UNIVERSITY OF SWAZILAND
SUPPLEMENTARY EXAMINATION PAPER

PROGRAMME: BSC AGRIC IV (L&WM), BSC AGRIC ED. IV & BSC AGRIC V (APH)

COURSE CODE: LUM 406

TITLE OF PAPER: RURAL WATER SUPPLY

TIME ALLOWED: TWO (2) HOURS

SPECIAL MATERIAL REQUIRED: NONE

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO OTHER QUESTIONS.

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SECTION I: COMPULSORY QUESTION

QUESTION 1

(a) Briefly but concisely, discuss the merits and demerits of conveying potable water in
   i. an open canal; (5 marks) and
   ii. a pipeline (5 marks).

(b) An unconfined aquifer of coarse gravel has a hydraulic conductivity of 750 cm/hr as determined by other well tests in the same aquifer. The static water level before pumping starts is 50 m above the impermeable boundary at the bottom of the aquifer. At a pumping rate of 31.54 litres per second, drawdown in the observation well at a radial distance of 120 m from the centre of the pumped well is 1.26 m. Determine the expected:
   i. drawdown in an observation well at 20 m distance; (10 marks)
   ii. drawdown in the pumped well; (10 marks)
   iii. total area (in ha) influenced by the pumped well. (10 marks)

SECTION II: ANSWER TWO QUESTIONS FROM THIS SECTION

QUESTION 2

With the aid of clearly labelled diagrams, briefly but concisely, describe what is meant by the following terms:
   a) a confined aquifer (6 marks)
   b) in-field catchment for harvested water; (6 marks)
   c) a flowing well; (6 marks)
   d) Thiessen polygon method of determining mean precipitation (6 marks)
   e) an advanced storm. (6 marks)

QUESTION 3

Discuss the potentials and challenges of exploiting groundwater resources for human use in Swaziland. (30 marks)

QUESTION 4

Discuss why Swaziland faces water shortage for human use in rural areas despite the many rivers that flow through the country (30 marks)

USEFUL EQUATIONS

Thiem's equation for confined aquifer

$$q = \frac{2 \pi K D (h_2 - h_1)}{\ln (r_2/r_1)} \quad (1)$$

where

q = the well discharge (m^3/d)
K = hydraulic conductivity (m/d)
D = aquifer thickness (m)
r_1 and r_2 = respective distances of the piezometers from the pumped well (m)
h_1 and h_2 = the respective steady-state elevations of the water levels (from the bottom of the pumped well) in the observation wells (m)

Thiem's equation for unconfined aquifer

$$q = \frac{\pi K (h_2^2 - h_1^2)}{\ln (r_2/r_1)} \quad (2)$$

where

q = the well discharge (m^3/d)
K = hydraulic conductivity (m/d)
r_1 and r_2 = the respective distances of the observation wells from the pumping well (m)
h_1 and h_2 = the respective steady-state elevations of the water levels (from the bottom of the pumped well) in the observation wells (m)