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Total No. of Questions : 11 ]

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# ASP-649

M.A./M.Sc. (Final) Examination, 2021

MATHEMATICS

Paper - Opt-VII

(Mathematical Theory of Statistics)

(Due and Imp. Paper IX)

Time : 1½ Hours ]

[ Maximum Marks : 100

## Section-A

(Marks : 2 × 10 = 20)

**Note :-** Answer all *ten* questions (Answer limit 50 words). Each question carries 2 marks.

(खण्ड-अ)

(अंक : 2 × 10 = 20)

**नोट :-** सभी दस प्रश्नों के उत्तर दीजिए (उत्तर-सीमा 50 शब्द)। प्रत्येक प्रश्न 2 अंक का है।

## Section-B

(Marks : 4 × 5 = 20)

**Note :-** Answer all *five* questions. Each question has internal choice (Answer limit 200 words). Each question carries 4 marks.

(खण्ड-ब)

(अंक : 4 × 5 = 20)

**नोट :-** सभी पाँच प्रश्नों के उत्तर दीजिए। प्रत्येक प्रश्न में विकल्प का चयन कीजिए (उत्तर-सीमा 200 शब्द)। प्रत्येक प्रश्न 4 अंक का है।

## Section-C

(Marks : 20 × 3 = 60)

**Note :-** Answer any *three* questions out of five (Answer limit 500 words). Each question carries 20 marks.

(खण्ड-स)

(अंक : 20 × 3 = 60)

**नोट :-** पाँच में से किन्हीं तीन प्रश्नों के उत्तर दीजिए (उत्तर-सीमा 500 शब्द)। प्रत्येक प्रश्न 20 अंक का है।

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ASP-649 P.T.O.

**Section–A**

2 each

1. (i) Define sample space and conditional probability.
- (ii) State Kolmogorov's Inequality.
- (iii) Give *two* examples where negative binomial distribution will be used.
- (iv) Write *two* assumptions of Karl Pearson's Correlation Coefficient.
- (v) Write M.G.F. of  $\chi^2$ -distribution.
- (vi) Define students 't'.
- (vii) Write the formula for coefficient of Association between two attributes.
- (viii) What do you mean by Test of significance for difference of means ?
- (ix) What do you mean by efficient and sufficient estimator ?
- (x) Write *four* methods of Estimation.

**Section–B**

4 each

2. A continuous random variable X has a p.d.f.  $f(x) = 3x^2$ ,  $0 \leq x \leq 1$  find *a* and *b* such that :
  - (i)  $P\{X \leq a\} = P\{X > a\}$  and
  - (ii)  $P\{X > b\} = 0.05$

*Or*

For geometric distribution  $P(x) = 2^{-x}$ ;  $x = 1, 2, 3, \dots$  prove that Chebyshev's inequality gives :

$$P[|X - 2| \leq 2] > 1/2$$

3. In a distribution exactly, 7% of the items are under 35 and 89% are under 63. What are mean and standard deviation of the distribution ?

*Or*

Obtain the rank correlation coefficient for the following data :

<b>X</b>	<b>Y</b>
68	62
64	58
75	68
50	45
64	81
80	60
75	68
40	48
55	50
64	70

4. Below are given the gain in weights (in lbs) of pigs fed on two diets A and B :

**Gain in weight**

<b>Diet A</b>	<b>Diet B</b>
25	44
32	34
30	22
34	10
24	47
14	31
32	40
24	30
30	32
31	35
35	18
25	21
	35
	29
	22

Test, if the two diets differ significantly as regards their effect on increase in weight.

*Or*

If  $X$  is  $t$ -distributed, show that  $X^2$  is  $F$ -distributed.

5. Find the association between proficiency in English and in Hindi among candidates at a certain test if 245 of them passed in Hindi, 285 failed in Hindi 190 failed in Hindi but passed in English and 147 passed in both.

*Or*

The means of two single large samples of 1000 and 2000 members are 67.5 inches and 68.0 inches respectively. Can the samples be regarded as drawn from the same population of standard deviation 2.5 inches ? (Test at 5% level of significance)

6. Let  $x_1, x_2, x_3, \dots, x_n$  be a random sample from  $N(\mu, \sigma^2)$  population. Find the sufficient estimator for  $\mu$  and  $\sigma^2$ .

*Or*

Find the maximum likelihood estimate for the parameter  $\lambda$  of a Poisson distribution on the basis of a sample of size  $n$ . Also find its variance.

**Section-C**

20 each

7. In a factory machines A and B are producing springs of the same type of this production, machines A and B produce 5% and 10% defective springs respectively. Machines A and B produce 40% and 60% of the total output of the factory. One spring is selected at random and it is found to be defective. What is the probability that this defective spring was produced by machine A ?
8. The equation of two regression lines obtained in a correlation analysis are as follows :

$$3x + 12y = 19, 3y + 9x = 46$$

Obtain :

- (i) The value of correlation coefficient  
(ii) Mean values of X and Y
9. For a Chi-square distribution with n.d.f. establish the following recurrence relation between the moments :

$$\mu_{r+1} = 2r(\mu_r + n \mu_{r-1}); r \geq 1$$

Hence find  $\beta_1$  and  $\beta_2$ .

10. Random samples drawn from two countries gave the following data relating to the heights of adults males :

	<b>Country A</b>	<b>Country B</b>
Mean heights (in inches)	67.42	67.25
Standard deviation (in inches)	2.58	2.50
Number in samples	1000	1200

- (i) Is the difference between the means significant ?  
(ii) Is the difference between the standard deviation significant ?
11. Obtain maximum likelihood estimators for  $\alpha$  and  $\beta$  for the rectangular population :

$$f(x; \alpha, \beta) = \begin{cases} \frac{1}{\beta - \alpha}, & \alpha < x < \beta \\ 0, & \text{elsewhere} \end{cases}$$