CSM – 69/18
Statistics
Paper – II

Time : 3 hours

Full Marks : 300

The figures in the right-hand margin indicate marks.

*Candidates should attempt Q. No. 1 from Section – A and Q. No. 5 from Section – B which are compulsory and **three** of the remaining questions, selecting at least **one** from each Section.*

SECTION – A

1. (a) Write the general theory of control chart and hence explain the construction of $\bar{X}$ and R chart.   15

   (b) Show that failure rate of the series system is equal to the sum of failure rates of its components.   15

   (c) Explain different components of time series.

   15

(d) Write a short note on scope and method of collection of official statistics. 15

2. (a) Differentiate between single double and sequential sampling plan for attributes. Suppose that a single-sampling plan with $n = 89$ and $c = 2$ is being used for receiving inspection where the supplier ships the product in lots of size $N = 10,000$. Find AOQ if the incoming lot of quality $p = 0.01$. 20

(b) Define reliability and mean time between failures (MTBF) of a system. Derive reliability, hazard rate and MTBF for exponential distribution. 20

(c) Derive reliability and MTBF of a 2 unit parallel system with identical components under assumptions that failure rates are constant for each component. 20

3. (a) Define the additive and multiplicative models. Explain Box-Jenkins method of testing stationarity in time series. 25

(b) Write a short note on ACF and PACF. Describe the method of determining order of auto regressive and moving average in ARIMA models. 25

(c) Define Laspeyre and Pasches index numbers. 10

4. (a) Derive the ordinary least square method of estimating regression coefficients in a general linear model. Show that it is BLUE. 25

(b) Explain different diagnostics used in identifying multicollinearity, heteroscadascity in a general linear model. 25

(c) What is CSO ? What are the objectives and functions of CSO ? What role does it play in the country. 10

SECTION – B

5. (a) Explain the formulation and structure of a linear programing problem and hence describe graphical solution of solving a linear programing problem. 15

(b) What is a Markov chain ? Explain simple properties of a finite Markov chain.   15

(c) Write short note on direct and indirect method of standardization.   15

(d) Define Z scores, T scores and percentile scores.   15

6. (a) Describe simplex procedure of solving a linear programing problem.   20

(b) The following is the pay off matrix of company A who had 3 strategies of marketing a drug against company B who has 4 strategies of marketing :

	B1	B2	B3	B4
A1	8	−2	9	−3
A2	6	5	6	8
A3	−2	4	−9	5

Determine the saddle point solution of the game.   20

(c) Explain the optimum inventory policy for a classic inventory model with static demand.

20

7. (a) For a Markov chain, prove that :   20

$$P(X_n = j \mid X_{n1} = i|, ..., X_{nk} = ik) = P(X_n = j \mid X_{nk} = ik)$$

when ever $n_1 < n_2 < ..... < n_k < n$.

(b) In a Gambler's Ruin problem with $p = 0.4$ and $n = 6$, starting in state 3, determine expected number of visits to state 2 and probability of ever visiting state 4.   20

(c) Describe M/M/1 queue. Derive expression for expected number of people in the queue.

20

8. (a) Define the following : $4 \times 5 = 20$

(i) Crude death rate

(ii) Infant mortality rate

(iii) Standardized death rate

(iv) Maternal mortality rare

(v) Age specific birth rate

(b) Explain with notations the steps involved in construction of a bridge life table. 20

(c) How do you fit a logistic growth model. 20

———— ❋ ————