AFRICA UNIVERSITY
(A United Methodist-Related Institution)

"Investing in Africa's Future"

FACULTY OF MANAGEMENT AND ADMINISTRATION

COURSE TITLE: **MMS402 – Production and Operations Management**

SEMESTER 1: **Final Examination - Conventional**

DATE: **November 2013**

LECTURER: **Dr. S. Murairwa**

TIME: **3 Hours**

INSTRUCTIONS

Answer **all questions** in Section A and **any three (3) questions** in section B

Start **each** question on a new page in your answer booklet.

The marks allocated to **each** question are shown at the end of the section.

Show all your workings.

Credit will be given for logical, systematic and neat presentations.

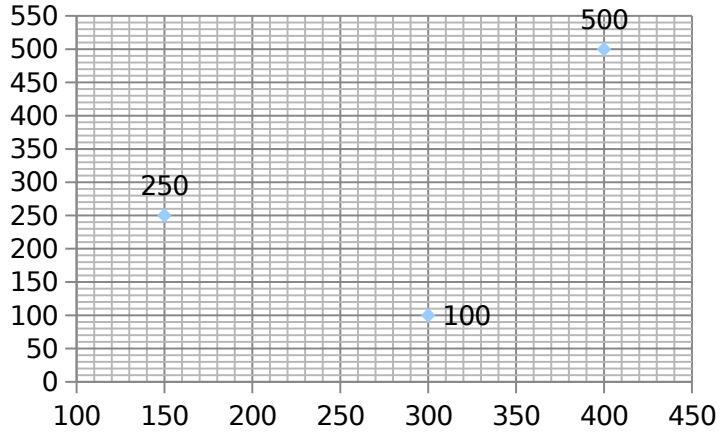
SECTION A: ANSWER ALL QUESTIONS

1. Define the following Production and Operations Management terms:
   (a) Profit [**2 Marks**]
   (b) Break even analysis [**2 Marks**]
   (c) Continuous inventory control system [**2 Marks**]
   (d) Quality [**2 Marks**]
   (e) Production [**2 Marks**]

2. With a well labelled diagram, explain the production system. Identify the transformational processes of manufacturing and transportation [**12 Marks**]

3. Explain the main differences between product and service [**4 Marks**]

4. A company is planning to construct a warehouse that is to be served by suppliers A, B and C. The locations of the three suppliers and annual number of truck carriers that will serve the warehouse are shown below.



   a) Use the appropriate technique to determine coordinates for the best site for the company's warehouse [**8 Marks**]
   b) State three qualitative and three quantitative factors for considering when locating a manufacturing facility [**6 Marks**]

SECTION B: ANSWER ANY THREE (3) QUESTIONS

5. Quality is the totality of features and characteristics of a product or service that bears on its ability to satisfy given needs.
   (a) Draw and explain the Deming Wheel **[4 Marks]**
   (b) Draw and explain the meaning of quality as a final perspective [**6 Marks**]
   (c) A production process sampled 30 times with a sample size of 8, gave $\overline{\overline{X}} = 28.5$ and $\overline{R} = 1.6$.

i) Construct R-chart and $\overline{X}$ chart [**6 Marks**]

ii) Explain how you would use both charts to determine the state of the process **[4 Marks]**

6. You are given the estimated annual demand of 20000 gallons of paint, an annual carrying cost of \$0.65 per gallon and ordering cost of \$150 per order.

a) Show that $Q^{i} = \sqrt{\frac{2DC_o}{C_h}}$ **[3 Marks]**

b) Find the:

i) Optimum order quantity **[2 Marks]**

ii) Total cost **[2 Marks]**

iii) Number of orders per year **[2 Marks]**

iv) Order cycle time **[2 Marks]**

c) State the objective of the economic order quantity model **[2 Marks]**

d) State the objectives of the facility layout decisions **[7 Marks]**

7. A computer software firm has experienced the following demand for its software package:

Demand	70	79	67	80	63	73	62	77	69	70

(a) Outline the steps of the forecasting process [**6 Marks**]

(b) Develop an exponential smoothing forecast using $\alpha = 0.40$ [**5 Marks**]

(c) Forecast the demand for period 11 [**2 Marks**]

(d) Use the same demand data to fit the linear trend model [**5 Marks**]

(e) Forecast the series for periods 11 and 19 [**2 Marks**]

8. Strategic decisions in operations:

a) State and explain the product and service operations strategies [**6 Marks**]

b) Explain the processes and technology production strategies [**8 Marks**]

c) With examples, state the measures of productivity [**6 Marks**]

The end of paper

Additional information

(1) Model: $F_{t+1} = \alpha D_t + (1-\alpha) F_t$

(2) Model: $AF_{t+1} = F_{t+1} + T_{t+1}$

(3) Model: $T_{t+1} = \beta(F_{t+1} - F_t) + (1-\beta)T_t$

(4) Formula $\text{Capacity utilization rate} = \dfrac{\text{Capacity used}}{\text{Best operating level}}$

(5) Quality table

Sample Size	Factors of x-chart	Factors of R-Chart	
n	**A2**	**D3**	**D4**
2	1.88	0	3.267
3	1.023	0	2.574
4	0.729	0	2.282
5	0.577	0	2.114
6	0.483	0	2.004
7	0.419	0.076	1.924
8	0.373	0.136	1.864
9	0.337	0.184	1.816
10	0.308	0.223	1.777

(6)

Expected Value $EV(x) = \sum_{i=1}^{n} p(x_i) x_i$

X bar chart

$UCL = \overline{\overline{X}} + z\,\sigma_{\overline{X}}$

$LCL = \overline{\overline{X}} - z\,\sigma_{\overline{X}}$

R chart

$UCL = D_4 \overline{R}$

$LCL = D_3 \overline{R}$

(7) Model: $y = a + bx,$

$a = \bar{y} - b\bar{x}, \qquad b = \dfrac{\sum xy - n\bar{x}\bar{y}}{\sum x^2 - n\bar{x}^2}$

(1) Model: $WMA_n = \dfrac{\sum_{i=1}^{n} W_i D_i}{n}$

(2) Model: $MA_n = \dfrac{\sum_{i=1}^{n} D_i}{n}$

(8) $c =$ Mean # of defects per unit in the population

$UCL = c + z\sqrt{c}$

$LCL = c - z\sqrt{c}$

(9) $p =$ Percent defect in the population $\bar{p} = \dfrac{\text{Total \# Defects}}{\text{Total \# of Units Observed}}$

$\sigma_p = \sqrt{\dfrac{\bar{p}(1-\bar{p})}{n}}$

$UCL = p + z\,\sigma_p$

$LCL = p - z\,\sigma_p$

(10) $$C_{pk} = Min\left(\frac{\bar{\bar{x}} - LSL}{3\sigma}, \frac{USL - \bar{\bar{x}}}{3\sigma}\right) \qquad C_p = \frac{Tolerance\ Range}{Process\ Range} = \frac{USL - LSL}{6\sigma}$$

(11) $$LFR = Max\left\{\sum_{i=1}^{n} W_i S_{1i};\ \sum_{i=1}^{n} W_i S_{2i};\ \ldots\ldots\ldots;\ \sum_{i=1}^{n} W_i S_{ni}\right\}$$

(12) $$x = \frac{\sum_{i=1}^{n} x_i W_i}{\sum_{i=1}^{n} W_i}, \qquad y = \frac{\sum_{i=1}^{n} y_i W_i}{\sum_{i=1}^{n} W_i}$$

(13) $$TC = \frac{Q}{2} C_h + \frac{D}{Q} C_o + DC$$

(14) $Z = v_p - c_f - vc_v$

- **Fixed Costs (c_f)** - costs that remain constant regardless of number of units produced.
- **Variable Cost (c_v)** - unit cost of product.
- **Total variable cost (vc_v)** - function of volume (v) and variable per-unit cost.