NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF APPLIED CHEMISTRY

END OF SEMESTER EXAMINATIONS – DECEMBER 2001

QUALITY ASSURANCE MANAGEMENT AND CONTROL – SCH 4111

TIME – (3) THREE HOURS

INSTRUCTIONS TO CANDIDATES

Answer **ALL** questions from Section A and **ANY THREE** questions from Section B.

SECTION A (40 marks)

1. A manufacturer of transistors found the following number of defectives in 25 subgroups of 50 transistors 3,5,4,2,3,2,7,0,2,4,2,3,4,1,2,4,8,2,4,2,6,4,3,1 and 4. Construct a control chart for the fraction defective, plot the sample data on this chart and comment on the state of control. (15 marks)

2. One radio was checked for defects on every ten leaving the assembly line. A sample of ten radios had the following faults: 8,5,6,4,3,8,8,10,9,9.

   Using the appropriate Control Chart, compute the Upper Control Limit (UCL) and the Lower Control Limit (LCL). Plot the results and comment on the quality status of the operation. (15 marks)

3. Write short notes on the following types of Quality Costs.

   (a) Failure Costs (2 marks)

   (b) Appraisal Costs (1 mark)

   (c) Prevention Costs (2 marks)

4. Outline how one can go about installing a Quality Control System on a new product line. (5 marks)

SECTION B

1.

Subgroup	1	2	3	4	5
$\bar{X}$	1,524	1,520	1,488	1,521	1,505
R	0,039	0,028	0,035	0,033	0,041

Subgroup	6	7	8	9	10
$\bar{X}$	1,510	1,495	1,491	1,491	1,482
R	0,025	0,030	0,037	0,028	0,043

Subgroup	11	12	13	14	15
$\bar{X}$	1,475	1,478	1,522	1,531	1,531
R	0,032	0,027	0,041	0,038	0,028

Subgroup	16	17	18	19	20
$\bar{X}$	1,502	1,490	1,465	1,529	1,444
R	0,040	0,054	0,060	0,020	0,029

(a) Calculate Control Limits for X and R, plot the given data and determine whether or not the process may be considered to be in Control.

(12 marks)

(b) What do you understand by the term ***"Total Quality Control"*** and how can this be achieved in an organization.

(8 marks)

2. (a) Explain and comment on how the following aspects are applied in deciding whether to use a Preventive Maintenance Policy or a Repair Policy.

(i) Downtime Costs (4 marks)
(ii) Quality Related Costs (4 marks)

(b) A Company operates a bank of 100 etching machines for silicon chip manufacture. The machines operate for three shifts per day and have the following probability of breakdown after maintenance, based on company records.

MONTH FOLLOWING MAINTENANCE	PROBABILITY OF BREAKDOWN(S)
1	0,0
2	0,1
3	0,1
4	0,1
5	0,2
6	0,5

The Company has been following a PM Policy. It is now reconsidering that policy because maintenance costs seem too high. The unit factor costs are:

C_R = $100.00

C_{pm} = $75,00

Where C_R = Cost of Repair
C_{pm} = Cost of Preventive Maintenance

Should the Company replace its Preventative Maintenance Program with a Repair Policy. (12 marks)

3. Briefly describe the Management Review Process and indicate its expected benefits. (20 marks)

4. Briefly discuss and comment on the common obstacles and problems organizations encounter in implementing an ISO 9000 Quality Assurance Management System.

(20 marks)

5.

Subgroup	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	-1	0	1	1	0	-2	2	1	-1	1	2	1	0	2	1
	-1	1	1	-2	3	-2	1	-2	2	-1	-1	-3	0	-1	-1
	0	-3	2	-1	-2	1	-1	-1	1	0	-2	-2	-1	-1	2
	-2	2	-1	0	-2	1	0	-1	1	0	-1	1	0	0	0
	1	1	0	-1	1	2	0	0	2	-	-1	0	1	-2	-2
$\bar{X}$	-0.6	0.2	0.6	-0.6	0	0	0.4	-0.6	1.0	-0.2	-0.6	-0.6	0	-0.4	0
R	3	5	3	3	5	4	3	3	3	?	4	4	2	4	4

Subgroup	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	2	1	0	-2	-3	1	-2	2	1	3	2	1	1	2	0
	-1	0	0	1	3	1	1	2	0	-1	0	-2	0	0	0
	0	0	1	2	1	0	3	-1	1	0	0	-2	0	3	2
	0	0	-2	0	2	-1	1	1	2	1	1	1	-2	1	1
	1	1	-1	1	0	2	-3	0	-2	1	1	1	-1	-2	-1
$\bar{X}$	0.4	0.6	-0.4	0.4	0.6	0.6	0	0.8	0.4	0.4	0.8	-0.2	-0.4	-0.8	0.4
R	3	1	4	4	6	3	6	3	4	4	2	3	3	5	3

(a) Calculate the Grand Mean and Grand Range. (8 marks)

(b) Calculate the UCL and LCL of the Mean and Range. (8 marks)

(c) Construct the graphs. (4 marks)

END OF QUESTION PAPER!!!

TABLE XV Control Chart Constants

Number of observations in sample, n	CHART FOR AVERAGES: Factors for control limits			CHART FOR STANDARD DEVIATIONS: Factors for central line	CHART FOR STANDARD DEVIATIONS: Factors for control limits				CHART FOR RANGES: Factors for control limits	CHART FOR RANGES: Factors for control limits			
	A'	A_1	A_2	c_2	B_1	B_2	B_3	B_4	d_2	D_1	D_2	D_3	D_4
2	2.121	3.760	1.880	0.5642	0	1.843	0	3.267	1.128	0	3.686	0	3.267
3	1.732	2.394	1.023	0.7236	0	1.858	0	2.568	1.693	0	4.358	0	2.575
4	1.500	1.880	0.729	0.7979	0	1.808	0	2.266	2.059	0	4.698	0	2.282
5	1.342	1.596	0.577	0.8407	0	1.756	0	2.089	2.326	0	4.918	0	2.115
6	1.225	1.410	0.483	0.8686	0.026	1.711	0.030	1.970	2.534	0	5.078	0	2.004
7	1.134	1.277	0.419	0.8882	0.105	1.672	0.118	1.882	2.704	0.205	5.203	0.076	1.924
8	1.061	1.175	0.373	0.9027	0.167	1.638	0.185	1.815	2.847	0.387	5.307	0.136	1.864
9	1.000	1.094	0.337	0.9139	0.219	1.609	0.239	1.761	2.970	0.546	5.394	0.184	1.816
10	0.949	1.028	0.308	0.9227	0.262	1.584	0.284	1.716	3.078	0.687	5.469	0.223	1.777
11	0.905	0.973	0.285	0.9300	0.299	1.561	0.321	1.679	3.173	0.812	5.534	0.256	1.744
12	0.866	0.925	0.266	0.9359	0.331	1.541	0.354	1.646	3.258	0.924	5.592	0.284	1.716
13	0.832	0.884	0.249	0.9410	0.359	1.523	0.382	1.618	3.336	1.026	5.646	0.308	1.692
14	0.802	0.848	0.235	0.9453	0.384	1.507	0.406	1.594	3.407	1.121	5.693	0.329	1.671
15	0.775	0.816	0.223	0.9490	0.406	1.492	0.428	1.572	3.472	1.207	5.737	0.348	1.652

Statistic	STANDARDS GIVEN: Central line	STANDARDS GIVEN: Limits	ANALYSIS OF PAST DATA: Central line	ANALYSIS OF PAST DATA: Limits
$\bar{X}$	$\bar{X}'$	$\bar{X}' \pm A\sigma'$	$\bar{\bar{X}}$	$\bar{\bar{X}} \pm A_1\bar{\sigma}$ or $\bar{\bar{X}} \pm A_2\bar{R}$
σ	$c_2\sigma'$	$B_1\sigma', B_2\sigma'$	$\bar{\sigma}$	$B_3\bar{\sigma}, B_4\bar{\sigma}$
R	$d_2\sigma'$	$D_1\sigma', D_2\sigma'$	$\bar{R}$	$D_3\bar{R}, D_4\bar{R}$

Source: *ASTM Manual on Quality Control of Materials*, American Society for Testing and Materials, Philadelphia, Pa., 1951; by permission.