

M.SC. (APPLIED STATISTICS)

(MSCAST)

Term-End Examination

June, 2026

**MST-014 : STATISTICAL QUALITY CONTROL
AND TIME SERIES ANALYSIS**

Time : 3 Hours

Maximum Marks : 50

Note : (i) *Question No. 1 is compulsory.*

(ii) *Attempt any **four** questions from the remaining question No. 2 to 6.*

(iii) *Use of scientific calculator (non-programmable) is allowed.*

(iv) *Symbols have their usual meanings.*

1. State whether the following statements are True or False. Give reasons in support of your answer. 5×2=10

(a) A house gets electric power from a generator or solar panels which are

connected in parallel configuration. The reliability of the generator is 0.70 and solar panel is 0.80. The probability that the house has power on any given day will be 0.94.

- (b) If potential process capability index (C_p) is greater than 1, then the process is incapable and the products do not meet the desired specifications.
- (c) The variation in the weight of cricket balls may be due to assignable causes only.
- (d) If autocovariance function for a time series data are :

$$C_0 = 10.933, C_1 = 9.133, C_2 = 7.4$$

then autocorrelation functions are $r_1 = 0.835$ and $r_2 = 0.677$.

- (e) If we want to control the proportion defectives of a process then we use C chart.
2. A pen drive manufacturing company supplies pen drives in lots of size 250 to the buyers. A Single sampling plan with $n = 15$,

$C = 1$ is being used for the lot inspection. The company and the buyer decide that $AQL = 0.01$ and $LTPD = 0.10$. If the incoming lots contain 3% defective pen drive, calculate :

- (i) Probability of accepting the lot
- (ii) Producer's risk
- (iii) Consumer risk
- (iv) AOQ if rejected lots are screened and all defective pen drives are replaced by non-defectives ones.

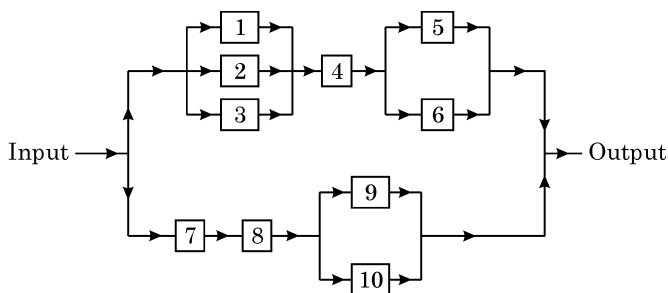
(v) ATI : Given $\sum_{x=0}^1 15 C_x p^x - p^{15-x}$

$$= 0.9270 \text{ for } p = 0.03$$

$$= 0.9904 \text{ for } p = 0.01$$

$$= 0.5490 \text{ for } p = 0.10) \quad 10$$

3. The configuration of a system is shown in the following diagram :



Assume that all components are independent and reliability of each component is given for a mission of 100 hours as follows :

$$R_1 = 0.50, R_2 = 0.60, R_3 = 0.70, R_4 = 0.80, \\ R_5 = 0.50, R_6 = 0.70, R_7 = 0.50, R_8 = 0.80, \\ R_9 = 0.50, R_{10} = 0.50$$

Find the reliability of the system for a mission of 100 hours. 10

4. A furniture manufacturing company observed that atmost 90% of the rejected furniture are due to scratch marks on the furniture. The quality control team of the company decided to set up control chart to reduce the number of defects. To do so, the team collected 20 random samples of one piece of the furniture and counted the number of scratch marks on them. The obtained data are given below :

Sample No.	1	2	3	4	5	6	7	8	9	10
Scratch Marks	10	19	5	9	2	8	7	13	3	2

Sample No.	11	12	13	14	15	16	17	18	19	20
Scratch Marks	22	4	6	9	7	2	5	12	4	2

- (i) Which control chart should be used in this case ?
- (ii) Calculate the control limits for this chart.
- (iii) Do these data form a controlled process ? If not, calculate the revised control limits. 10
5. The following data give the average quarterly prices of a product for three years :

Year/ Quarter	2021	2022	2023
I	13	14	15
II	12	16	15
III	15	18	18
IV	15	17	19

- (i) Compute seasonal indices using ratio to moving average method.

- (ii) Do seasonal indices significantly influence the price of the product ? 10
6. (a) Consider the time series model :
- $$Y_t = 2 + \epsilon_t + 0.8 \epsilon_{t-1}$$
- Where, $\epsilon_t \sim N(0, 2)$.
- (i) Is this a moving average model ? If yes, check whether it is invertible or not ?
- (ii) What are the mean and variance of the above time series ? 6
- (b) Describe rectifying sampling plan with an example. 4

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