MODEL QUESTION

NEW COURSE (Based on Revised syllabus)

Bachelor Level : 4 yrs program : I year /IOST **F.M : 100**

Fundamentals of Statistics (STA101) **Pass Marks: 35**

Time: 3 Hours

Group A

Attempt any Four questions. **[4x10 = 40]**

1. Give the various meanings of the term statistics. Describe the scope of statistical methods and specify their limitations.

2. Prove that if deviations are small compared with the mean M so that $(x/M)^3$ and higher powers of x/M may be neglected,

$G = M\left(1 - \frac{\sigma^2}{2M^2}\right)$, where M, G and σ are respectively arithmetic mean, geometric mean and standard deviation of variate x.

3. What are the differences between correlation and regression coefficients? If the lines of regression of Y on X, and X on Y are respectively are $a_1X+b_1Y = c_1$ and $a_2X+ b_2Y = c_2$, prove that $a_1b_2 \leq a_2b_1$

4. Differentiate between independent and mutually exclusive events. Can two events be mutually exclusive and independent simultaneously?

Prove that for n events $A_1, A_2, \ldots\ldots, A_n$:

$P(\cup_{i=1}^{n} A_i) \leq \sum_{i=i}^{n} P(A_i)$

5. Define mathematical expectation of a random variable. If X and Y are two discrete random variables, prove that E(X+Y) = E(X) + E(Y).

6. Discuss the measure characteristics of Normal distribution. Obtain moment generating function of Normal distribution.

Group B

Attempt any Eight questions. **[8x5=40]**

7. What are the requisites of a good average? The number of sick days due to colds and flu last was recorded by a sample of 10 adults. The data are : 5, 2, 5, 6, 5, 12, 7, 4, 5 and 9. Calculate mean, median and mode, and interpret your results.

8. A variate takes the values a, ar, ar^2, ………… ar^{n-1} each with frequency unity. Show that A.M. = $\frac{a(1-r^n)}{n(1-r)}$, the G.M. = a $r^{(n-1)/2}$ and the H.M. = $\frac{a\,n\,(1-r)\,r^{n-1}}{1-r^n}$.

9. What do you understand by absolute and relative measure of dispersion?

Prove that Var(aX) = a^2 Var (X)

10. What is meant by skewness? Show that for a discrete distribution $\beta_2 \geq \beta_1$.

11. What do you understand by union, intersection and complementation of events? If A and B are independent events, prove that, $P(A \cup B) = 1 - P(A') P(B')$.

12. Define sensitivity and specificity of a diagnostic test, explain how they are used in real life problems.

13. State under what conditions binomial distribution tends to Poisson distribution. There are 5000 students in a university. Calculate the probability that exactly 15 of them have their birthdays on 1 January.

14. For the continuous distribution ,

$dF = y_0(x - x^2)\, dx$, $0 \leq x \leq 1$,

y_0 being constant, find arithmetic mean and harmonic mean.

15. If $X_1$and X_2 are two independent random variables, then show that the moment generating function of the product of the above variables is equal to the moment generating function of their sum.

16. State the condition under which a function is said to be a probability density function. Examine whether the following function is a probability density function.

$f(x) = \frac{3}{8}(4x - 2x^2)$, 0 <x < 2

= 0, otherwise

17. Find mean and variance of uniform probability distribution.

Group C

18. Attempt all questions. [10X2 = 20]

a) Distinguish between ratio scale and interval scales of measurement?

b) A car travels first 40 km. at a rate of 80 km/hr and second 90 km at a rate of 60 km/hr. What is average speed?

c) The arithmetic mean of the runs scored by two batsmen A and B in the series are 50 and 38 respectively. The standard deviations of their runs are respectively 15 and 12. Who is more consistent player?

d) Draw a box and whisker plot from the following information: Minimum value= 12, Q_1= 16, Median = 21, Q_3= 25 and maximum value = 32.

e) Show that the correlation coefficient between two variables X and Y is the geometric mean of the regression coefficients of Y on X and X on Y.

f) State Baye's theorem.

g) Identify the following as discrete or continuous random variables. (i) Increase in length of life by a cancer patient as a result of surgery. (ii) Numbers of deer killed per year in a state wild life preserve.

h) For a discrete random variable X has the cumulative distribution function F(X) is as follows:

X	1	2	3	4	5
F(X)	0.20	0.32	0.67	0.90	1

Find P(X=3)

i) Give the expression of moment generating function for the following distribution:

(i) $X \sim$ Binomial (n, p) (ii) $X \sim$ Poisson (λ)

j) Find the probability that a random variable having standard normal distribution will take on the value less than 1.2.