THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

Faculty of Engineering & Technology

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

DIPLOMA IN MECHANICAL ENGINEERING (PRODUCTION OPTION)
[Institutional Based Programmes)

EPR 2303: METROLOGY

END OF SEMESTER EXAMIANTION
SERIES: AUGUST 2012
TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*
- *Advanced SMP tables*
- *Calculator*

This paper consists of **FIVE** questions. Answer any **THREE** questions
Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

Question One (20 marks)

a) Distinguish between quality control and statistical quality control. **(3 marks)**

b) (i) State **EIGHT** benefits of statistical quality control.

(ii) Explain why inherent sources of variation cannot be controlled even under the best of circumstances.

(iii) State **FOUR** assignable causes of variation. **(8 marks)**

c) The mean value and standard deviation of a set of observations have been found to be 100 and 10 respectively. Determine what percentage of observations will lie between:

i) 84 and 116
ii) Above 82
iii) Below 79? **(9 marks)**

Question Two (20 marks)

a) State the importance of control charts. **(3 marks)**

b) Give a step by step account of how a control chart is formed. **(8 marks)**

c) State **FOUR** factors to be considered when deciding a sample size. **(4 marks)**

d) A distribution of a sample results from a mass production process is obtained, this distribution being symmetrical, having $\bar{x} = 10mm$ and $S = 1.3mm$. What is the probability of a component size of between 10 and 12.6mm being obtained in a random sample? (5 marks)

Question Three (20 marks)

a) Give **THREE** objectives for starting control charts. (5 marks)

b) (i) Distinguish between the P and M chart.
(ii) Give a step by step account of how a P chart is formed. (9 marks)

c) Twenty samples were taken from a production line for gauging each sample containing 100 parts. The following numbers of defects were found in each sample.

3, 4, 5, 5, 5, 5, 4, 7, 6, 7, 6, 6, 4, 3, 5, 8, 5, 4, 6, 5.

i) Calculate $\bar{p}$ and
ii) Draw the distribution. **(6 marks)**

Question Four (20 marks)

a) Distinguish between a $\overline{X}$ and $\overline{W}$ charts. **(3 marks)**

b) A box contains there balls numbered 1,2 and 3 respectively. Two balls are withdrawn separately and at random. Calculate the total number of possible ways in which the two balls out of three may be withdrawn, if:

i) Each ball is replaced after drawing and order of drawing is taken into account.
ii) Each ball is not replaced after drawing and order of drawing is taken into account.
iii) Each ball is not replaced after drawing and no account is taken of the order of drawing.

(6 marks)

c) 25 samples of 20 components were taken at random from a process and the number of defectives in each sample were:

2,2,1,0,2,1,4,4,5,2,1,2,1,0,1,3,3,0,2,1,2,0,0,5,0

i) Derive the limits and draw up a control chart for number defectives.
ii) Plot the above results upon the chart. **(11 marks)**

Question Five (20 marks)

a) Explain the importance of points falling below the lower control limits of the P charts.

(2 marks)

b) Samples of 200 components taken at random each day are gauged as a means of checking the following results are given for the first 24 days in terms of fraction defectives (P).

0.45,	0.5,	0.6,	0.35,	0.55,	0.65,	0.75,	0.75,
0.65,	0.45,	0.55,	0.5,	0.6,	0.35,	0.5,	0.45,
0.45,	0.5,	0.5,	0.5,	0.55,	0.55,	0.6,	0.45,

i) From the sample calculate $\bar{P}$
ii) Determine the action and warning limits
iii) Draw a P chart and;
iv) Plot the results of the 24 days sampling upon the charts
v) Is the process in statistical control for this period production? Explain your answer.

(18 marks)