(3 Hours) [Total Marks: 100]

N.B.:

1) All questions are compulsory.

2) Figures to the right indicate full marks

3) Attempt <u>any four</u> sub-questions <u>from question one</u> and <u>any two</u> sub-questions from remaining questions.

4) Use of calculator is allowed.

Q.1 a) Explain the following terms in content of epidemic Theory. [5]

       i) An infective. ii) Susceptible. iii) Carrier.

  b) Describe the method of estimating relative potency of test preparation in case of [5]

    Direct Assay.

  c) With reference to clinical Trials' explain phase – I. [5]

  d) In content of Inventory models, explain the controlled variables. [5]

  e) With reference to Game Theory explain. [5]

  i) Saddle point. ii) Pay-off matrix. iii) value of the game.

  f) In content of Decision Theory, write a note on i) Huruicz criterion ii) Maximin [5]
    Criterian.

Q.2 (a) Describe general epidemic model with removals. Hence find i) the condition for the [10]
    epidemic to start. Ii) the expression for number of susceptibles at time 't'.

  (b) Explain a carrier model with the assumptions. Assuming Carrier model Show that [10]
    number of carriers at the end of an epidemic is zero. Also obtain the expression for the
    number of suscetibles who escape infection.

  (c) For a data on household of size three with single introductions, obtain [10]

    i) Reed Frost probabilities of all possible chains.

    ii) Maximum Likelihood Estimator (MLE) of p, the probability of adequate contact and
       its standard error.

..2

TURN OVER

Q.3 (a) In case of (2 x 2) symmetric parallel line assay, derive expressions for all .   [10]

contrasts.   Hence state the ANOVA and the conclusions

(b) What are Indirect and quantal Response Assays ? Explain. Describe Probit Method; of   [10]

estimating $(LD)_{50}$.

(c) In contest of 'Clinical Trials' write a note on i) Inclusion and exclusion Criterian.   [10]

ii) Placebo.

Q.4 (a) In a certain manufacturing situation, the demand is uniform at the rate r units per unit time, [10]

production is instantaneous, C_1 is inventory holding cost per unit quantity per unit time,

shortage are not allowed and C_3 is set up cost. Derive economic lot size formula, optimum

cost and optimum ordering interval. Assume Lead Time to be zero.

(b) Find the optimum level to which stock should be raised at the beginning of each period   [10]

t (t is fixed and known), when demand 'r' is random variable with probability p(r) . C_1

is the holding cost and C_2 is the shortage cost per unit per unit time. Assume demand

to be instantaneous. Lead Time is zero.

(c) In contest of Game Theory, explain the Dominance Rute. For a given payoff matrix   [10]

for player A, obtain the optimum strategies for both the players.

$$
\begin{array}{c c c c}
 & B_1 & B_2 & B_3 \\
A_1 & \begin{bmatrix} 7 & -2 & 8 \\ A_2 & -2 & 1 & 5 \end{bmatrix}
\end{array}
$$

Q.5 (a) Why does problem of replacement arise ?   [10]

Obtain a criterion for determining replacement age of an equipment whose purchase

price is C, Ri is the maintenance cost during i^{th} period and S is the scrap value. Assume

that money value remains constant.

..3

Q.5 (b) Explain what are Group Replacement and individual replacement policies ? If system [10]

contains N items, C_1 is the cost of individual replacement and C_2 is the cost of group

replacement ($C_1 > C_2$), derive the optimum Group Replacement Policy.

(c) Write a note on Decision Tree [10]

Consider the following payoff matrix.

States of nature

		θ_1	θ_2	θ_3
Courses of	a_1	30	9	9
action	a_2	40	14	4
	a_3	55	19	2

Determine the optimum course of action using Hurwicz criterion.

Take $\alpha = 0.4$.