NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF APPLIED CHEMISTRY
SUPPLEMENTARY EXAMINATIONS – JULY 2003
CHEMICAL ENGINEERING PLANT DESIGN – SCH 4108
TIME – (3) THREE HOURS

INSTRUCTIONS TO CANDIDATES

Answer **FOUR** questions only. Total marks is 100.

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1. Explain what the following terms mean citing examples:

   (a) macrolocation of a plant

   (b) microlocation of a plant (25 marks)

2. (a) What factors are to be considered in making a feasibility survey for a proposed process design? (13 marks)

   (b) What is fixed – capital investment? (12 marks)

3. Put the following linear programming problems into standard form:

   (a) max $f(\mathbf{x}) = 3x_1 + 2x_2 + 5x_3$ .....(1)

   Subject to: $13x_1 + 14x_2 - 15x_3 \leq 40$.....(2)

   $9x_1 + 18x_2 + 3x_3 \leq 25$.....(3)

   $x_2 \geq 10$.....(4)

   $xj \geq 0$; $j = 1,2,3$

   (10 marks)

   (b) min $f(\mathbf{x}) = x_1 + x_2 + x_3 + x_4$ .....(1)

   subject to: $5x_1 + 6x_2 + 7x_3 + 2x_4 \geq 40$.....(2)

   $3x_2 + 5x_4 = 20$.....(3)

   $2x_1 - x_3 \leq 10$.....(4)

   $xj \geq 0$; $j = 1,2,3$ and x_4 is free. (15 marks)

4. Find all basic solutions, basic feasible solutions and optimum solution of the following Linear Programming Problems.

(a) min $f(\mathbf{x}) = x_1 - x_2 + x_3$

subject to: $x_1 + 2x_2 + 3x_3 = 6$

$4x_1 + 5x_2 - 6x_3 = 6$

$xj \geq 0; \quad j = 1,2,3,$ (10 marks)

(b) max $f(\mathbf{x}) = x_1 - x_2$

subject to: $2x_1 + x_2 - x_3 = 0$

$x_1 - x_2 + 2x_3 + 2x_4 = 6$

$4x_2 + x_3 - x_4 = 4$

$xj \geq 0; \quad j = 1,2,3,4$ (15 marks)

5. (a) Define what is meant by:

(i) an open loop system

(ii) a closed loop system (8 marks)

(b) With the aid of a sketch diagram, explain how a feed forward control system operates. (17 marks)

END OF QUESTION PAPER!!!