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 - Parallel**

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) Flexibility [**2 Marks**]
   (b) Competitive priorities [**2 Marks**]
   (c) Inventory control system [**2 Marks**]
   (d) Total quality management [**2 Marks**]
   (e) Operations [**2 Marks**]

2. With a well labelled diagram, explain the interaction of the production system with its environment [**9 Marks**]

3. The criteria for creating a factor rating system are cost, strategic value, risk and financials with weights of 0.15, 0.40, 0.20 and 0.25 respectively. The values for the Sites 1, 2, 3 and 4 are given below. Also enter the values for Site 5 as 80 for each criterion.

Site 1:	90	70	85	50
Site 2:	75	80	90	70
Site 3:	85	65	90	99
Site 4	65	78	90	89

   (a) Use the factor rating model to determine the best site [**6 Marks**]
   (b) Draw the graph of the results you obtained in (a) [**3 Marks**]
   (c) Outline the steps for implementing the factor rating system [**6 Marks**]

4. John sells a product for $10 and it costs $5 to produce and it has a fixed cost of $25,000 per year.
   a) How much will he need to sell to break-even? [**3 Marks**]
   b) What quantity demand will earn $1000? [**3 Marks**]

SECTION B: ANSWER ANY THREE (3) QUESTIONS

5. You are given the estimated annual demand of 1000 gallons of paint, an annual carrying cost of $0.55 per gallon and ordering cost of $120 per order.
   a) Show that $Q^{i} = \sqrt{\frac{2DC_o}{C_h}}$ **[3 Marks]**
   b) Calculate 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) Outline the steps for determining the production capacity requirements [**6 Marks**]

d) Explain the new challenges in Production and Operations Management [**3 Marks**]

6. Ten samples of fifteen parts each were taken from an ongoing production process. The samples and number of defects in each are shown in table below.

sample	Number of defects in sample
1	3
2	1
3	0
4	0
5	0
6	2
7	0
8	3
9	1
10	0

(a) Develop a p-chart and interpret [**6 Marks**]
(b) Explain the organisational change in responsibility for customer satisfaction [**6 Marks**]
(c) Explain four of Deming's fourteen points of achieving quality [**8 Marks**]

7. BATA produces high-quality training shoes for athletes. There are 420 minutes available for manufacturing the shoes in each day. The daily demand for shoes is 60. The information for the tasks is as follow:

Task	Performance time (Minutes)	Predecessors
A	1	—
B	3	A
C	2	B
D	4	B
E	1	C , D
F	3	A
G	2	F
H	5	G
I	2	E , H
J	3	I

i) Outline the steps of the line balancing process [**6 Marks**]
ii) Use the line balancing technique to equalise the amount of work at each workstation and determine the workstations. **[11 Marks]**
iii) Calculate the efficiency and balance delay of the line **[3 Marks]**

8. Poor product or service designs may not meet customer needs.

a) With a well labelled diagram, explain the product/service design process [**10 Marks**]
b) State and explain the special considerations in service design [**10 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) 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

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

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

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: $WMA_n = \dfrac{\sum_{1=1}^{n} W_i D_i}{n}$

(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 $= \dfrac{\text{Total \# Defects}}{\text{Total \# of Units Observed}}$

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

$\bar{p} = \dfrac{\text{Total \# Defects}}{\text{Total \# of Observations}}$

$UCL = p + z\,\sigma_p$

$LCL = p - z\,\sigma_p$

(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.