UNIVERSITY OF FORT HARE

PRINCIPLES OF IRRIGATION
AGC321

SUPPLEMENTARY EXAMINATIONS

FEBRUARY

2019

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Time:	**3 HOURS**
Subject:	**AGC321**
Marks:	**100**

This paper consists of 3 pages including the cover page

Internal Examiners
R MOYO

External Examiners

INSTRUCTIONS

ANSWER ANY FIVE (5) QUESTION

ANSWER ANY 5 QUESTION

1. a. Give the advantages of using overheard sprinkler irrigation for crop production (5)

   b. Give advantages of furrow irrigation for crop production. (5)

   c. Explain why land drainage should be an important part of an irrigation scheme. (10)

2. A wheat, soyabean rotation is planned in an area that receives an average annual rainfall of 620 mm. The total water requirement to meet the evapotranspiration requirements of both crops is 1170 mm. The shortfall in water supply will be met with irrigation water that has an electrical conductivity of 3.2 dS/m at 25°C.

   a. Will both crops be able to produce maximum yields? (5)

   b. Calculate the net irrigation requirement in order to prevent a build-up of salts in the soil. (15)

TABLE 1.CROP TOLERANCE AND YIELD POTENTIAL OF SELECTED CROPS AS INFLUENCED BY IRRIGATION WATER SALINITY (EC_w) OR SOIL SALINITY (EC_e) (dS/m)
YIELD POTENTIAL

FIELD CROPS	*100%*		*90%*		*75%*		*50%*		*"maximum"3*	
	EC_e	EC_w	EC_e	EC_w	EC_e	EC_w	EC_e	EC_w	EC_e	EC_w
Sorghum *(Sorghum bicolor)*	6.8	4.5	7.4	5.0	8.4	5.6	9.9	6.7	13	8.7
Wheat *(Triticum aestivum)*	6.0	4.0	7.4	4.9	9.5	6.3	13	8.7	20	13
Soybean *(Glycine max)*	5.0	3.3	5.5	3.7	6.3	4.2	7.5	5.0	10	6.7
Cowpea *(Vigna unguiculata)*	4.9	3.3	5.7	3.8	7.0	4.7	9.1	6.0	13	8.8

3. a. Explain how overhead sprinkler lateral pipe lines should be oriented to obtain the best application uniformity. (4)

   b. How can an overheard sprinkler system be designed to apply the correct pressure to the sprinklers. (4)

   c. A 60 ha irrigation scheme is designed for a maximum class A pan evaporation of 5.5 mm/day and a crop factor of 1.2. The whole area will be growing the same crop and water will be supplied by one pump. Actual operating time of the overheard sprinklers is planned for 22 hours per day. Assuming standard application efficiency, calculate the pump capacity required. (12)

4. a. A drip irrigation system has emitters with a discharge rate of 1.8 litres per hour spaced along drip laterals. Spacing between drip laterals is 1.2 meters. Calculate the application rate in m/h. (7)

b. Explain how the concept of the 'wetted onion' makes the action and management of drip irrigation different to other forms of irrigation. (10)

c. Explain why tensiometers are often used to monitor soil water levels in drip irrigated crops. (3)

5. a. The depth of wetted soil along the length of a border strip is measured after irrigation with the following results:

Distance from supply canal	**Depth of water penetration (mm)**
10	1750
30	1605
50	1419
70	1063
90	842
110	676

Christianson's Coefficient of Uniformity, Cu = $\left[\left[1 - \left\{\frac{\Sigma(x-\bar{x})}{n\bar{x}}\right\}\right]\right] \times 100$

Calculate the co-efficient of uniformity. (12)

b. Given the co-efficient in part (a) comment on how the uniformity of application could be improved. (8)

6. a. Calculate the water content of a soil profile over a depth of 1.5 m given the following information. (10)

Soil depth (mm)	**Soil bulk density (kg/m3)**	**Sample mass before drying (g)**	**Sample mass after drying (g)**
0-150	1150	58.7	56
150-300	1220	55	52
300-600	1290	64.4	61
600-1500	1410	57.7	54

b. i. Calculate how much net irrigation will have to be applied to wet the soil to field capacity and to provide for a leaching requirement of 0.125. The soil water content at field capacity is 12 mm/100 mm over the soil profile depth. (10)

b. ii. Calculate the gross volume of water required to bring a field with this soil to field capacity if the area is 5 ha and irrigation efficiency is expected to be 70 %

END OF EXAMINATION