UNIVERSITY OF RUHUNA

Faculty of Engineering

Mid-Semester 8 Examination in Engineering: October 2015

Module Number: CE8240 **Module Name: Water Resources Planning and Management**

[Two Hours]

[Answer all questions]

Q1. Briefly describe the water resources systems planning process.

[4.0 Marks]

Q2. An organization plans to cultivate two crops, crop A and crop B. The maximum cultivable land area available for both crops is 6,000 ha. Water requirements of the two crops are 8,000 m^3 and 4,000 m^3 per ha, respectively. Estimated profits of crop A and crop B are 6,000 \$/ha and 5,000 \$/ha, respectively.

i) For a given supply of water Q, structure an optimization model for the above problem.

[2.0 Marks]

ii) Solve the model using **simplex method**, if the amount of water available is 32 million m^3.

[4.0 Marks]

Answer part (iii) and (iv) based on the optimal tableau.

iii) There is a possibility to increase the available land and the water supply at additional costs of \$ 2,000/ha and \$ 300,000/Mm^3, respectively. Is this advisable?

[2.0 Marks]

iv) If the unit revenues of crop A and crop B are changed to 10,000 \$/ha and 4,000 \$/ha, respectively, will the current optimum remain the same?

[2.0 Marks]

Q3. Releases from a reservoir are used for water supply and hydropower. The benefits of water allocated to hydropower and water supply are $6\sqrt{3X_h}$ and $2X_w^{3/2}$, respectively. X_h and X_w represent the allocated water for hydropower and water supply, respectively. The available water of the reservoir is 4 million m^3. The demands for water supply and hydropower are 2 million m^3 and 3 million m^3, respectively. If the objective is to maximize the total benefits, formulate an optimization model for estimating the water allocations. Your model should clearly indicate objective function and constraints. Determine the allocations of the water.

[6.0 Marks]