UNIVERSITY OF SWAZILAND

FINAL EXAMINATION PAPER

PROGRAMME: BSC AGRIC III (LWM)

COURSE CODE: ABE 304

TITLE OF PAPER: RURAL WATER SUPPLY AND HYDROLOGY

TIME ALLOWED: TWO (2) HOURS

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO OTHER QUESTIONS.

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SECTION I: COMPULSARY

QUESTION 1

An earth dam is to be constructed to provide storage of at least 115, 000 m^3 of irrigation water. The catchment from which the water will be obtained has a total size of 144 ha of sandy clay soil. The catchment is 800 m wide, and has a maximum length of 1800 m with a slope of 10 m fall over the full length. The area receives an average rainfall of 800 mm/year. The rainfall intensity for the catchment area is 100 mm/h with a runoff coefficient (C) of 0.36.

A) **i.** Determine if the catchment is capable of providing enough water for the required storage of 115, 000 m^3. (Table 1). **(10 marks)**

ii. Calculate the design peak runoff to accommodate the 100 mm/h storm.

(10 marks)

$$Q = \frac{CiA}{360}$$ **(1)**

B) **i.** Name the three (3) types of earth dams. **(6 marks)**

ii. Briefly discuss the role of water storage in agricultural production.

(14 marks)

[40 marks]

Table 1. Runoff from catchment areas

Average rainfall, R (mm)	Total annual evaporation (mm)	Reliability (yrs out of 10)	Runoff as a % of average rainfall, Y			
			Shallow sand or loam soils (%)	Sandy clays (%)	Elastic clays	Clay pans, inelastic clays or shales (%)
> 1100	-	8	10 – 15	0 – 15	15 – 20	15 - 25
	-	9	6.5 – 10	6.5 – 10	10 – 13	10 – 16.5
	-	8	10 – 12.5	10 – 15	12.5 – 20	15 - 20
	-	9	6.5 – 8	6.5 – 10	8 – 13	10 - 13
901- 1100	-	8	10-12.5	10 – 15	12.5 – 20	15 – 20
	-	9	6.5 – 8	6.5 – 10	8 – 13	10 - 13
501 – 900	< 1300	8	7.5 -10	7.5 – 15	7.5 – 15	10 - 15
		9	5 – 6.5	5 – 10	5 – 10	6.5 - 10
	1300-1800	8	5-7.5	5-12.5	5-10	10-15
		9	3-5	3-8	3-6.5	6.5-10
401-500	1300-1800	8	2.5-5	5-10	2.5-5	7.5-12.5
		9	1.5-3	3-6.5	1.5-3	5-8
250-400	< 1800	8	0-2.5	0-5	0-2.5	2.5-7.5
		9	0-1.5	0-3	0-1.5	1.5-5
	≥ 1800	8	0	0-2.5	0	2.5-5
		9	0	0-1.5	0	1.5-3

Source: Nelson (1985)

SECTION II: ANSWER ANY TWO QUESTIONS

QUESTION 2

A) Discuss briefly the data that you would require to determine the water demand requirements for a small rural community. **(15 marks)**

B) A small rural community of 15, 000 people in the Highveld of Swaziland had water requirements of 40l/h/d with a peak day factor (PDF) of 1.3. Calculate the design capacity for this community in m^3/day and m^3/ h. **(10 marks)**

C) What material would you recommend for the construction of the water storage tank for the community water supply and why? **(5 marks)**

[30 marks]

QUESTION 3

A) Most NGO erected boreholes are reported to be failing in some rural areas in Swaziland. Discuss briefly any two **contingency** water sources that you could recommend for domestic use. **(15 marks)**

B) Describe briefly **any** five (5) options that could be followed to minimise the rate of failure and **sustain** borehole use in rural areas. **(15 marks)**

[30 marks]

QUESTION 4

A) i. State the "continuity principle" in hydraulics and explain briefly its relevance in rural water supplies. **(10 marks)**

ii. Water flows from a tank into a pipe at a rate of 1.0 l/s. Calculate the velocity of entrance into the pipe if the internal diameter of the inlet is 45 mm. **(5marks)**

B) Describe with the aid of a diagram the three categories of small community water distribution. **(15 marks)**

[30 marks]