USN ☐☐☐☐☐☐☐☐☐☐

Sixth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Statistical Quality Control

Time: 3 hrs.

Max. Marks:100

**Note: 1. *Answer FIVE full questions, selecting
at least TWO questions from each part.*
*2. Use of SQC tables permitted.***

PART – A

1 a. Define the following terms: (i) Quality   (ii) Quality control. Discuss few benefits from statistical quality control. **(07 Marks)**
   b. Briefly explain the four categories of quality costs. **(08 Marks)**
   c. Discuss the most common working statistical tools used in quality control. **(05 Marks)**

2 a. A machine shop produces steel pins. The width of 100 pins was checked after machining and data was recorded as shown in the table below. **(10 Marks)**

Width in mm	9.50 – 9.51	9.52 – 9.53	9.54 – 9.55	9.56 – 9.57
Frequency	06	02	20	32

Width in mm	9.58 – 9.59	9.60 – 9.61	9.62 – 9.63	9.64 – 9.65
Frequency	22	08	06	04

   (i) Find the Arithmetic mean, standard deviation.
   (ii) What percentage of pins manufactured has width 9.52 to 9.53?
   b. Briefly explain normal distribution and its characteristics. **(06 Marks)**
   c. Briefly explain the normal distribution and its characteristics. **(04 Marks)**

3 a. Explain the variation due to chance and assignable causes with suitable examples. **(05 Marks)**
   b. Define a control chart? What are possible objectives of the control chart? **(06 Marks)**
   c. Explain the factors to be considered in determining : (i) Sample size   (ii) Frequency of subgrouping (iii) Control limits. **(09 Marks)**

4 a. Briefly explain about $\overline{X}$ and R types of control charts. Mention the expressions used for control limits for both charts. **(05 Marks)**
   b. Briefly explain about Type-I and Type-II errors. **(05 Marks)**
   c. The table below given the data for the diameter of pins which are ground on a new grinding machine.

1	2	3	4	5	6	7	8	9	10
11.2	11.2	10.8	10.9	11.0	10.9	11.4	11.1	10.9	10.8
10.9	10.8	11.1	10.8	11.2	10.9	11.8	10.8	10.6	11.1
10.8	11.9	11.5	11.5	10.8	11.4	11.2	11.6	11.1	11.0
11.1	10.9	11.0	11.0	10.6	11.2	11.2	10.9	11.0	10.9

   i) Determine the control limits for $\overline{X}$ and R charts.
   ii) Construct $\overline{X}$ and R control charts, plot the data and interpret the results. **(10 Marks)**

PART – B

5 a. Define process capability? Briefly explain the following three cases of process capability:
   (i)   Process capability < (USL – LSL)
   (ii) Process capability = (USL – LSL)
   (iii) Process capability > (USL – LSL)   **(10 Marks)**
   b. Explain the capability index C_{PK}.   **(05 Marks)**
   c. In an operation the design called for a shaft of diameter 2.00 ± 0.002 cms. A control chart was drawn for samples of 5 and $\overline{R}$ was found to be 0.0009 and $\overline{\overline{X}}$ = 1.999. Determine the value of C_{PK}.   **(05 Marks)**

6 a. A manufacturer uses a injection moulding to produce a plastic insulation barrier. He inspects 100 barriers daily picked randomly from the production and determines the number of defects. He wishes to use the data accumulated during a 10 day period to construct an attribute chart.
   (i) Plot the appropriate control chart.
   (ii) What control limits would you recommend for future uses.   **(10 Marks)**

Lot No.	1	2	3	4	5	6	7	8	9	10
No. of Items rejected	6	14	18	10	2	20	18	5	12	8

   b. The following are the inspection results of a piece of woolen cloth measuring 100 mtrs.

Piece No.	1	2	3	4	5	6	7	8	9	10
No. of defects	3	3	6	3	0	1	3	5	7	8

   (i) Determine the control limits for C-chart.
   (ii) Plot the data and offer your comments.   **(10 Marks)**

7 a. Explain the terms AQL, producers risk, consumers risk, LTPD and AOQ with the help of a sketch of OC curve.   **(12 Marks)**
   b. Briefly explain double sampling plan with the help of flow diagram.   **(08 Marks)**

8 a. With neat sketch, explain CUSUM control chart. Compare CUSUM control charts with Shewart control chart.   **(10 Marks)**
   b. Explain EWMA control chart? How to implement the EWMA chart?   **(10 Marks)**

* * * * *