Annexure No.	20 G
SCAA Dated	29.02.2008

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

B.Sc., DEGREE EXAMINATION
PART III – Mathematics/Mathematics (CA)
Allied A –STATISTICS FOR MATHEMATICS-I

Time : Three hours   **Model Question paper**   Maximum : 100 Marks

SECTION-A   (10 x 1=10 Marks)
Answer ALL questions.
Choose the best answer

1. A random variable X has the following probability distribution:

   x: 0   1   2   3
   p(x):   3k   5k   7k   5k

   The value of k is
   a)1/8   b) 1/20   c)1/12   d)1/14

2. If X is random variable, then $V(aX+b)$ is equal to
   a) $a\,V(X)$ b) $a^2\,V(X)$ c) $a\,V(X) + b$ d) $a^2\,V(X)+b^2$

3. If X and Y are two independent random variables then
   a) $f(x,y) = f(x).g(y)$ b) $f(x,y) > f(x).g(y)$ c) $f(x,y) < f(x).g(y)$ d) $f(x,y) = f(x/y).g(y)$

4. If X and Y are independent then the conditional expectation $E(X/Y)$ is
   a) $E(Y)$ b)$E(Y/X)$ c) $E(XY)$ d)$E(X)$

5. If X is r.v with mean $\bar{X}$ then the expression $E(X- \bar{X})^2$ represents
    a) μ_3 b) μ_2 c) μ_4 d) None of these

6. The expectation of the number on the die when a six faces die is thrown is
   a) 7/3   b) 3/7   c)7/2   d)2/7

7. If X is a r.v then $E(e^{tX})$ is known as
   a) m.g.f   b) p.g.f   c)c.g.f   d) none of these

8. If X is a r.v and k is any positive number then $p(|X- \mu| < k\,\sigma)$
    a) $\geq 1/k^2$ b) $\leq 1/k^2$ c)) $\geq 1- 1/k^2$ d) $\leq 1- 1/k^2$

9.If X and Y are independent poisson variates with parameters λ_1 and λ_2 respectively then
   X+Y is a
a) Poisson variate   b) Binomial variate   c) Normal variate   d) none of these

10. Correlation between two independent random variables is
 a) 0   b) +1   c) -1   d) none of these

SECTION-B   (5x 6=30 MARKS)
Answer ALL questions.
All questions carry equal marks.

11. a) Define distribution function and state its properties.   Or
     b) Define p.m..f and pd.f .give examples.

12. a) Derive poisson distribution as a limiting case of Binomial distribution by stating its
       conditions.   Or
     b) Define marginal, conditional and joint probability density functions.

13. a) The joint probability distribution of the random variables X and Y is
      f(x,y)= (x+3y)/24 where (X,Y):(1,1),(1,2),(2,1),(2,2)
        Find   i) marginal distributions of X and Y
           ii) Condional distributions of X given Y= 2
           iii) Conditional expectation of X given Y=2

Or
   b) Define mgf and characteristic functions and mention their properties.
14 a) A random variable X has the following pdf

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

   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 χ^2 statistic and derive its probability density function.
    ii) State and prove the additive property of χ^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, χ^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 .

1. The standard error of the sampling distribution of the mean is
   a).the deviation of the sampling distribution of the mean.
   b). the standard deviation of the sampling of any statistic.
   c). the standard deviation of the sampling distribution of the statistic
   d). the standard deviation of the sampling distribution of both mean and variance

2. If n is the sample size,μ is the population mean and σ^2 is the population variance, then the
   standard error of the standard deviation is
   a) $\sigma/\sqrt{n-1}$ b) $\sigma/\sqrt{n}$ c) $\sigma/2n$ d) σ/n

3. Crammer-rao lower bound to variance of unbiased estimator θ of N (μ,θ), when μ is known is
   a) θ^2/n b) $\theta^2/2n$ c) $2\theta^2/n$ d)$\theta/2n$

4. If X_1 and X_2 are random sample from a population N (μ,σ^2),then the efficiency of
  $\mu=(X_1+2X_2)/3$ with respect to $\bar{x}$ is
  a) 5/9   b) 9/10   c)3/5   d)1/3

5. The sample mean fails to be an m.l.e for the unknown parameter θ in a situation where the
population is
 a) Normal $(\theta, 1)$ b) poisson (θ) c) both (a) & (b)   d) none of these

6. The 95% confidence limits for the population mean in the case of large sample is
 a) $\bar{x} \pm 1.96\sigma$ b) $x \pm 1.96\sigma/\sqrt{n}$ c) $x \pm 1.96\ 1/\sqrt{n}$ d) $x \pm 1.96\sqrt{n}\ /\sigma$

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) χ^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 θ in $f(x,\theta) = e^{-(x-\theta)}$, $x \geq 0$; $-\infty < x < \infty$

17.a) Explain the method of minimum χ^2.state its properties.   Or

   b) i) Explain the use of χ^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	α	Total
B	69	10	79
β	91	30	121
Total	160	40	200

Using χ^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