

**Q.1/** What are the objectives of control chart?

**Q.2/** Assume that (5000) items are put under the test, and if failure rate equal to  $5 \cdot 10^{-4}$  find:

- 1- Reliability for  $t = 500$  h.
- 2-  $N_s(t)$  for  $t = 500$  h.
- 3-  $N_f(t)$  for  $t = 500$  h.

**Q.3 /** Assume two units are connected in series and failure rates are  $\lambda_1$  and  $\lambda_2$  respectively find: -

- 1- Reliability of the system.
- 3-  $f(t)$
- 4- MTBF of the system.

**Q.4/** Explain the **quality characteristics** in detail.

**Q.5 /** Suppose that two units connected in parallel and assume that each has the same constant failure rate (  $\lambda_1 = \lambda_2 = \lambda = 0.01$  ) find

- 1- Reliability of the system.
- 2- The reliability of the system where  $t = 100$  h.
- 3- MTBF of the system.

**Q.6/** Show that

The general expression of reliability is  $R(t) = e^{-\int_0^t Z(s) ds}$

**Q.7/ Explain the following briefly:**

- 2- Quality Characteristics.      3- Type of Errors.      1- Source of Variation.

**Q.8/** The following data were collected from a process manufacturing power supplies. The variable of interest is output voltage, and  $n = 5$ .

Sample Number	1	2	3	4	5	6	7	8	9	10
$\bar{X}$	103	102	104	105	104	106	102	105	106	104
R	4	5	2	11	4	3	7	2	4	3
Sample Number	11	12	13	14	15	16	17	18	19	20
$\bar{X}$	105	103	102	105	104	105	106	102	105	103
R	4	2	3	4	5	3	5	2	4	2

Set up  $\bar{X}$  and R control charts on this process. Is the process in statistical control? Use following table values:

$(A_2, n = 5) = 0.577$  ,  $(A_1, n = 5) = 1.342$  ,  $(B_4, n = 5) = 2.089$  ,  $(B_3, n = 5) = 0$  ,  $(D_4, n=5) = 2.114$  ,  
 $(D_3, n=5) = 0$ .