UNIVERSITY OF SWAZILAND
SUPPLEMENTARY EXAMINATION PAPER

PROGRAMME: DIPLOMA IN AGRIC. ED. 3 AND DIPLOMA IN AGRICULTURE 3

COURSE CODE: LUM 303 (OLD PROGRAMME)

TITLE OF PAPER: IRRIGATION

TIME ALLOWED: TWO (2) HOURS

SPECIAL MATERIAL REQUIRED: NONE

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO OTHER QUESTIONS

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

QUESTION 1

An irrigation project was being planned for Big-bend, in the Lowveld of Swaziland. Cotton was to be grown in the summer months in a 10 hectare field (250m x 400m). The water supply is an open source at one corner, with a maximum vertical lift of 2m. The cotton is intended to be scheduled to avoid it coming under water stress. The peak design water requirements have already been determined as 10 mm/day net, with a maximum allowable soil moisture deficit of 100 mm. An efficiency of 80% has been suggested for design purposes.

a) Calculate the net and gross applications at each irrigation, and the corresponding intervals between irrigations.

[10 marks]

b) If the application rate is set at 10.17 mm/hr, determine the set time, and the maximum number of moves per day if the system can be operated for the whole day (i.e. 24 hours).

[10 marks]

c) Given that a pump is being used to bring the water to the field and the pump duty is 33.6 m head of water at 23.6 l/s with a pump efficiency of 0.6. Calculate the power required in kilowatts.

[10 marks]

d) If the pump were to deliver water for 6 out of 7 days, over a cropping season of 180 days. Calculate the pumping costs for the whole season of the cotton crop, given that the Swaziland Electricity Company charges E0.46 per kw-hr.

[10 marks]

QUESTION 2

Discuss the following water potentials as used in soil physics.

- Gravitational potential
- Pressure potential
- Matric potential
- Osmotic potential
- Hydraulic potential

[30 marks]

QUESTION 3

a) For irrigation system design, the net irrigation requirement is determined using the equation; $I_n = ET_c - R$, where I_n is the net irrigation, ET_c is the crop water requirement and R is 'effective' rainfall.

i) Define 'effective rainfall' and discuss the rationale of using it instead of 'observed rainfall'. **[5 marks]**

ii) Discuss the factors that determine how much of rainfall will be effective. **[10 marks]**

b) i) Define dependable rainfall **[5 marks]**

ii) Using the ranking method, determine the dependable rainfall (with a return period of 4 years out of 5) from the rainfall data given in Table 1.

Table 1: Observed rainfall from 1969-1999 (Luyengo campus weather station)

Year	Rainfall (mm)	Year	Rainfall (mm)
1969	907	1985	634
1970	592	1986	624
1971	894	1987	635
1972	1075	1988	693
1973	907	1989	771
1974	824	1990	468
1975	958	1991	781
1976	1070	1992	586
1977	1192	1993	829
1978	926	1994	424
1979	494	1995	719
1980	733	1996	775
1981	817	1997	871
1982	535	1998	720
1983	754	1999	847
1984	1171		

[10 marks]

QUESTION 4

With the aid of a clearly labelled diagram, describe how a neutron probe is used in real time scheduling; also mention its advantages and disadvantages.

[30 marks]