

<b>Annexure No.</b>	<b>20 G</b>
<b>SCAA Dated</b>	<b>29.02.2008</b>

**BHARATHIAR UNIVERSITY, COIMBATORE**  
(For the students admitted from 2008 – 2009 onwards)  
**ALLIED PAPER-I**  
(For B.Sc Mathematics /Mathematics (C.A))

**Subject title: Statistics for Mathematics-I**

**Course number:** \_\_\_\_\_ **Number of credit hours:7(SEVEN)**

**Subject description:** This course introduces Statistical concepts and mathematical analysis.

**Goal:** To enable the students to understand mathematical aspects of statistics

**Objective:** on successful completion of the paper the students should have understood the concepts of probability, random variable, various discrete and continuous probability distributions and the concepts of correlation and regression.

**UNIT-I**

Random variables- discrete and continuous random variables –distribution function-properties- probability mass function, probability density function-mathematical expectation – addition and multiplication theorems on expectations

**UNIT II**

Moment generating and cumulating generating & characteristic functions and their properties.

Joint probability distributions-marginal and conditional probability distributions-independence of random variables-transformation of variables (one & two dimensional only).Tchebychev's inequality, weak law of large numbers and central limit theorem

**UNIT III**

Probability distributions: Binomial, Poisson and Normal distributions and their properties and fitting of distributions. Chi-square, t and F Statistics, their probability functions and their properties.

**UNIT IV**

Curve fitting and principle of least squares: fitting of curves of straight line, second degree parabola, power curve and exponential curves-correlation and regression analysis.

**UNIT-IV**

Simple problems related to the above units.

**Books recommended for study:**

1. Fundamentals of Mathematical statistics by Guptha, S.C & Kapoor, V.K
2. Introduction to Statistical methods by Guptha ,C.B and Vijay Guptha (1988)

**ALLIED PAPER-II**  
(For B.Sc Mathematics /Mathematics (C.A))

**Subject title: Statistics for mathematics-II**

**course number:**

**Number of credit hours: 7 (Seven)**

**Subject description:** This paper introduces Applied Statistical concepts and mathematical analysis.

**Goal:** To enable the students to understand mathematical aspects of applied statistics

**Objective:** on successful completion of the paper the students should have understood the concepts of estimation ,testing ,sampling, design of experiments

**UNIT-I**

Concept of population, sample, statistics, parameter-point estimation-concept of point estimation - consistency, unbiased ness, efficiency- sufficiency-Neyman factorization theorem- Cramer Rao inequality -Rao-Blackwell theorem.

**UNIT-II**

Methods of estimation-maximum likelihood, moments, and minimum chi-square –properties- interval estimation –confidence interval-derivation of confidence intervals based normal, t, and chi-square and F.

**UNIT-III:**

Test of hypothesis: Type-I error and II errors-power test –Neyman-Pearson Lemma-likelihood ratio tests-concept of most powerful test (statements and results only).

Test of significance-standard error-large sample tests with respect to mean, standard deviaton, proportion, difference between means, standard deviations and proportions-exact tests based on t, chi-square and F distributions.

**UNIT-IV**

Sampling from finite population-simple random sampling, stratified random sampling and systematic sampling-estimation of mean, total and their standard errors. Sampling and non-sampling errors (concepts only). Analysis of variance: one way, two classifications -fundamental principles of experimentation-CRD, RBD and LSD.

**UNIT-V.**

Simple problems related to all the above units.

**Books recommended for study:**

1. Fundamentals mathematical Statistics by Guptha, S.C & Kapoor, V.K
2. Fundamentals of Applied statistics by Guptha, S.C& Kapoor, V.K



Or

b) Define mgf and characteristic functions and mention their properties.

14 a) A random variable X has the following pdf

$$f(x) = 2e^{-2x}, x \geq 0 \\ = 0, x < 0$$

find the mgf and hence find its mean and variance

Or

b) State and prove weak law of large numbers.

15. a) Using the principle of least squares, obtain the normal equations for fitting a straight line.

Or

b) Obtain mode of Normal distribution.

**SECTION-C (5x12=60 marks).**

Answer ALL questions.

All questions carry equal marks.

16.a) i) State and prove addition theorem on expectation.

ii) A continuous r.v X has the following probability law

$$f(x) = kx^2, 0 \leq X \leq 1 \\ = 0 \text{ elsewhere}$$

Determine k and compute  $p(X \leq .5)$

Or

b) i) State and prove multiplication theorem

ii) A r.v has the following distribution function

$$F(x) = 0, \text{ for } x \leq 0 \\ = x/2, \text{ for } 0 \leq x < 1 \\ = 1/2, \text{ for } 1 \leq x < 2 \\ = x/4, \text{ for } 2 \leq x < 4 \\ = 1, \text{ for } x \geq 4$$

Is the distribution function continuous? If so, find its probability density function.

17 a).If X and Y are two jointly distributed random variable with the following joint pdf

$$f(x,y) = k(6-x-y), 0 \leq X \leq 2; 2 \leq Y \leq 4; \\ = 0 \text{ elsewhere}$$

Find i) k

ii)  $V(x)$  and  $V(y)$

iii) Correlation between X and Y

iv) Are X and Y independent?

Or

b) i) If X and Y are jointly distributed random variables then prove that

$$E(E(X/Y)) = E(X)$$

ii) .State and prove Tchebychev's inequality

18.a). Obtain the mgf of binomial distribution. Hence find the first four moments.

Or

b) Show that prove that for the normal distribution the QD, MD and SD are approximately

10:12:15

- 19.a) i) Define  $\chi^2$  statistic and derive its probability density function.  
ii) State and prove the additive property of  $\chi^2$  variate.  
Or  
b) i) Define F statistic and its probability distribution  
ii) Obtain mode of F distribution
- 20 a) State and prove the interrelationship between t,  $\chi^2$  and F distributions  
Or  
b) Fit a second degree parabola to the following data:
- |    |    |    |    |    |    |
|----|----|----|----|----|----|
| X: | 1  | 2  | 3  | 4  | 5  |
| Y: | 16 | 18 | 19 | 20 | 24 |

B.Sc., DEGREE EXAMINATION  
First Semester

PART III – Branch I-Mathematics

Allied A –**STATISTICS FOR MATHEMATICS-II**

Time : Three hours

**Model Question paper**

Maximum : 100 Marks

SECTION-A (10 x 1=10 Marks)

Answer ALL questions.

Choose the best answer .

- The standard error of the sampling distribution of the mean is
  - the deviation of the sampling distribution of the mean.
  - the standard deviation of the sampling of any statistic.
  - the standard deviation of the sampling distribution of the statistic
  - the standard deviation of the sampling distribution of both mean and variance
- If  $n$  is the sample size,  $\mu$  is the population mean and  $\sigma^2$  is the population variance, then the standard error of the standard deviation is
  - $\sigma/\sqrt{n-1}$
  - $\sigma/\sqrt{n}$
  - $\sigma/2n$
  - $\sigma/n$
- Crammer-rao lower bound to variance of unbiased estimator  $\theta$  of  $N(\mu, \theta)$ , when  $\mu$  is known is
  - $\theta^2/n$
  - $\theta^2/2n$
  - $2\theta^2/n$
  - $\theta/2n$
- If  $X_1$  and  $X_2$  are random sample from a population  $N(\mu, \sigma^2)$ , then the efficiency of  $\mu = (X_1 + 2X_2)/3$  with respect to  $\bar{x}$  is
  - 5/9
  - 9/10
  - 3/5
  - 1/3
- The sample mean fails to be an m.l.e for the unknown parameter  $\theta$  in a situation where the population is
  - Normal ( $\theta, 1$ )
  - poisson ( $\theta$ )
  - both (a) & (b)
  - none of these
- The 95% confidence limits for the population mean in the case of large sample is
  - $\bar{x} \pm 1.96\sigma$
  - $\bar{x} \pm 1.96\sigma/\sqrt{n}$
  - $\bar{x} \pm 1.96/\sqrt{n}$
  - $\bar{x} \pm 1.96\sqrt{n}/\sigma$

- 7 the probability of rejecting a false hypothesis is known as  
a) Level of significance b) power of the test c) both (a)&(b) d) none of these
8. To test the homogeneity of several variances one has to use  
a) t-test b) F test c) Bartlett's test d) Analysis of variance
9. Non-sampling errors occur in  
a) Census survey b) sample survey c) both in (a) & (b) d) none of these
10. To test the equality of several treatment means we use  
a) t-test b)  $\chi^2$  test c) ANOVA d) none of these

SECTION-B (5x 6=30 MARKS)

Answer ALL questions.

All questions carry equal marks.

- 11 a). Explain sampling distribution and standard error.  
Or  
b). Show that the sample variance  $S^2 = (1/n) \sum (x - \bar{x})^2$  is not an unbiased estimator of population variance.
- 12 a). Explain the estimation procedure by the method of moments and indicate the circumstances under which it is most appropriate.  
Or  
b). State any four of the optimal properties of the maximum likelihood estimator.
- 13 a). Explain interval estimation and compare it with point estimation.  
Or  
b) Distinguish between Type I and Type II errors.
- 14 a). Explain the procedure for test of significance.  
Or  
b) Explain paired t-test.
- 15 a). Differentiate between SRSWR and SRSWOR.  
Or  
b) Define CRD. State its advantages

SECTION-C (5x12=60 marks).

Answer ALL questions.

All questions carry equal marks.

- 16 a) State and prove Cramer-Rao inequality. Or  
b) i) define a sufficient statistic. State the factorization theorem on sufficiency.

- ii) Obtain the sufficient statistic for  $\theta$  in  $f(x, \theta) = e^{-(x-\theta)}$ ,  $x \geq 0$ ;  $-\infty < x < \infty$
- 17.a) Explain the method of minimum  $\chi^2$ .state its properties. Or  
 b) i) Explain the use of  $\chi^2$  distribution in interval estimation.  
 ii) Explain the method of obtaining a 95% confidence interval for the difference between two proportions
- 18 a).State and prove Neyman-Pearson lemma. Or  
 b) Explain how you test the equality of variances and state assumptions if any.
- 19 a) Derive an unbiased estimator for population mean in sample random sampling without replacement. Obtain its standard error  
 Or  
 b) ) Give the complete statistical analysis for two-way classification with one observation per cell.
- 20 a).To find whether a certain vaccination prevents a certain disease or not ,an experiment was conducted the following figures were obtained ,A showing vaccination and B attacked by the disease .

	A	$\alpha$	Total
B	69	10	79
$\beta$	91	30	121
Total	160	40	200

Using  $\chi^2$ -test analyse the results of the experiment for independence between A and B.

- b) Carry out analysis of variance for the data of yields of 4 varieties, 5 observations being taken on each variety.

	Variety No.			
	1	2	3	4
Observation No.				
1	13	15	14	14
2	11	11	10	10
3	10	13	12	15
4	16	18	13	17
5	12	12	11	10