

Reference Books:

ALLIED STATISTICS
FOR B. Sc (Computer Science)
(Common to B.Sc (Information Science) and B.C.A)
(For the candidates admitted from 2017 – 2018 onwards)
SEMESTER II or IV: Allied Statistics
Paper - II: Applied Statistics

Unit – I:

Unit – II:

Unit – III:
Normal distribution (Definition, Simple problems only) – Curve fitting – Method of least squares – fitting of Straight line and parabola – Simple problems.

Unit – IV:
Sampling distribution and Standard error (Concept only) – Test of Significance: Large sample tests for mean, difference of Means, Proportion and difference of Proportions – Simple problems.

Unit – V:
Chi – Square test – Assumptions, Characteristics and its applications – Chi-Square tests for goodness of fit and independence of attributes – Simple problems.

Reference Books:
ALLIED STATISTICS PRACTICAL
FOR B. Sc (Computer Science)
(Common to B.Sc (Information Science) and B.C.A)
(For the candidates admitted from 2017 – 2018 onwards)
SEMMESTER I & II or III & IV
(Based on Allied Statistics Theory Paper I & II)

Unit – I:
Construction of uni - variate frequency distribution – Diagrammatic and Graphical representation of Statistical data.

Unit – II:
Computation of measures of Central Tendency – Calculation of measures of Dispersion – Coefficient of variation.

Unit – III:
Fitting of $Y=a+bX$, $Y=a+bX+cX^2$ by the methods of least squares.

Unit – IV:
Fitting of Binomial, Poisson distribution – Test for goodness of fit using Chi-Square test.

Unit – V:
Computation of correlation co-efficient and Rank correlation – Regression equation (2 Variables Only)

Note:
Total: 100 marks

*University Examination (Written practical) : 60 Marks
*Continuous Internal Assessment (Including Practical Record) : 40 Marks

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

Nature and scope of Statistical methods – Limitations – types of data – Classification and Tabulation of data – Diagrammatic and Graphic representation of data

UNIT – II:

Formation of frequency distribution – Measures of central Tendency – Mean, Median, and Mode – Merits and demerits.

UNIT – III:

Measures of dispersion – Range, Quartile Deviation, Mean Deviation, Standard deviation – Co-efficient of variation

UNIT – IV:


UNIT – V:

Sampling – Merits and Demerits of Sampling – Simple, Stratified and Systematic sampling methods (Concept Only) – Concept of Sampling and non – Sampling errors

Reference Books:

UNIT – I:

Probability; Definition – Addition and Multiplication theorems – Conditional Probability – (Simple Problem only)

UNIT – II:

Sampling distribution and Standard error (Concept Only) – Test of Significance: Large sample tests for mean, difference of Means, Proportion and difference of Proportions – Simple problems.

UNIT – III:

Chi – Square test – Assumptions, Characteristics and applications – Chi – Square tests for goodness of fit and independence of attributes – Simple problems. Fitting of Straight line and parabola – Simple problems

UNIT – IV:

Analysis of variance (ANOVA) – concepts and examples – explanation. ANOVA for one way and two way classifications – Procedures and simple problems.

Unit-V:

Analysis of Time Series – Definition – Components and uses of Time Series, Measures of Secular trend, Measure of Seasonal Variation - Method of simple average only

Reference Books:

ALLIED STATISTICS PRACTICAL
FOR B. Sc (GEOGRAPHY)
(For the candidates admitted from 2017 – 2018 onwards)
SEMESTER I & II or III & IV
(Based on Allied Statistics Theory Paper I & II)

Unit – I:

Construction of uni - variate frequency distribution – Diagrammatic and Graphical representation of Statistical data.

Unit – II:

Computation of measures of Central Tendency – Calculation of measures of Dispersion – Coefficient of variation.

Unit – III:

Fitting of $Y=a+bX$, $Y=a+bX+cX^2$ by the methods of least squares.

Unit – IV:

Fitting of Binomial, Poisson distribution – Tests for goodness of fit using Chi-Square test.

Unit – V:

Computation of correlation co-efficient and Rank correlation – Regression equation (2 Variables Only)

Note:
Total: 100 marks

*University Examination : 60 Marks
(Written practical)
*Continuous Internal Assessment : 40 Marks
(Including Practical Record)

- 5 questions are to be set without omitting any unit. All questions carry equal marks. Any 3 questions are to be answered in 3 hours duration.
ALLIED STATISTICS
FOR B. Sc (MICROBIOLOGY)
(Common to B.Sc (Bio – Chemistry) and B.Sc (Bio – technology))
(For the candidates admitted from 2017 – 2018 onwards)
SEMESTER III: Allied Statistics
Paper I: Bio - Statistics

Unit – I:
Biostatistics – definition – types of data – Primary and Secondary data – Methods of Collection of data – Sources of data in life science – Limitation and uses of statistics.

Unit – II:
Classification and Tabulation of data – Diagrammatic and Graphic representation of data.

Unit – III:
Measures of Central Tendency: Mean, Median, Mode, Geometric Mean and Harmonic Mean – Merits and Demerits.

Measures of dispersion: Range, Standard deviation, Mean deviation, Quartile deviation, – Merits and Demerits, Coefficient of variations.

Unit – IV:
Correlation: Types and Methods of Correlation , Rank – Correlation. Regression : Simple regression equation – fitting of regression equation.

Unit – V:
Sampling distribution - Standard error – Test of Hypothesis: Simple Hypothesis , Null hypothesis – Test of Significance: Large sample tests with regard to Mean, Differences of Means, Proportions and difference of Proportions - Small Sample Test with regard to Mean, Difference of Means and Variances – Chi – square test.

Reference Books:


Note:
1) This paper has to taught teacher and exam papers to be valued by only Statistics Board.
2) While setting the question paper, 50% theory and 50% problems to be considered.
ALLIED STATISTICS
FOR B. Com
(Common to B.Com (C.A), B.Com (C.S) and B.Com (Co – operation))
(For the candidates admitted from 2017 – 2018 onwards)
SEMESTER III: Allied Statistics
Paper - I: Business Statistical Methods

Unit – I :

Introduction – Types of data – Classification and Tabulation of Statistical data – Central Tendency – Measure of Central Tendency – Mean, Median, Mode, Harmonic Mean and Geometric Mean, Combined Mean.

Unit – II :


Unit – III :


Simple regression analysis – Fitting of Regression lines.

Unit – IV :

Index Number – Definition and Uses of Index Numbers, Construction of Index numbers – Simple & Weighted Index numbers – test for an Ideal index Number – Chain and Fixed base index – Cost of living index numbers.

Unit – V :

Analysis of Time Series – Definition – Components and Uses of Time Series. Measures of Secular trend, Measure of Seasonal Variation – Method of Simple average only.

Text Books:
   21.

Reference Books :
1. Statistical Methods – S.P.Gupta

Note :
1) Problems : 80% & Theory : 20%
2) This paper has to be taught by a statistics teacher. This paper has to be referred to Statistics board for valuation.
ALLIED STATISTICS
FOR B. Com
(Common to B.Com (C.A), B.Com (C.S) and B.Com (Co – operation))
(For the candidates admitted from 2017 – 2018 onwards)
SEMESTER IV: Allied Statistics
Paper - II: Business Statistical Decision Techniques

Unit – I:
Matrix: Definitions – Operations on Matrix – Determinant of Matrix. Inverse of a Matrix (Ad - joint Method only)
Application: Solving of Linear equations – Matrix inverse Method; Cramer’s Rule.

Unit – II:
Sequence and Series – Arithmetic Progression and Geometric Progression
Interpolation: Binomial Expansion Method; Newton’s Forward and Backward Method, Lagrange’s Method.

Unit – III:
Probability: Definition – Addition and Multiplication theorems – Conditional Probability – (Simple Problem Only)

Unit – IV:
Linear Programming – Formation of LPP. Solution to LPP – Graphical method, Simplex method, Big – M- Method

Unit – V:

Text Book :

Reference Books :
1. Dr.S.P. Gupta ; Dr.P.A.Gupta; Dr.Manmohan – Business Statistics and Operation Research

Note :
1) Problems : 80% & Theory : 20%
2) This paper has to be taught by a statistics teacher. This paper has to be referred to Statistics board for valuation.
ALLIED STATISTICS
FOR B.A (ECONOMICS)
(For the candidates admitted from 2017 – 2018 onwards)
SEMESTER III: Allied Statistics
Paper - I: Statistical Methods for Economics

Unit – I:
Nature and scope of statistical methods and their Limitations – types of data – Primary data and Secondary data – Methods of Collection of Data - Classification and Tabulation of data.

Unit – II:
Diagrammatic representation – Simple, Multiple and Component - Percentage bar diagrams – Pie diagrams.

Unit – III:
Formation of frequency distribution – Graphical Representation – Histogram – Frequency polygon and frequency curve – O’ gives curve – Lorenz Curve.

Unit – IV:
Measures of Central Tendency – Arithmetic Mean, Median, and Mode – Harmonic Mean – Geometric Mean, Weighted arithmetic mean and their uses in Economics.

Unit – V:

Reference Books:
3. A.L. Nayar and Das – Statistics
4. M.R.Vittal - Statistics

Note:
1) Problems : 80% & Theory : 20%
2) This paper has to be taught by a statistics teacher. This paper has to be referred to Statistics board for valuation.
Unit – I:


Unit – II:

Regression – Regression Lines – Types of Regression lines – Fitting of Regression lines – Uses in Economics

Unit – III:


Unit – IV:

Index numbers – Definition – Uses of index numbers – Types of Index numbers – Methods of construction – Simple index number and weighted index numbers – test for an Ideal index number – Consumer index number.

Unit – V:

Basic sampling methods – Simple random sampling – Systematic Sampling, Stratified random sampling, Quota Sampling, Purposive Sampling.

Reference Books:

3. A.L. Nayar and Das – Statistics
4. M.R.Vittal - Statistics

Note:

1) Problems : 80% & Theory : 20%
2) This paper has to be taught by a statistics teacher. This paper has to be referred to Statistics board for valuation.
ALLIED STATISTICS
FOR B.B.A
(For the candidates admitted from 2017 – 2018 onwards)
SEMIESTER I : Allied Statistics
Paper: I Business Mathematics and Statistics - I

Unit – I:

Series: Sequence – Series – Arithmetic Progression – Geometric Progression – Harmonic Progression (Simple Problems)

Unit – II:


Unit – III:


Unit – IV:


Unit – V:


Note:

1) Problems : 80% & Theory : 20%
2) This paper has to be taught by a statistics teacher. This paper has to be referred to Statistics board for valuation.

Text Books:

Reference Books:
2. Sundharsan , AN introduction to Business Mathematics, Sultan Chand & Company.
ALLIED STATISTICS
FOR B.B.A
(For the candidates admitted from 2017 – 2018 onwards)
SEMESTER II : Allied Statistics
Paper - II: Business Mathematics and Statistics - II

Unit – I:


Unit – II:

Basics of Calculus – limits – rules of differentiation – maxima and minima (for single variable only) – Simple application problems in maxima and minima

Unit – III:


UNIT - IV:


Unit – V:

Index numbers – definition – Construction of index numbers – Unweighted and Weighted Index numbers – fixed and chain base index numbers – test for an Ideal index numbers – cost of living index numbers.

Note :

1) Problems : 80% & Theory : 20%
2) This paper has to be taught by a statistics teacher. This paper has to be referred to Statistics board for valuation.

Text Books :


Reference Books:

2. Dr.S.P Gupta & Dr.M.P. Gupta, Business Statistics, Sultan & Chand Sons.
Unit – I:


Unit – II:


Unit – III:

Diagrammatic and graphic presentation: Introduction – Significance of diagrams and graphs - Types of diagrams – Types of graphs – Limitations of diagrams and graphs.

Unit – IV:

Measure of Central Tendency: Introduction – Methods of Measure of Central Tendency - Mean, Median, Mode, Geometric Mean and Harmonic Mean.

Unit – V:


TEXT BOOK
1. Business Statistics - P.A.Navanithan

REFERENCE BOOKS:
2. Pillai R.S.N & Mrs. Bagavathi, Statistics – Sultan Chand & Company
3. Sharma,Business Statistics - MarghamPulications

Note: (1) Problems: 80 %; Theory: 20%.
(2) This paper has to be taught by a statistics teacher. This paper has to be referred to statistics board for valuation.
MODEL QUESTION PAPER
PERIYAR UNIVERSITY, SALEM - 11
For the candidates admitted from 2017 – 2018 onwards)
NMEC – I Statistical Methods
SEMESTER – III

Time: 3 Hours       Maximum Marks : 75

SECTION – A (10x2=20)
Answer any THREE questions
All questions carry EQUAL marks

1. Define of Statistics.
2. What are the methods of collection of primary data?
3. Mention the types of Frequency Distribution.
4. Write the types of tabulation?
5. Give the types of diagrams.
6. Write the uses of graphs.
7. Find Median. - 23,34,45,56,67,78,89,90,
8. Calculate the Geometric Mean  of 32 and 2.
9. What is the range of the marks: 34, 35, 56, 67, 78, 98.
10. Define: Skewness

SECTION – B (5x5=25)
Answer all the questions choosing either (A) or (B)
All questions carry equal marks

11.a) What are the limitations of Statistics?
(OR)

b) What are the methods of collection of primary data and explain any one of them.

12.a) Describes the classification of data.
(OR)

b) What are the rules adopted to frame a good table?

13.a) How to construct Pie diagram?
(OR)

b) Draw a histogram and hence find the modal wage

<table>
<thead>
<tr>
<th>wage in Rs</th>
<th>300-320</th>
<th>320-340</th>
<th>340-360</th>
<th>360-380</th>
<th>380-400</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of laborers</td>
<td>25</td>
<td>50</td>
<td>75</td>
<td>60</td>
<td>15</td>
</tr>
</tbody>
</table>

14. a) Find the mean to the following data.

<table>
<thead>
<tr>
<th>Marks</th>
<th>00-20</th>
<th>20-40</th>
<th>40-60</th>
<th>60-80</th>
<th>80-100</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Students</td>
<td>25</td>
<td>50</td>
<td>75</td>
<td>60</td>
<td>40</td>
</tr>
</tbody>
</table>

(OR)
b) Calculate the Geometric Mean.

<table>
<thead>
<tr>
<th>Value</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>1</td>
<td>4</td>
<td>10</td>
<td>3</td>
<td>5</td>
<td>2</td>
</tr>
</tbody>
</table>

15.a) Calculate the Quartile deviation to the following data

<table>
<thead>
<tr>
<th>Value</th>
<th>10</th>
<th>20</th>
<th>25</th>
<th>15</th>
<th>40</th>
<th>75</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>1</td>
<td>4</td>
<td>10</td>
<td>3</td>
<td>5</td>
<td>2</td>
</tr>
</tbody>
</table>

(OR)

b) Calculate the standard deviation and its co-efficient of variation to the following data.

05 10 20 25 40 42 45 48 70 80

SECTION – C(3x10=30)

Answer any three questions

All questions carry equal marks

16. Describes the methods of collecting primary data.

17. Marks in statistics of 60 students in an examination are given below.
Prepare a frequency table taking class intervals as 0-10, 10-20, and so on.

<table>
<thead>
<tr>
<th>C.I</th>
<th>0-5</th>
<th>5-10</th>
<th>10-15</th>
<th>15-20</th>
<th>20-25</th>
<th>25-30</th>
<th>30-35</th>
<th>35-40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>9</td>
<td>12</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>15</td>
<td>10</td>
<td>13</td>
</tr>
</tbody>
</table>

18. Draw the Ogive curves and find the median to the following data.

19. Find the mean, median, and mode to the given data.

<table>
<thead>
<tr>
<th>Height</th>
<th>158 - 160</th>
<th>160-162</th>
<th>162 - 164</th>
<th>164-166</th>
<th>166-168</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Students</td>
<td>15</td>
<td>40</td>
<td>65</td>
<td>50</td>
<td>30</td>
</tr>
</tbody>
</table>

20. Identify the standard batsman to the following score of the player A and B.

Player A : 45 56 76 87 90 45 59 40
Player B.: 34 57 54 52 56 61 50 58
NON – MAJOR ELECTIVE COURSES (NMEC – II)  
OFFERED COURSE BY STATISTICS BOARD  
TO OTHER BOARD  
(For the candidates admitted from 2017 – 2018 onwards)  
SEMESTER IV  
NMEC - II: STATISTICAL METHODS AND THEIR APPLICATIONS

Unit – I:

Correlation – Types of Correlation – Measures of Correlation – Scatter diagram - Karl Pearson’s co-efficient of correlation – Spearman’s rank correlations co-efficient.

Unit – II:

Simple regression analysis – Regression equation, Fitting of Regression equation – Relationship between Regression Co-efficient and Correlation co-efficient.

Unit – III:

Index Number - Definition of Index Numbers - Uses – Methods to construction of Simple& Weighted Index numbers – Cost of living index numbers.

Unit – IV:


Unit – IV:

Seasonal variation – Seasonal index – Methods of measuring seasonal index – Simple average method only– Cyclical variation(concept only), Random variation (concept only).

REFERENCE BOOKS:

Note:  (1) Problems: 80 %; Theory: 20%.
(2) This paper has to be taught by a statistics teacher. This paper has to be referred to statistics board for valuation.
MODEL QUESTION PAPER
PERIYAR UNIVERSITY, SALEM - 11
For the candidates admitted from 2017 – 2018 onwards)
NMEC- II STATISTICAL METHODS AND THEIR APPLICATIONS
SEMESTER – IV

Time: 3 Hours       Maximum Marks : 75

SECTION – A (10x2=20)
Answer any THREE questions
All questions carry EQUAL marks

1. What is meant by correlation?
2. Sum of the square of difference of the ranks of 10 pair is 100. Calculate the Rank correlation co-efficient.
3. Define:-Regression
4. Find the Correlation co-efficient when Regression co-efficient are \( b_{yx} = 0.6 \) and \( b_{xy} = 0.8 \)
5. Give the important of Index numbers
6. Calculate the Fisher Index numbers when Laspeyre’s and Paasche Price Index numbers are 240 & 260
7. Write any two uses of Time Series Analysis.
8. What are the normal equations are used to fit the straight line?
9. Write any two methods of measuring seasonal index.
10. What is cyclical variation?

SECTION – B (5x5=25)
Answer all the questions
All questions carry equal marks

11. a) Describe the Scatter diagram method.
   (OR)
   b) Compute Karl Pearson’s co-efficient correlation to the following data
      
      \[
      \begin{array}{cccccccc}
      X: & 12 & 09 & 08 & 10 & 11 & 13 & 07 \\
      Y: & 14 & 08 & 06 & 09 & 11 & 12 & 03 \\
      \end{array}
      \]

12. a) Fit the regression equation of X on Y to the following data
      
      \[
      \begin{array}{cccccccc}
      X: & 12 & 45 & 65 & 76 & 23 & 35 \\
      Y: & 45 & 23 & 34 & 45 & 56 & 67 \\
      \end{array}
      \]
   (OR)
   b) Write the properties of regression Co-efficient.
13. a) Construct (i) Laspeyre’s and (ii) Paasche’s Index numbers

<table>
<thead>
<tr>
<th>Commodity</th>
<th>2001 Price</th>
<th>2002 Price</th>
<th>2001 Quantity</th>
<th>2002 Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>06</td>
<td>10</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>B</td>
<td>02</td>
<td>02</td>
<td>100</td>
<td>120</td>
</tr>
<tr>
<td>C</td>
<td>04</td>
<td>06</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>D</td>
<td>10</td>
<td>12</td>
<td>30</td>
<td>25</td>
</tr>
</tbody>
</table>

(OR)

b) Calculate the Cost of living Index Number from the following data

<table>
<thead>
<tr>
<th>Item</th>
<th>Base year price</th>
<th>Current year price</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>39</td>
<td>47</td>
<td>4</td>
</tr>
<tr>
<td>Fuel</td>
<td>08</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td>Clothing</td>
<td>14</td>
<td>18</td>
<td>3</td>
</tr>
<tr>
<td>House Rent</td>
<td>12</td>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>25</td>
<td>30</td>
<td>1</td>
</tr>
</tbody>
</table>

13. a) Explain the Semi average method

(OR)

b) Calculate 3 yearly moving averages of sales of 10 years data as shown below.

<table>
<thead>
<tr>
<th>Year: 2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales:</td>
<td>246</td>
<td>250</td>
<td>251</td>
<td>252</td>
<td>245</td>
<td>249</td>
<td>250</td>
<td>254</td>
<td>260</td>
</tr>
</tbody>
</table>

15 a) what are the Methods of measuring seasonal index?

(OR)

b) Construct the seasonal Index to the following data

<table>
<thead>
<tr>
<th>Year</th>
<th>Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Q1</td>
</tr>
<tr>
<td>2010</td>
<td>24</td>
</tr>
<tr>
<td>2011</td>
<td>35</td>
</tr>
<tr>
<td>2012</td>
<td>46</td>
</tr>
</tbody>
</table>

SECTION – C (3x10=30)

Answer any three questions

All questions carry equal marks

16. Compute Rank Correlation coefficient to the given data and comment on that.

<table>
<thead>
<tr>
<th>Judge:</th>
<th>Ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1 1</td>
</tr>
<tr>
<td>II</td>
<td>3 5</td>
</tr>
<tr>
<td>III</td>
<td>6 4</td>
</tr>
<tr>
<td></td>
<td>6 7</td>
</tr>
<tr>
<td></td>
<td>8 10</td>
</tr>
<tr>
<td></td>
<td>2 3</td>
</tr>
<tr>
<td></td>
<td>10 5</td>
</tr>
<tr>
<td></td>
<td>7 8</td>
</tr>
</tbody>
</table>

17. Fit the regressions lines to the following data and estimate X when Y = 60

<table>
<thead>
<tr>
<th>X:</th>
<th>10 12 13 12 16 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y:</td>
<td>40 38 43 45 37 43</td>
</tr>
</tbody>
</table>
18. Construct a) Laspeyres and b) Paasche Price Index numbers to the given data.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Price 2010</th>
<th>Price 2012</th>
<th>Quantity 2010</th>
<th>Quantity 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>06</td>
<td>10</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>B</td>
<td>02</td>
<td>02</td>
<td>100</td>
<td>120</td>
</tr>
<tr>
<td>C</td>
<td>04</td>
<td>06</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>D</td>
<td>10</td>
<td>12</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>E</td>
<td>08</td>
<td>12</td>
<td>40</td>
<td>36</td>
</tr>
</tbody>
</table>

19. Fit the trend line by the Method of least squares
   X: 10 14 13 18 16 19 23 43 34 19
   Y: 40 38 43 45 37 43 37 55 44 26

20. Construct the seasonal Index to the following data

<table>
<thead>
<tr>
<th>Year</th>
<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Q1</td>
</tr>
<tr>
<td>2006</td>
<td>24</td>
</tr>
<tr>
<td>2007</td>
<td>35</td>
</tr>
<tr>
<td>2008</td>
<td>46</td>
</tr>
<tr>
<td>2009</td>
<td>54</td>
</tr>
</tbody>
</table>