KAL-1660

M. A. / M. Sc. (Final) Examination, 2025

MATHEMATICS

PAPER - III
(Optional)

MATHEMATICAL STATISTICS
(Only for Due/Ex Students)

Time allowed : **Three Hours**

Max. Marks : **100**

Note : *Non-Programmable Scientific Calculator is allowed in this paper.*

This question paper contains three sections as under:

SECTION-A ***खण्ड–अ*** ***Max. Marks - 10***

*This section contains **one compulsory** question with **10** parts, having **2** parts from each unit, short answer in **20** words for each part. All questions carry **equal** marks.*

इस खण्ड में एक अनिवार्य प्रश्न हैं, जिसमें प्रत्येक इकाई से 2 लघु प्रश्न लेते हुये कुल 10 लघु प्रश्न होंगे। प्रत्येक लघु प्रश्न का उत्तर 20 शब्दों से अधिक में न हो। सभी प्रश्नों के अंक समान हैं।

SECTION-B ***खण्ड–ब*** ***Max. Marks - 50***

*This section contains **10** questions having 2 questions from each unit. Answer 5 questions (250 words each) selecting one question from each unit. All questions carry **equal** marks.*

इस खण्ड में प्रत्येक इकाई से 2 प्रश्न लेते हुये कुल 10 प्रश्न हैं। प्रत्येक इकाई से एक प्रश्न का चयन करते हुये कुल 5 प्रश्नों के उत्तर देने हैं। प्रत्येक प्रश्न का उत्तर 250 शब्दों से अधिक में न हो। सभी प्रश्नों के अंक समान हैं।

SECTION-C ***खण्ड–स*** ***Max. Marks - 40***

*This section contains **04** descriptive type questions (questions may have sub division) covering all units but not more than one question from each unit. Answer any two questions. (500 words each). All questions carry equal marks.*

*इस खण्ड में **04** वर्णनात्मक प्रश्न होंगे। प्रश्न के भाग भी हो सकते हैं जो सभी इकाइयों में से दिये जायेंगे, किन्तु एक इकाई में से अधिक प्रश्न नहीं होगा। कोई दो प्रश्नों के उत्तर दिये जाने हैं। प्रत्येक प्रश्न का उत्तर **500** शब्दों से अधिक न हो। सभी प्रश्नों के अंक समान हैं।*

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SECTION - A

1 (a) State Markov's inequality.

(b) Write formula for Partial correlation coefficient.

(c) If mean of Poisson distribution is 3 then find its variance and standard deviation.

(d) Write concept and expression for Geometric function.

(e) What is Estimation? Explain it.

(f) What is distribution at order statistics?

(g) What do you mean consistent estimator?

(h) Explain the regression and write the two lines of regression y on x and x on y.

(i) Write a short note on analysis of variance.

(j) Let (x_i, y_i) be paired sample observations $(i = 1, 2 \ldots\ldots n)$ then write hypothesis of sign test.

SECTION - B

UNIT - I

2 If the variables are uniformly bounded then the condition.

$$\lim_{x \to \infty} \frac{Bn}{n^2} = 0$$

is necessary as well as sufficient for weak low of large number (WLLN) to hold.

OR

3 Use Chebyschev's inequality to determine how many times a fair coin must be tossed in order that the probability will be at least 0-90 that the ratio of the observed number of heads to the numbers of tosses will be between 0.4 and 0.6

UNIT - II

4 Find moments of the Poisson distribution.

OR

5 Let X have a (standard) Cauchy distribution, find a p.d.f. for X^2 and identify its distribution.

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UNIT - III

6 If X is a binomial variate with parameters n and b and Fv_1, v_2, is an F-statistics with v_1 an v_2 d.f. prove that

$$P(X \le k-1) = P\left[F_{2k,\,2(n-k+1)} > \frac{n-k+1}{k} \cdot \frac{P}{1-P}\right]$$

OR

7 In random sampling from normal population $N(\mu, \sigma^2)$, find the maximum likelihood estimators for

(i) μ when σ^2 is known

(ii) σ^2 when μ is known

(ii) The Simultaneous estimation of μ and σ^2.

UNIT - IV

8 X and Y are two random variables with variance $\sigma^2 x$ and $\sigma^2 y$ respectively and r is the coefficient of correlation between them. If $V = x + yk$ and $V = x + (\sigma x/\sigma y)y$, find the value of k so that U and V are uncorrected.

OR

9 Write test for the variance of a Normal population.

UNIT - V

10 For 2×2 contingency table.

a	b
c	d

Prove that Chi-square test of independence gives

$$\chi^2 = \frac{N(ad-bc)^2}{(a+c)(b+d)(a+b)(c+d)},\ N = a+b+c+d$$

OR

11 Write advantages and drawbacks of Non-parametric methods over parametric methods.

SECTION - C

12 Joint distribution of X and Y is given by:

$$f(x, y) = 4xy\, e^{-(x^2+y^2)};\ x \ge 0,\ y \ge 0$$

Test whether X and Y are independent for the above Joint distribution, find the conditional density of X given $Y = y$.

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13 Find the MGF of a standard binomial variate $\left(\frac{X-np}{\sqrt{npq}}\right)$ and obtain its limiting form as $n \to \infty$. Also interpret the result.

14 Let (X, Y) have the Joint p.d.f. given by

$$f(x,y)=\begin{cases}1, & \text{if } |y|<x, 0<x<1\\ 0, & \text{otherwise}\end{cases}$$

Show that the regression of Y on X is linear but regression of X on Y is not linear.

15 For the double Poisson distribution

$$p(x)=P(X=x)=\frac{1}{2}\cdot\frac{e^{-m_1}m_1^x}{x!}+\frac{1}{2}\frac{e^{-m_2}m_2^x}{x!},$$

$x=0,1,2...$

show that the estimates for m_1 and m_2 by the method of moments are :

$$\mu_1' \pm \sqrt{\mu_2' - \mu_1' - \mu_1'^2}$$

https://pyqlelo.com