UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 8 Examination in Engineering: December 2015

Module Number: ME8323 **Module Name: Production and Operations Management**

[Three Hours]

[Answer **all questions**, each question carries **twelve** marks]

Q1. a) Define Method Study and state its' objectives.

[2.0 Marks]

b) What is critical examination in Method Study?

[2.0 Marks]

c) Briefly explain the importance of "Principle of Motion Economy."

[2.5 Marks]

d) With clearly drawn charts explain the significant of "Man Machine" and "Multiple Activity Charts."

[2.5 Marks]

e) Explain the following statement.
"Method Study should always be carried out by professional and qualified method study expert with the help of workers, supervisors and managers."

[3.0 Marks]

Q2. a) Define Work Measurement and discuss its' importance.

[2.5 Marks]

b) Explain the following in connection with Time Study
(i) Cumulative Time Methods
(ii) Fly Back Timing

[2.5 Marks]

c) Explain four various allowances used to calculate the standard time.

[3.0 Marks]

d) (i) Assuming that the total observed time for an operation of assembling an electric switch is 1.00 min. If the rating is 120%, find normal time. If an allowance of 10% is allowed for the operation, determine the standard time.
(ii) An operator manufactures 50 jobs in 6 hours and 30 minutes. This time includes the time for setting his machine. Calculate the operator's efficiency.
Standard time allowed for the job was:
Setting time = 35 min and production time per piece = 8 min

[4.0 Marks]

Q3. a) I. What are the seven concepts of the TQM philosophy?
II. Explain three of them.
III. Process improvements will never end but continue. Briefly explain two approaches that can help with continuous improvement.

[6.0 Marks]

b) Discuss the role of management in total quality costs and as management becomes involved, which costs actually rise and which fall.

[2.0 Marks]

c) Why is Acceptance sampling widely used by manufacturing companies and other organizations?

[2.0 Marks]

d) How might Acceptance sampling conflicts with the goals of "world-class" operations?

[2.0 Marks]

Q4. a) What is meant by the statement that a process is in a state of statistical control?

[2.0 Marks]

b) Discuss the logic behind the general use of 3 sigma limits for Shewhart control charts.

[2.0 Marks]

c) In a textile finishing plant, dyed cloth is inspected for the occurrence of defects per 50 square meters. The data on ten rolls of cloth are shown in Table Q4.

I. Draw a control chart for nonconformities per unit.

II. Does the process appear to be in statistical control?

[8.0 Marks]

Q5. A production manager at Ultra Clean Dishwashing company is monitoring the quality of the company's production process. There has been concern relative to the quality of the operation to accurately fill the 16 ounces of dishwashing liquid. The product is designed for a fill level of 16.00 ± 0.30 ounces. The company collected the sample data (shown in Table Q5.1) on the production process:

a) Does the process appear to be in statistical control?

[8.0 Marks]

b) Calculate C_p and C_{pk}. Do you think this process is capable of meeting the design standard?

[4.0 Marks]

Table Q4

Roll Number	No. of square meters inspected	Total no. of defects
1	500	14
2	400	12
3	650	20
4	500	11
5	475	7
6	500	10
7	600	21
8	525	16
9	600	19
10	625	23

Table Q5.1

Sample	Observations/ (ounces)			
	1	2	3	4
1	16.40	16.11	15.90	15.78
2	15.97	16.10	16.20	15.81
3	15.91	16.00	16.04	15.92
4	16.20	16.21	15.93	15.95
5	15.87	16.21	16.34	16.43
6	15.43	15.49	15.55	15.92
7	16.43	16.21	15.99	16.00
8	15.50	15.92	16.12	16.02
9	16.13	16.21	16.05	16.01
10	15.68	16.43	16.20	15.97

Table Q5.2: Variables and Attribute Data for control charts

Variables Data ($\bar{X}$ and R Control Charts):

$\bar{x}$ Control Chart
$UCL = \bar{\bar{x}} + A_2\bar{R}$
$LCL = \bar{\bar{x}} - A_2\bar{R}$
$CL = \bar{\bar{x}}$

R Control Chart
$UCL = \bar{R}\,D_4$
$LCL = \bar{R}\,D_3$
$CL = \bar{R}$

Capability Study
$PCR = (USL - LSL)/(6\hat{\sigma})$; where $\hat{\sigma} = \bar{R}/d_2$

n	A_2	D_3	D_4	d_2
2	1.880	0.000	3.267	1.128
3	1.023	0.000	2.574	1.693
4	0.729	0.000	2.282	2.059
5	0.577	0.000	2.115	2.326
6	0.483	0.000	2.004	2.534
7	0.419	0.076	1.924	2.704
8	0.373	0.136	1.864	2.847
9	0.337	0.184	1.816	2.970
10	0.308	0.223	1.777	3.078

Attribute Data (p, np, c, and u Control Charts):

Control Chart Formulas

	p (fraction)	np (number of nonconforming)	c (count of nonconformances)	u (count of nonconformances/unit)
CL	$\bar{p}$	$n\bar{p}$	$\bar{c}$	$\bar{u}$
UCL	$\bar{p} + 3\sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$	$n\bar{p} + 3\sqrt{n\bar{p}(1-\bar{p})}$	$\bar{c} + 3\sqrt{\bar{c}}$	$\bar{u} + 3\sqrt{\frac{\bar{u}}{n}}$
LCL	$\bar{p} - 3\sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$	$n\bar{p} - 3\sqrt{n\bar{p}(1-\bar{p})}$	$\bar{c} - 3\sqrt{\bar{c}}$	$\bar{u} - 3\sqrt{\frac{\bar{u}}{n}}$
Notes	If n varies, use $\bar{n}$ or individual n_i	n must be a constant	n must be a constant	If n varies, use $\bar{n}$ or individual n_i