UNIVERISTY OF ESWATINI

DEPARTMENT OF GEOGRAPHY, ENVIRONMENTAL SCIENCE AND PLANNING

FINAL EXAMINATION, DECEMBER 2019

B.A., B.Ed., BSc., BASS, (FT/PT)

TITLE OF PAPER:	INTRODUCTION TO THE NATURAL ENVIRONMENT
COURSE NUMBER:	GEP111
TIME ALLOWED:	THREE (3) HOURS
INSTRUCTIONS:	THIS PAPER IS DIVIDED INTO THREE SECTIONS
SECTION A:	TECHNIQUES AND SKILLS ANSWER IN A SEPARATE ANSWER BOOK. 1. ANSWER ALL QUESTIONS (COMPULSORY) 2. THIS SECTION CARRIES 40 MARKS
SECTION B:	COMPULSORY SHORT QUESTIONS (35 MARKS)
SECTION C:	ANSWER ONE OF THE QUESTIONS (25 MARKS) ILLUSTRATE YOUR ANSWERS WITH APPROPRIATE DIAGRAMS.

SPECIAL REQUIREMENTS: Graph paper, Tracing paper, Map of Swaziland 1:50 000 Bhalekane Sheet No. 6)

THIS PAPER SHOULD NOT BE OPENED UNTIL PERMISSION IS GRANTED BY THE INVIGILATOR

GEP111: INTRODUCTION TO THE NATURAL ENVIRONMENT –DECEMBER 2019

ANSWER SECTIONS B AND C IN A SEPARATE ANSWER BOOK FROM SECTION A

SECTION A: TECHNIQUES AND SKILLS (40 MARKS) COMPULSORY

QUESTION 1

For all questions requiring a map, refer to 1:50 000 Map of Swaziland: Bhalekane Sheet No. 6. For all questions show your workings.

a) Using the map provided, give the 6-figure grid reference of the following locations:
   i) Sikhunyane School (2 marks)
   ii) Litshe Trigonometric Station (2 marks)

b) Using the 6-figure grid reference provide the location of the following areas:
   i) Sand River Dam Reservoir (4 marks)
   ii) Farm No. 63 (4 marks)

c) Calculate the scale of an aerial photograph whose focal length is 5cm carried by an aircraft at 5000m above a terrain of 1500m. (3 marks)

d) Calculate the shortest distance along the road between Dvokolwako School and Manzana School in metres and kilometres. (4 marks)

e) Using the map provided calculate the total surface area for Farm no. R/259 in hectares and square kilometres. (6 marks)

f) Copy and complete Table 1 below (6 marks)

Table 1: The relationship between area of maps, scale and true area on Earth.

Area on Map	**Scale of Map**	**True area on Earth**
16.5cm²	1:150 000	**.....km²**
65.3.cm²	**1:.....**	1125.4 ha

g) Using the information in Tables 3, 4, 5 and 6, copy and complete the Table 2 below (calculate the incoming, out-going and net radiation in the following table for the month of September) (9 marks)

Table 2: Copy and complete missing values

Location	**es**	**T (°C)**	**n (hours)**	**Ri**	**Ro**	**H**
20 °N	5.8	9	7.0			
0 °	15.35	20	10.5			
30 °S	14.2	26	11.2			

(40 Marks)

Table 3: Solar Radiation (R_a) expressed in equivalent evaporation (mm/day)

Latitude	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
60°N	1.4	3.6	7	11.1	14.6	16.4	15.6	12.6	8.5	4.7	2	0.9
50°N	3.7	6	9.2	12.7	15.5	16.6	16.1	13.7	10.4	7.1	4.4	3.1
40°N	6.2	8	11.1	13.8	15.9	16.7	16.3	14.7	12.1	9.3	6.8	5.6
30°N	8.1	10.5	12.8	14.7	16.1	16.5	16.2	15.2	13.5	11.2	9.1	7.9
20°N	10.8	12.4	14	15.2	15.7	15.8	15.8	15.4	14.4	12.9	11.3	10.4
10°N	12.8	13.9	14.8	15.2	15	14.8	14.9	15	14.8	14.2	13.1	12.5
Equator	14.6	15	15.2	14.7	13.9	13.4	13.6	14.3	14.9	15	14.6	14.3
10°S	14.6	15	15.2	14.7	13.9	13.4	13.6	14.3	14.9	15	14.6	14.3
20°S	16.8	15.7	15.1	13.9	12.5	11.7	12	13.1	14.4	15.4	15.7	15.8
30°S	17.2	15.8	13.5	10.9	8.6	7.5	7.9	9.7	12.3	14.8	16.7	17.5
40°S	17.3	15.1	12.2	8.9	6.4	5.2	5.6	7.6	10.7	13.8	16.5	17.8
50°S	16.9	14.1	10.4	6.7	4.1	2.9	3.4	5.4	8.7	12.5	16	17.6
60°S	16.5	12.6	8.3	4.3	1.8	0.9	1.3	3.1	6.5	10.8	15.1	17.5

Source: Shaw, 1983. *Hydrology in Practice*

Table 4:Values of σT^4

°F	0	1	2	3	4	5	6	7	8	9
30	11	11.1	11.2	11.3	11.4	11.5	11.6	11.6	11.7	11.9
40	11.9	12	12.1	12.2	12.3	12.4	12.5	12.6	12.7	1 2.8
50	12.9	130	13.1	13.2	13.3	13.4	13.5	13.6	13.7	13.9
60	14	14.1	14.2	14.3	14.4	1.5	14.6	14.5	14.8	14.9
°C										
-0	11.2	11								
0	11.2	11.4	11.5	11.7	11.9	12	12.2	12.3	12.5	12.7
10	12.9	13.1	13.3	13.5	13.7	13.9	14	14.2	14.4	14.6
20	14.8	15	15.2	15.4	15.6	15.8	16	16.2	16.4	16.6

Source: Shaw, 1983. *Hydrology in Practice*

Table 5: Relationship between noon solar angle and intensity of solar radiation

Solar angle	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°
0°	0	1.75	3.49	5.23	6.98	8.72	10.5	12.2	13.9	15.6
10°	17.4	19.1	20.8	22.5	24.2	25.9	27.6	29.2	30.9	32.6
20°	34.2	35.8	37.5	39.1	40.7	42.3	43.8	45.4	47	48.5
30°	50	51.5	53	54.5	55.9	57.4	58.8	60.2	61.6	62.9
40°	64.3	65.6	66.9	68.2	69.5	70.7	71.9	73.1	74.3	75.5
50°	76.6	77.7	78.8	79.9	80.9	81.9	82.9	83.9	84.8	85.7
60°	86.6	87.5	88.3	89.1	89.9	89.9	90.6	92.1	92.7	93.4

70°	94	94.6	95.1	95.6	96.1	96.6	97	97.4	97.8	98.2
80°	98.5	98.8	99	99.3	99.5	99.6	99.8	99.9	99.9	100

Table 6:mean daily duration of maximum possible sunshine hours (N)

North Lat.	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
South Lat.	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
60°N/S	6.7	9	11.7	14.5	17.1	18.6	17.9	15.5	12.9	10.1	7.5	5.9
58°N/S	7.2	9.3	11.7	14.3	16.6	17.9	17.3	15.3	12.8	10.3	7.9	6.5
56°N/S	7.6	9.5	11.7	14.1	16.2	17.4	16.9	15	12.7	10.4	8.3	7
54°N/S	7.9	9.75	11.7	13.9	15.9	16.9	16.5	14.8	12.7	10.5	8.5	7.4
52°N/S	8.38	9.94	11.8	13.8	15.6	16.5	16.1	14.6	12.7	10.6	8.8	7.8
50°N/S	8.58	10	11.8	13.7	15.3	16.3	15.9	14.4	12.6	10.7	9	8.1
48°N/S	8.8	10.2	11.8	13.6	15.2	16	15.6	14.3	12.6	10.9	9.36	8.3
46°N/S	9.1	10.4	11.9	13.5	14.9	15.7	15.4	14.2	12.6	10.9	9.5	8.7
44° N/S	9.3	10.5	11.9	13.4	14.7	15.4	15.2	14	12.6	11	9.7	8.9
42°N/S	9.4	10.6	11.9	13.4	14.6	15.2	14.9	13.9	12.6	11.1	9.8	9.1
40°N/S	9.63	10.7	11.9	13.3	14.4	15	14.7	13.7	12.5	11.2	10	9.3
35°N/S	10.1	11	11.9	13.1	14	14.5	14.3	13.5	12.4	11.3	10.3	9.86
30°N/S	10.4	11.1	12	12.9	13.6	14	13.9	13.2	12.4	11.5	10.6	10.2
25°N/S	10.7	11.3	12	12.7	13.3	13.7	13.5	13	12.3	11.6	10.9	10.6
20°N/S	11	11.5	12	12.6	13.1	13.3	13.2	12.8	12.3	11.7	11.2	10.9
15°N/S	11.3	11.6	12	12.5	12.8	13	12.9	12.6	12.2	11.8	11.4	11.2
10°N/S	11.6	11.8	12	12.3	12.6	12.7	12.6	12.4	12.1	11.8	11.6	11.5
5°N/S	11.8	11.9	12	12.2	12.3	12.4	12.3	12.3	12.1	12	11.9	11.8
Equator	12	12	12	12	12	12	12	12	12	12	12	12

Source: Shaw, 1983. *Hydrology in Practice*

SECTION B: ANSWER THE FOLLOWING QUESTION:

QUESTION 2:

a) Describe the theory of plate tectonics and describe how this accounts for earthquakes, and why it has replaced the earlier concept of 'Continental Drift'. (15 marks)

b) Draw a diagram of the hydrological cycle and explain how humans have affected it. (10 marks)

c) Explain FIVE of the following terms or concepts BRIEFLY: (10 marks)
   i) Aquifer
   ii) Groundwater table
   iii) Troposphere
   iv) Shield volcano
   v) Metamorphic aureole
   vi) Constructive plate margin
   vii) Xenolith

(35 Marks)

SECTION C: ANSWER EITHER QUESTION 3 OR QUESTION 4

QUESTION 3:

a) Describe the vertical structure of the earth's atmosphere in relation to temperature. (8 marks)

b) Describe HOW the atmospheric circulation contributes to the heat balance of the earth. (5 marks)

c) Draw a simple diagram to illustrate how a stream may transport it's load. (5 marks)

d) Briefly explain the formation and the basis for the classification of metamorphic rocks, and name two examples of **sedimentary** rocks. (7 marks)

(25 Marks)

QUESTION 4:

a) Describe the term 'Global Climate Change', and explain how human behaviour has contributed to this. (9 marks)

b) Explain how humans have modified components of the atmospheric system. (4 marks)

c) Describe why scientists have concluded that there is a heat exchange between the earth's poles and the equator. (4 marks)

d) Sedimentary rocks are classified according to how they form. Give a detailed account of this classification system and name two **igneous** rocks. (8 marks)

(25 Marks)

EQUATIONS

Fahrenheit to Celsius: $^{\circ}C = \frac{5}{9}(^{\circ}F - 32)$

Celsius to Fahrenheit: $^{\circ}F = \frac{9}{5}{}^{\circ}C + 32$

Kelvin to Celsius: $K = {}^{\circ}C + 273.15$
Celsius to Kelvin: $^{\circ}C = K - 273.15$
Fahrenheit to Kelvin: $K = {}^{\circ}F + 457.87$
Kelvin to Fahrenheit: $^{\circ}F = K - 457.87$

1 centimeter	= 10 millimeters	1 cm	= 10 mm
1 meter	= 100 centimeters	1 m	= 100 cm
1 kilometer	= 1000 meters	1 km	= 1000 m
1 inch	= 2.54 centimeters	1 in	= 2.54 cm
1 foot	= 30.48 centimeters	1 ft	= 30.48 cm
1 yard	= 91.44 centimeters	1 yd	= 91.44 cm
1 yard	= 0.9144 meters	1 yd	= 0.9144 m
1 mile	= 1609.344 meters	1 mi	= 1609.344 m
1 mile	= 1.609344 kilometers	1 mi	= 1.609344 km

$R_o = \ldots \sigma T^4 \left\{0.56 - 0.09\sqrt{e_s}\right\}\left\{0.1 + (0.9 \times (n \div N))\right\} \quad mm/day$

$e/e_s \times 100$

$K = (120.6 - T)\left(4\sqrt{v+5} - v/4\right)$

$R = \dfrac{(1 \div A)(\sum R_j a_j)}{n}$

$R = (1 \div n)(\sum R_j)$

$R = (1 \div A)(\sum r_i a_i)$

$R_l = 0.95 R_a \times (n \div N) \quad mm/day$

$Q = m^3/s$

$q_j = \dfrac{(v_j + v_{j+1})}{2}\dfrac{(y_i + y_{i+1})}{2} b_j$

$Q = \sum q_j$

S=f/H

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