Assignment – Module 4

1. Obtain the minimum of the following functions using both constraint and weighting method

   $Z_1 = x_1^2 + x_2^2 - 2x_1 + 5$

   $Z_2 = x_1^2 + x_2^2$

   s.t.

   $x_1 - x_2 \leq 1$

   $x_1 \leq 2$

2. A reservoir is planned for hydropower and irrigation through withdrawals from its storage. Let X_1 be the allocation of water to hydropower and X_2 be the allocation for irrigation, the objectives for hydropower and irrigation are planned to be maximized given by

   $Z_1 = 3X_1 - 2X_2$

   $Z_2 = - X_1 + 4 X_2$

   The total storage available is limited to 5 units each year for both hydropower and irrigation, out of which the withdrawal limit to hydropower is 3 units.

   (a) Formulate a multiobjective planning model using weighting approach with weights for hydropower and irrigation withdrawals being w1 and w2 respectively. Plot the decision space and the objective space and solve to determine the optimal share of withdrawals for hydropower and irrigation, if

   i. w1 =1, and w2 = 2.;

   ii. w1 =2, and w2 = 1.

(b) Formulate the problem using the Constraint approach.

3. Assume that in the problem no.2, while maximizing the weighted objective function, $Z = w_1 Z_1 + w_2 Z_2$, the decision maker chose the point E ($X_1 = 2$, $X_2 = 1$) in the decision space as the preferred solution, instead. Determine the value or range of values of the marginal rate of substitution of the objective Z_2 to Z_1. Interpret what it means in the perception of the decision maker.