

UNIVERSITY OF ESWATINI
DEPARTMENT OF GEOGRAPHY, ENVIRONMENTAL SCIENCE AND
PLANNING

MAIN EXAMINATION DECEMBER 2018

B.Sc. IV

TITLE OF PAPER : WATER RESOURCES PLANNING

COURSE NUMBER : GEP 413/ GEP 421

TIME ALLOWED : THREE (3) HOURS

INSTRUCTIONS : SECTION A IS COMPULSORY
ANSWER ANY TWO (2) QUESTIONS FROM
SECTION B. ILLUSTRATE YOUR ANSWERS
WITH APPROPRIATE DIAGRAMS AND SHOW
YOUR WORKING IN ALL CALCULATIONS

MARKS ALLOCATED : QUESTION ONE CARRIES 40 MARKS AND THE
OTHER QUESTIONS CARRY 30 MARKS EACH

THIS PAPER IS NOT TO BE OPENED UNTIL PERMISSION HAS BEEN GRANTED
BY THE INVIGILATOR

SECTION A: COMPULSORY QUESTION

Question 1

A flood has demonstrated that the drainage structure of a certain area is not adequate. In planning the improvement three possible courses of action are considered as follows:

- Leave an existing undamaged 24-inch corrugated steel culvert in place and install another of the same size alongside (Assume the existing culvert has a remaining life of 20 years).
- Remove the above-mentioned culvert and replace it with a single 36-inch culvert.
- Remove the above-mentioned culvert and replace it with a reinforced concrete culvert of adequate cross section.

The present 24-inch pipe has a salvage value of E4,304.00. Estimates of the new installation have been made as follows:

Description	24-inch	36-inch	Concrete
Costs of pipes delivered	E10,761.00	E21,522.00	E0.00
Installation costs	E5,380.00	E7,533.00	E30,133.00
Estimated life	20 years	20 years	40 years

Assuming an interest of 5%, use the present worth method to choose the best alternative.

(40 marks)

SECTION B: ANSWER ANY TWO QUESTIONS

Question 2

- Explain the need for data in water resources planning. **(10 marks)**
- Discuss the four factors which may influence the choice of one or more water resources alternatives for further implementation. **(20 marks)**

(30 marks)

Question 3

Discuss the importance of hydraulic structures in an irrigation scheme. **(30 marks)**

Question 4

A rural community in the Lubombo region has a population of about 6,500 people. The rural water consumption per capita is 45 L. Design a water supply scheme that would meet the demand till year 2031. (Hint; the population growth for Swaziland is 1.8 %).

(30 marks)

Question 5

Discuss any three irrigation methods and explain the suitability of each.

(30 marks)

5%		End-of-Period Compound Interest Factors										5%	
N	Single Payment		Uniform Payment Series					Arithmetic Gradient					
	Compound Amount Factor F/P	Present Worth Factor P/F	Capital Recovery Factor A/P	Present Worth Factor P/A	Sinking Fund Factor A/F	Compound Amount Factor F/A	Present Worth Factor P/G	Uniform Payment Factor A/G					
1	1.050	.9524	1.0500	.952	1.0000	1.000	0	0					
2	1.103	.9070	.5378	1.859	.4878	2.050	.907	.488					
3	1.158	.8638	.3672	2.723	.3172	3.153	2.635	.967					
4	1.216	.8227	.2820	3.546	.2320	4.310	5.103	1.439					
5	1.276	.7835	.2310	4.329	.1810	5.526	8.237	1.903					
6	1.340	.7462	.1970	5.076	.1470	6.802	11.968	2.358					
7	1.407	.7107	.1728	5.786	.1228	8.142	16.232	2.805					
8	1.477	.6768	.1547	6.463	.1047	9.549	20.970	3.245					
9	1.551	.6446	.1407	7.108	.0907	11.027	26.127	3.676					
10	1.629	.6139	.1295	7.722	.0795	12.578	31.652	4.099					
11	1.710	.5847	.1204	8.306	.0704	14.207	37.499	4.514					
12	1.796	.5568	.1128	8.863	.0628	15.917	43.624	4.922					
13	1.886	.5303	.1065	9.394	.0565	17.713	49.988	5.322					
14	1.980	.5051	.1010	9.899	.0510	19.599	56.554	5.713					
15	2.079	.4810	.0963	10.380	.0463	21.579	63.288	6.097					
16	2.183	.4581	.0923	10.838	.0423	23.657	70.160	6.474					
17	2.292	.4363	.0887	11.274	.0387	25.840	77.140	6.842					
18	2.407	.4155	.0855	11.690	.0355	28.132	84.204	7.203					
19	2.527	.3957	.0827	12.085	.0327	30.539	91.328	7.557					
20	2.653	.3769	.0802	12.462	.0302	33.066	98.488	7.903					
21	2.786	.3589	.0780	12.821	.0280	35.719	105.667	8.242					
22	2.925	.3418	.0760	13.163	.0260	38.505	112.846	8.573					
23	3.072	.3256	.0741	13.489	.0241	41.430	120.009	8.897					
24	3.225	.3101	.0725	13.799	.0225	44.502	127.140	9.214					
25	3.386	.2953	.0710	14.094	.0210	47.727	134.228	9.524					
26	3.556	.2812	.0696	14.375	.0196	51.113	141.259	9.827					
27	3.733	.2678	.0683	14.643	.0183	54.669	148.223	10.122					
28	3.920	.2551	.0671	14.898	.0171	58.403	155.110	10.411					
29	4.116	.2429	.0660	15.141	.0160	62.323	161.913	10.694					
30	4.322	.2314	.0651	15.372	.0151	66.439	168.623	10.969					
31	4.538	.2204	.0641	15.593	.0141	70.761	175.233	11.238					
32	4.765	.2099	.0633	15.803	.0133	75.299	181.739	11.501					
33	5.003	.1999	.0625	16.003	.0125	80.064	188.135	11.757					
34	5.253	.1904	.0618	16.193	.0118	85.067	194.417	12.006					
35	5.516	.1813	.0611	16.374	.0111	90.320	200.581	12.250					
40	7.040	.1420	.0583	17.159	.00828	120.8	229.545	13.377					
45	8.985	.1113	.0563	17.774	.00626	159.7	255.315	14.364					
50	11.467	.0872	.0548	18.256	.00478	209.3	277.915	15.223					
55	14.636	.0683	.0537	18.633	.00367	272.7	297.510	15.966					
60	18.679	.0535	.0528	18.929	.00283	353.6	314.343	16.606					
65	23.840	.0419	.0522	19.161	.00219	456.8	328.691	17.154					
70	30.426	.0329	.0517	19.343	.00170	588.5	340.841	17.621					
75	38.833	.0258	.0513	19.485	.00132	756.7	351.072	18.018					
80	49.561	.0202	.0510	19.596	.00103	971.2	359.646	18.353					
85	63.254	.0158	.0508	19.684	.000803	1245	366.801	18.635					
90	80.730	.0124	.0506	19.752	.000627	1595	372.749	18.871					
95	103.0	.00971	.0505	19.806	.000490	2041	377.677	19.069					
100	131.5	.00760	.0504	19.848	.000383	2610	381.749	19.234					
∞	∞	0	.05	20	0	∞	400	20					