



**UNIVERSITY OF SWAZILAND
SUPPLEMENTARY EXAMINATION PAPER**

PROGRAMME: BSC AGRIC III (LWM)

COURSE CODE: LUM 304 (NEW PROGRAMME)

TITLE OF PAPER: RURAL WATER SUPPLY AND HYDROLOGY

TIME ALLOWED: TWO (2) HOURS

**INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO
OTHER QUESTIONS.**

**DO NOT OPEN THIS PAPER UNTIL PERMISSION HAS BEEN
GRANTED BY THE CHIEF INVIGILATOR**

SECTION I: COMPULSARY**QUESTION 1**

- A) Explain the “continuity principle” in hydraulics. [5marks]
- B) 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 40 mm [6marks]
- C) The pipe does not maintain its size as its outlet has a diameter of 45mm; calculate the new velocity at that section of the pipe. [6 marks]
- D) Discuss 4 materials that have been or are still being used in making pipes. [12 marks]
- E) Friction losses are incurred as water moves along a pipe system. How much is lost depends on several factors. Discuss at least three (3). [12 marks]

SECTION II: ANSWER ANY TWO QUESTIONS**QUESTION 2**

An earth dam is to be constructed to provide storage of at least 120, 000 m³ 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.

- i. Determine if the catchment is capable of providing enough water for the required storage of 120, 000 m³. (Table 1). [10 marks]
- ii. Calculate the design peak runoff to accommodate the 100 mm/h storm using equation 1.

[10 marks]

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

- B)
 - i. Name the three (3) types of earth dams. [6 marks]
 - ii. Briefly discuss the role of water storage in land and water management.

[14 marks]

Table 1. Runoff from catchment areas

Average rainfall, R (mm)	Total annual evap. (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)

QUESTION 3

Briefly discuss the following concepts as used in rural water supply.

- i. Roof water harvesting. [10 marks]
- ii. Water collected from streams. [10 marks]
- iii. Ground water extraction. [10 marks]

QUESTION 4

Discuss the role of water harvesting technologies for domestic use in Swaziland.

[30 marks]