Indian Statistical Institute, Bangalore
M.S. (QMS) First Year
First Semester - Statistical Process Control I

Final Exam Date: 14 November, 2016 Time: 3 hours Max. Marks: 50

Answer as many questions as you can. Maximum you can score is 50

1. Describe the step by step details of process capability analysis using normal probability plot method? [5]
2. What is pre control chart? Describe how it is used for process control? [5]
3. Give switching procedure between normal, tightened and reduced inspection in MIL STD 105E? [5]
4. A sample of five units is taken from a process every half an hour. The xbar and R values are given in the table below. [12]

Sample Number	xbar	Rbar	Sample Number	xbar	Rbar
1	41.5	5	11	40.6	5
2	40.7	6	12	39.4	6
3	40.5	5	13	38.6	4
4	39.8	4	14	42.5	6
5	38.6	6	15	41.8	6
6	40.7	5	16	40.7	6
7	39.6	3	17	39.8	5
8	40.2	1	18	37.7	5
9	41.4	0	19	38	6
10	41.9	4	20	37.9	5

   a. Estimate the process mean and standard deviation?
   b. If the specification on the characteristic under study is 40 ± 8. Compute the process capability indices and percentage not meeting the specification?
   c. Construct a modified control chart to monitor the process such that Cpk will be maintained at 1.2?

5. Suppose that a single sampling plan with n = 50 and c = 3 is being used for receiving inspection where the supplier ships the product in lots of size N = 3000. [12]
   a. Draw the OC curve for this plan? If 0.095 is the desired LTPD, compute the consumer's risk?
   b. Draw the ATI curve for this plan?

6. A company uses a double sampling plan with $n_1 = 40$, $c_1 = 2$, $n_2 = 50$ and $c_2 = 3$ for incoming inspection where the supplier ships the product in lots of size $N = 5000$. If the incoming fraction nonconforming $p = 0.04$, compute the probability of acceptance, ASN, AOQ and ATI? [12]

7. A supplier ships a component in lots of size $N = 6000$. The AQL has been established for this product at 2.5. Find the normal, tightened and reduced single sampling plans for this situation from MIL STD 105E, assuming that general inspection level II is appropriate? [4]