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Reg. No:..........................

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Degree Examination, March/April 2021

BSTA6B10 – Mathematical Methods in Statistics II

(2018 Admission onwards)

Time: 3 hours

Max. Marks:120

Part A

(Answer all questions; each question carries 1 mark)

Multiple Choice Questions (Questions 1-6)

1. $|e^z| =$ ………

   a) e^x b) e^{-x} c) e^{-2} d) e

2. $Sin\ x =$ ……..

   a) $\frac{e^{ix}-e^{-ix}}{2}$ b) $\frac{e^{ihx}+e^{-ihx}}{2}$ c) $\frac{e^{ix}+e^{-ix}}{2}$ d) $\frac{e^{ihx}-e^{-ihx}}{2}$

3. For the function $f(z) = \frac{\sin z}{z}, z = 0$ is----------

   a) Pole of order 2 c) Essential singular point

   b) Pole of order 1 d) Removable singular point

4. The value of $\int_{|z|=1} \frac{dz}{z-4} dz$ is ------------

   a) $2\pi i$ b) 4 c) 2π d) 0

5. $f(z) = \sum_{n=1}^{\infty} \frac{n}{2^n} z^n$ has radius of convergence :

   a) 0 b) 2 c) 1 d) None of these

Fill in the blanks (Questions 7-12)

6. The parametric form of the unit circle is …………………
7. Converse of the Cauchy's integral theorem is known as ………………
8. $arg(e^z)$is…………
9. The poles of $f(z) = \frac{z+2}{(z^2+1)^3(z-2)}$are ………………
10. $\int_c z^2 dz =$ …………… ,where c: |z|=2

(10x1=10 Marks)

Part B

(Answer any eight questions; each question carries 5 marks)

11. Verify Cauchy-Reimann equations for the function

$$f(z) = sinxcoshy + icosx\ sinhy.$$

12. Find the harmonic conjugate of $u = x^2 - y^2$
13. State and prove Liouville's theorem.
14. State and prove Cauchy's Residue Theorem.
15. What is removable singularity? Give an example

16. State and prove Morera's Theorem.

17. Discuss the nature of singularity of $e^{\frac{1}{z}}$. at $z = 0$.

18. Expand $f(z) = \frac{z}{(z-1)(z-3)}$ as Laurent's series in $0 < |z-1| < 2$

19. What do you mean by an isolated singularity?

20. What is an analytic function? Is $f(z) = e^z$ analytic. Justify

21. Find the real and imaginary part of the complex function: $w = z^2 + 3z$,

wherez $= 3 + 5i$.

22. If $f(z)$ and $\overline{f(z)}$ are both analytic in a domain D, prove that $f(z)$ is a constant throughout D.

(8x5=40 Marks)

Part C

(Answer any four questions; each question carries 10 marks)

23. State and prove Cauchy's integral formula.

24. Show that $sinhx\ siny$ is harmonic in a domain and find harmonic conjugate $v(x,y)$of u.

25. State and prove Taylor's theorem

26. Evaluate $\int_c \frac{z+1}{z^2} dz$,where $c: |z| = 1$.

27. Expand $\frac{z^2-1}{(z+1)(z+3)}$ as Laurent's series in the annulus $2 < |z| < 3$.

28. Prove that$f(z) = \sqrt{|xy|}$is not analytic at the origin even if the Cauchy –Reimann equations are satisfied at the origin.

29. If f(z) is a regular function of z , prove that

$$\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right) |f(z)|^2 = 4\,|f'(z)|^2.$$

30. Show that $f'(z)$ does not exist at any point of z when

   a. $f(z) = \bar{z}$

   b. $f(z) = Re(z)$

(4x10=40 Marks)

Part D

(Answer any two questions; each question carries 15 marks)

31. Evaluate$\int_{-\infty}^{\infty} \frac{cos2x}{(x^2+1)(x^2+4)} dx$

32. Using residues evaluate $\int_0^{2\pi} \frac{d\theta}{5+4\,sin\theta}$

33. State and prove Morera's theorem.

34. Find the Laurent's series expansion for $f(z) = \frac{1}{(z-1)(z-2)}in1 < |z| < 2$.

(2x15=30 Marks)

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Degree Examination, March/April 2021

BSTA6B11 – Design of Experiments

(2018 Admission onwards)

Time: 3 hours

Max. Marks:120

Part A

Answer All Questions. Each carries 1 mark

1. Define linear hypothesis.
2. Define BLUE
3. State the distribution of experimental error.
4. State the number of levels of factors used in a s^n design.
5. Application of CRD insists ------property of experimental material.

Questions 6 to 10 state true or false

6. In ANOVA Least Squares estimation technique is adopted.
7. CRD is the most suitable design for Agricultural field experiments.
8. Missing observations does not affect Statistical Analysis of RBD
9. RBD gives more degrees of freedom to the error sum of squares than an LSD.
10. LSD can be applied for any number of experimental units.

(10 x1 = 10 marks)

Part B

Answer Any 8 Questions. Each carries 5 marks

11. Define Experimental Unit and Experimental Error.
12. Briefly explain Standard Gauss Markov Set up.
13. Explain linear additive models used in ANOVA
14. The following data gives marks of five students of three different schools.

School1	64	39	52	71	48
School2	47	52	56	51	64
School 3	60	62	59	70	57

Test whether performance of schools differ significantly?

15. Define Critical Difference and state its use in design of experiments.
16. Define Contrast and Orthogonal Contrast..

17. Complete ANOVA table of LSD given below

Source	Sum of Squares	Degrees of freedom	Mean Sum of Squares	F ratio
Rows	72	……	----	2
Columns	…..	……	-----	….
Treatments	180	……	2.5	….
Error	…..	6		
Total	……	-----		

18. State merits and demerits of LSD.

19. Distinguish between Main and Interaction effects in factorial design.

20. Explain Missing Plot Technique used in design of experiments.

21. Define efficiency and relative efficiency of designs.

22. Distinguish between Survey variable and Concomitant variable.

(8 x 5 = 40 marks)

Part C

Answer Any 4 Questions. Each carries 10 marks

23. Explain the Principles Experimental Design.

24. Explain Statistical Analysis of Two Way classified data.

25. The following data is the layout of a CRD

Treatment	Observations
T1	25, 27, 31, 28, 35, 30
T2	40, 37, 33, 34
T3	39, 36, 42, 40, 43
T4	24, 22, 20, 23, 22

Identify the critically different treatment pairs.

26. Explain estimation and analysis of one missing value in LSD.

27. Derive efficiency of RBD compared to CRD.

28. Explain 2^3experiments.

29. Explain Duncans Multiple Range Test..

30. Explain one way ANCOVA.

(4 x 10 = 40 Marks)

Part D

Answer Any 2 Questions. Each carries 15 marks

31. State and prove Gauss Markov Theorem.
32. Explain Statistical Analysis of LSD deriving various sums of squares.
33. Estimate the missing observation of RBD given below and carryout ANOVA

Block 1	T1 (55)	T2 (59)	T3 (49)	T4 (50)	T5 (56)
Block 2	T1 (57)	T2 (51)	T3 (56)	T4 (45)	T5 (48)
Block 3	T1 (52)	T2 (64)	T3 (52)	T4 (58)	T5 (52)
Block 4	T1 (...)	T2 (55)	T3 (60)	T4 (57)	T5 (54)

34. Explain Yates method of computing totals of various treatment combinations. Analyse the following 2^2 design carried out using RBD with 5 blocks

A	B	AB	(1)	A	B	AB	(1)	A	B	AB	(1)
87	69	110	55	76	72	107	48	92	83	125	62
A	B	AB	(1)	A	B	AB	(1)				
68	52	88	47	72	59	93	54				

(2 x 15 = 30 Marks)

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Degree Examination, March/April 2021

BSTA6E(03) – Reliability Theory

(2018 Admission onwards)

Time: 3 hours

Max. Marks:120

Part A

(Answer all questions; each question carries 1 mark)

Multiple Choice Questions (Questions 1-5)

1. The dual of 2-out of-4 structure is
   (a) 2-out of-4 structure b)1 – out of –4 structure
   c)3 – out of –4 structure d)Parallel structure of 4 components
2. The structure function of *series system* is
   (a) $\phi(x) = \max(x_1, x_2, \dots, x_n)$ b)$\phi(x) = \min(x_1, x_2, \dots, x_n)$
   c)$\phi(x) = (x_1 + x_2 + \cdots + x_n)$ d) $(x) = (x_n - x_1)$
3. For a coherent system which of the following is true
   (a) A component may be relevant b)Each of the component is relevant
   c)No component is relevant d)At least two components are relevant
4. The structure function of 2-out of -3 structure is
   (a) $x_1x_2x_3$ $b)x_1x_2x_3 + x_1x_2(1-x_3) + x_1(1-x_2)x_3 + (1-x_1)x_2x_3$
   $c)1 - x_1x_2x_3$ $d)$None of the above
5. Which of the following is correct?
   (a) $IFR \rightarrow IFRA$ (b) $IFRA \rightarrow IFR$
   (c) $IFR \rightarrow DFR$ (d) $DFRA \rightarrow DFR$

Fill in the blanks (Questions 6-10)

6. Reliability of a 2- component series system is ________
7. 1-out of -3 system is a ________ system.
8. The number of components in the system is called ________ of the system.
9. $E(\phi(x))$ represents ________ of a system.
10. The function $\frac{f(t)}{1-F(t)}$ is called ________

(10 x 1= 10 Marks)

Part B

(Answer any eight questions; each question carries 5 marks)

11. Explain dual of a structure ϕ with a example.
12. Draw diagram to represent a series system?
13. Define coherent system. Give one example.
14. Describe the representation of a structure using minimal path sets.
15. Derive the reliability of a parallel structure.
16. If all the n components have the same reliability p, then find the system reliability of a parallel structure.
17. Explain the method of computing exact system reliability based on minimal path sets.
18. Consider a 2-out-of-4 structure with four independent components of the same type. At a specified point of time the component reliability is p=0.97. Find the system reliability at that time.
19. What do you mean by structural importance of components?
20. Explain the concepts of DFR and IFR distributions.
21. Define hazard rate. Find hazard rate of exponential distribution.
22. Derive the relationship between cumulative hazard rate with reliability function.

(8 x 5 = 40 Marks)

Part C

(Answer any four questions; each question carries 10 marks)

23. Define a coherent structure. Describe the representation of a structure using minimal cut sets.
24. Show that the dual structure of a series structure is a parallel structure and vice versa.
25. Define lack of memory property. Show that exponential distribution possesses that property.
26. Let $h(\underline{p})$ be the reliability function of a coherent structure. Show that $h(\underline{p})$ is strictly increasing in each p_i for $0 < p_i < 1$ for all i.
27. Derive the reliability of a k-out-of-n structure.
28. Explain the method of computing system unreliability using inclusion exclusion method.

29. Let $\phi(\underline{x})$ be the structure function of a coherent system of order n. Then show that

$$\prod_{i=1}^{n} x_i \leq \phi(\underline{x}) \leq \coprod_{i=1}^{n} x_i .$$

30. Discuss the role of weibull distribution in reliability theory.

(4 x 10 = 40 Marks)

Part D

(Answer any two questions; each question carries 15 marks)

31. Discuss the reliability importance of components in a series system, parallel system and 2-out-of-3 system if the component reliabilities are ordered as $p_1 \leq p_2 \leq \ldots \leq p_n$.

32. Define bridge structure. Represent a bridge structure as parallel-series/series-parallel structure

33. Explain gamma distribution in the context of reliability.

34. State and prove the pivotal decomposition of the reliability function.

(2 x 15 = 30 Marks)