FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Statistics Degree Examination, April 2025

BST6E03 – Reliability Theory

(2022 Admission onwards)

Time: 2hours

Max. Marks : 60

Section A
(Each question carries 2 marks)

1. Define the conditions for a system to be a coherent system
2. Prove that dual of a series system is a parallel system.
3. What is the structure function of a parallel coherent system
4. What is the use of importance measure ?
5. Give the structure function of a k out of n system?
6. Define minimal path sets and minimal cut sets
7. What is reliability importance measure?
8. What is positive ageing?
9. Which distribution possesses the lack of memory property?
10. Define Poisson distribution. Give mean and variance.
11. Distinguish between IFR and DFR distributions.
12. Discuss the failure rate function of Exponential distribution?

Maximum Marks = 20

Section B
(Each question carries 5 marks)

13. Explain the Bridge structure with five components. How can you represent the structure as Parallel-series/series-parallel structure.
14. How can you find out more important component in a reliability system?
15. If $h(\underline{p})$ be a system reliability of a coherent system, then show that $h(\underline{p})$ is strictly increasing in each p_i for $0 < p_i < 1$ for all i.
16. If $\phi(\underline{x})$ is the structure function of a coherent system of order n, obtain the bounds on system structure function.
17. Find the dual of a k-out-of-n system.
18. What is the relationship between reliability function and failure rate function? Establish your argument.
19. Write a short note on bathtub shaped models.

Maximum Marks = 30

20. Let ϕ be a coherent structure. Then prove that redundancy at the component level is better than the system level.

21. Explain how will you find the bounds on system reliability using minimal paths and cuts

(10 x1=10 Marks)

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Sixth Semester B.Sc Statistics Degree Examination, April 2025

BST6B12 – Operation Research and Statistical Quality Control

(2022 Admission onwards)

Time: 2 ½ hours

Max. Marks : 80

PART A
Each Question Carries 2 Marks

1. State the difference between Solution and Feasible Solution of a LPP.
2. Define LPP.
3. Define Unbounded solution of a LPP.
4. State Transportation Problem mathematically.
5. Define the Penalty used in Vogel's Approximation Method.
6. Define Balanced and Unbalanced AP.
7. Define Non Degenerate BFS of a TP.
8. State the uses of SQC.
9. Define Process Control and Product Control.
10. Define "Defective product" in SQC.
11. Define Chance and Assignable causes of variation.
12. Define Producer's Risk and Consumer's Risk.
13. Define OC function of a Sampling Inspection Plan.
14. Define AQL and LTPD.
15. Define AOQ and AOQL.

(Ceiling 25 marks)

PART B
Each Question Carries 5 Marks

16. Sole the following LPP graphically.

    Maximize $Z = x + y$,

    Subjected to $x + y \le 20$, $x + y \le 15$, $y \le 5$ $x, y \ge 0$.

17. Derive the CL, UCL and LCL of C chart.

18. Solve the following AP

Jobs		Individuals			
		A	B	C	D
	1	12	13	11	7
	2	14	10	12	6
	3	10	11	9	7
	4	9	7	8	5

19. Use Least Cost Cell Method of finding an IBFS to a TP

Origin		Destinations				Supply
		A	B	C	D	
	1	16	14	18	19	110
	2	12	16	15	17	120
	3	12	13	15	16	100
	4	13	11	13	14	90
Demand		105	117	96	102	

20. Briefly explain Two Phase method of solving LPP.

21. Briefly explain Double Sampling Plan.

22. Explain Sampling Inspection Plans used in product control.

23. The following are number of defectives observed in random samples of size 200 taken from a production process.14,8, 12, 10, 11, 16, 13, 17, 9, 15, 20, 11. Construct p chart and verify process control.

(Ceiling 35 marks)

PART C
Answer any two questions. Each question carries 10 marks

24. Solve the LPP   Maximize $Z = 8X_1 + 19X_2 + 7X_3$

Subjected to $3X_1 + 14X_2 + X_3 \le 25$, $X_1 + 3X_2 + 3X_3 \le 50$

$X_1, X_2, X_3 \ge 0$.

25. The following data gives mean and range of random samples of size 8 taken from a production process

Sample	1	2	3	4	5	8	7	8	9	10
Mean	26	24	27	22	25	24	28	23	25	24
Range	4	3	5	6	2	4	6	4	3	2

Construct suitable Control Charts and verify process control.

26. Explain optimality method or MODI Method of solving TP.

27. Plot the OC function of SSP with $N = 100$, $n = 25$, $C = 1$.

(2 x 10 = 20 marks)

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Statistics Degree Examination, April 2025

BST6B11 – Population Studies Actuarial Science and Vital statistics

(2022 Admission onwards)

Time: 2 ½ hours　　　　　　　　　　　　　　　　　　　Max. Marks : 80

(Use of Calculator is permitted)

PART A
Each question carries 2 marks

1. Define crude birth rate.

2. Explain gross reproduction rate.

3. Crude death rate is not a good indicator for mortality comparisons. Why?

4. Define age-specific mortality rate.

5. Define IMR and MMR.

6. The average population of a village was 75,000 in a year, and the number of deaths recorded was 1,500. Find the Crude Death Rate (CDR).

7. Explain the relationship between L_x and l_x in a life table.

8. Define Actuarial Science.

9. Define mortality and radix of the mortality table.

10. What is meant by the concept of risk in insurance?

11. Define peril and hazard.

12. Why are gambling losses uninsurable?

13. Differentiate between insurer and beneficiary in an insurance policy.

14. What is the difference between a pension plan and an annuity plan?

15. Explain the term sum assured and how it is different from premium.

(Maximum Marks = 25)

PART B
Each question carries 5 marks

16. Explain Specific death rate. List out its merits and demerits.

17. Define Total Fertility Rate (TFR). Give its disadvantages.

18. What are the assumptions of life table?

19. What do you mean by an abridged life table? Explain Reed-Merrell method.

20. Explain the difference between speculative and pure risk with examples.

21. Differentiate between life insurance and non-life insurance.

22. Briefly explain fire insurance.

23. Discuss the costs of insurance to society.

(Maximum Marks =35)

PART C
Each question carries 10 marks (Answer any TWO Questions)

24. What do you understand by the term 'vital statistics? Explain its various uses.

25. a) Explain characteristics of insurable risks.

    b) Explain the role of statistics in insurance.

26. Calculate crude and Standardized death rates for the Local population from the following data and compare them with crude death rate of the standard population

Age group	Standard Population	Deaths	Local Population	Deaths
0 - 10	600	18	400	16
10 - 20	1000	5	1500	6
20 – 60	3000	24	2400	24
60 - 100	400	20	700	21

27. Analyze the critical role of statistics in insurance, including its applications in premium calculations, risk assessment, and policy design.

(2 x 10 =20 marks)

(Pages : 2)

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Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE
Sixth Semester B.Sc Statistics Degree Examination, April 2025
BST6B10 – Design of Experiments
(2022 Admission onwards)

Time: 2 ½ hours

Max. Marks : 80

(Use of Scientific Calculator and Statistical table are permitted)

PART A
Each question carries 2 marks.

1. Define principle of least squares.

2. Define the term 'estimability' in linear models.

3. What is a fixed effects model in ANOVA?

4. Explain the importance of Post Hoc Tests.

5. Define the Least Significant Difference (LSD) test.

6. What is a Randomized Block Design (RBD)?

7. Explain the term 'local control' in experimental design.

8. How does a Latin square design differ from a Completely Randomized Design?

9. Write a note on Yates' notation for 2^2 factorial designs.

10. How do factorial experiments help in industrial experiments?

11. Define a Partially Balanced Incomplete Block Design (PBIBD).

12. What are the parameters of a Balanced Incomplete Block Design (BIBD)?

13. How does a 2^3 factorial design differ from a 2^2 factorial design?

14. Explain the concept of replication in experimental design.

15. What is an Analysis of Covariance (ANCOVA)?

Maximum Mark = 25

PART B
Each question carries 5 marks

16. Find the BLUE for $\beta_1 + 2\beta_2 + 3\beta_3$ using the least squares method for the given system:

$$y_1 = \beta_1 + \beta_2 - \beta_3 + \epsilon_1$$
$$y_2 = 2\beta_1 - \beta_2 + 3\beta_3 + \epsilon_2$$
$$y_3 = \beta_2 - 3\beta_3 + \epsilon_3$$

17. Discuss the practical applications of ANCOVA in research studies.

18. Compare the efficiency of Latin square design (LSD) with Randomized Block Design (RBD).

19. Explain the concept of Graeco Latin square design.

20. Explain the concept of missing plots in RBD and methods to handle them.

21. Write a short note on 2^2 factorial experiment which helps in agricultural research.

22. Discuss the construction and properties of a Balanced Incomplete Block Design (BIBD).

23. What are the applications of a factorial experiment in medical research?

Maximum Mark = 35

PART C
Each question carries 10 marks (Answer any TWO Questions)

24. Prove the Gauss-Markov theorem and discuss its significance in linear models.

25. A company wants to study the effect of three marketing strategies (A, B, C) on customer engagement levels. The engagement scores of customers exposed to these strategies are recorded as follows:

Marketing Strategy	A	A	A	B	B	B	C	C	C
Engagement Score	85	82	88	90	85	87	70	75	72

Conduct an ANOVA to test whether marketing strategy significantly affects customer engagement.

26. A researcher conducts a study on the growth of plants under different conditions. The following data is recorded:

Fertilizer	F1	F2	F1	F2	F1	F2	F1	F2
Watering Frequency	Low	High	High	Low	High	Low	Low	High
Plant Growth (cm)	12	18	15	10	17	11	14	19

Perform an analysis to determine the significance of fertilizer type and watering frequency on plant growth.

27. Explain how to analyze the missing plot technique in LSD and illustrate it with an ANOVA table.

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BST6B09 – Time Series and Index Numbers

(2022 Admission onwards)

Time: 2 ½ hours

Max. Marks : 80

(Use of Calculator is permitted)

PART A
Each question carries 2 marks.

1. How does time series forecasting apply to the field of weather prediction and healthcare?

2. Explain the mixed model in time series

3. Define cyclic variations in time series with example.

4. Explain lognormal distribution.

5. What is family budget method?

6. Describe the fitting of Pareto's law.

7. Explain Gini's coefficient.

8. Explain consumer price index

9. Define quantity index number

10. DescribeFisher Index Number

11. What are the scales of measurements?

12. Explain time-reversal test

13. What is cost of living index?

14. Define Likert scale

15. What is weighted-aggregate index number

Maximum Mark = 25

PART B
Each question carries 5 marks

16. Describe Lorentz curve and its uses.

17. Explain Link relative method.

18. Give major applications and limitations of index numbers.

19. Check whether Pasche's Index number satisfies Time Reversal and Factor Reversal Tests

20. Explain different methods to calculate the trends in the series.

21. Write a note on Marshal-Edgeworth index number and Dorbish-Bowley's Index number

22. Describe Base shifting, splicing and deflating of index numbers.

23. Explain different attitude measurement scales with example. Describe the advantages and limitations of scales in attitude measurements?

Maximum Mark = 35

PART C
Each question carries 10 marks (Answer any TWO Questions)

24. Construct Laspeyre's, Pasche's and Dorbish-Bowley's Index number.

Items	Price(Rs)		Quantity(Kg)	
	2022	2023	2022	2023
A₁	29	37	9	36
A₂	32	59	36	45
A₃	27	46	43	54
A₄	55	63	39	63 .

25. Explain the Moving Average Method and the principle of least square method to fit a linear trend. Fit a linear trend for the data by principle of least square method and estimate the sales at 2025.

Year	2009	2010	2011	2012	2013	2014	2015	2016
Sales	72	83	94	99	92	110	126	135

26. Explain the different classifications and types of index numbers with example.

27. What are the components of time series, explain each with example.

(2 × 10 = 20 Marks)