



UNIVERSITY OF RUHUNA, FACULTY OF AGRICULTURE
FIRST EXAMINATION IN BSc. AGRICULTURAL RESOURCE AMANGEMENT AND
TECHNOLOGY

FIRST EXAMINATION IN BSc. GREEN TECHNOLOGY (PART I)

August – 2022

APPLIED HYDROLOGY AND CLIMATOLOGY – EN1101

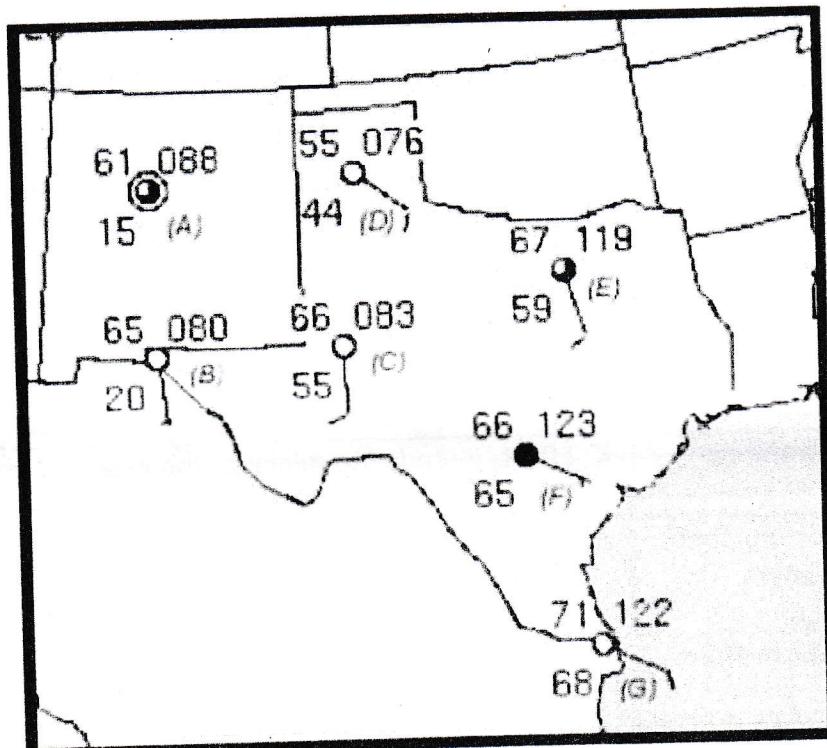
INDEX NO:

STRUCTURED AND ESSAY TYPE (TIME 2 1/2 HOURS)

- Answer all questions in PART A
- Answer to the structured questions in PART A must be done in the spaces provided.
- Answer only THREE questions from PART B
- Answers to Essay type questions in PART B must be done on the answer books
- All questions carry equal marks
- Only non-programmable calculators are permitted.
- Mobile phones are NOT permitted.

PART A: STRUCTURED TYPE

1. The following image is part of an actual synoptic weather map of 11 March 2021. It shows A-G stations (50 Marks)



(I)

- a) Which station is reporting the lowest temperature?.....
What is that temperature?.....
- b) Which station is reporting the highest dewpoint?.....
What is that dewpoint?.....
- c) Which station is reporting the highest air pressure?.....
What is that pressure?.....
- d) Which station is reporting the lowest air pressure?.....
What is that pressure?.....
- e) Which station probably has the highest relative humidity?.....
- f) Where is the air at that station coming from?.....
- g) Which station is probably in the driest air mass?.....
How do you know?.....

(II) Match each term in the left-hand column to the statement that it best exemplifies

(50 Marks)

1. Albedo	A. The meteorological conditions in a given place on a given day
2. Carbon taxes	B. An international group of scientists that evaluates scientific studies related to climate change to thoroughly and objectively assess the data
3. Precautionary principle	C. Governmental fees imposed on activities (such as fossil fuel use) that release CO ₂ into the atmosphere
4. Climate change	D. The ability of a surface to reflect away solar radiation
5. Mitigation	E. Acting in a way that leaves a safety margin when the data are uncertain or severe consequences are possible
6. Anthropogenic	F. The warming of the planet that results when heat is trapped by Earth's atmosphere
7. Adaptation	G. Long-term patterns or trends of meteorological conditions
8. Weather	H. Caused by or related to human action
9. Greenhouse gases	I. Efforts intended to help deal with a problem that exists, such as climate change
10. Climate	J. The observed and ongoing rise in the Earth's average temperature that is contributing to climate change
11. Global warming	K. Efforts intended to minimize the extent or impact of a problem such as climate change
12. Intergovernmental Panel on Climate Change (IPCC)	L. Alteration in the long-term patterns and statistical averages of meteorological events
13. Greenhouse effect	M. Molecules in the atmosphere that absorb heat and reradiate it back to Earth

2. Rainfall record in a catchment from 2000 to 2020 is given in the below table.

Year	Rainfall (mm)	Moving averages (C)
1990	2010	
1991	2180	
1992	1650	
1993	1875	
1994	1600	
1995	1800	
1996	1100	
1997	975	
1998	1250	
1999	1900	
2000	2000	
2001	2150	
2002	1850	
2003	1700	
2004	1500	
2005	1450	
2006	1310	
2007	1900	
2008	980	
2009	1200	
2010	1100	

- i) Calculate average annual rainfall of the given catchment **(10 marks)**

.....
.....

- iii) Calculate 3-year moving averages and fill the values in the column (C) (40 marks).

- iii) Plot moving averages curve in the given graph paper (30 marks)
- iv) Forecast change of rainfall trend. (20 marks)

PART B: ESSAY TYPE (Answer TWO questions only)

1.

- i. Define Followings (10 Marks)
- Relative humidity
 - Dewpoint

- ii. An air mass is at a temperature of 20°C with relative humidity of 75%.

Find:

- saturation vapor pressure
- actual vapor pressure
- the deficit in saturation and
- dew point.

(Use following Table)

(40 Marks)

Saturation vapour pressure as a function of temperature t
(Negative values of t refer to conditions over ice; 1 mm Hg = 1.33 mbar)

t ($^{\circ}\text{C}$)	e_s									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
-10	2.15									
-9	2.32	2.30	2.29	2.27	2.26	2.24	2.22	2.21	2.19	2.17
-8	2.51	2.49	2.47	2.45	2.43	2.41	2.40	2.38	2.36	2.34
-7	2.71	2.69	2.67	2.65	2.63	2.61	2.59	2.57	2.55	2.53
-6	2.93	2.91	2.89	2.86	2.84	2.82	2.80	2.77	2.75	2.73
-5	3.16	3.14	3.11	3.09	3.06	3.04	3.01	2.99	2.97	2.95
-4	3.41	3.39	3.37	3.34	3.32	3.29	3.27	3.24	3.22	3.18
-3	3.67	3.64	3.62	3.59	3.57	3.54	3.52	3.49	3.46	3.44
-2	3.97	3.94	3.91	3.88	3.85	3.82	3.79	3.76	3.73	3.70
-1	4.26	4.23	4.20	4.17	4.14	4.11	4.08	4.05	4.03	4.00
0	4.58	4.55	4.52	4.49	4.46	4.43	4.40	4.36	4.33	4.29
1	4.92	4.96	5.00	5.03	5.07	5.11	5.14	5.18	5.21	5.25
2	5.29	5.33	5.37	5.40	5.44	5.48	5.53	5.57	5.60	5.64
3	5.68	5.72	5.76	5.80	5.84	5.89	5.93	5.97	6.01	6.06
4	6.10	6.14	6.18	6.23	6.27	6.31	6.36	6.40	6.45	6.49
5	6.54	6.58	6.54	6.68	6.72	6.77	6.82	6.86	6.91	6.96
6	7.01	7.06	7.11	7.16	7.20	7.25	7.31	7.36	7.41	7.46
7	7.51	7.56	7.61	7.67	7.72	7.77	7.82	7.88	7.93	7.98
8	8.04	8.10	8.15	8.21	8.26	8.32	8.37	8.43	8.48	8.54
9	8.61	8.67	8.73	8.78	8.84	8.90	8.96	9.02	9.08	9.14
10	9.20	9.26	9.33	9.39	9.46	9.52	9.58	9.65	9.71	9.77
11	9.81	9.90	9.97	10.03	10.10	10.17	10.24	10.31	10.38	10.45
12	10.52	10.58	10.66	10.72	10.79	10.86	10.93	11.00	11.08	11.15
13	11.23	11.30	11.38	11.75	11.53	11.60	11.68	11.76	11.83	11.91
14	11.98	12.06	12.14	12.22	12.96	12.38	12.46	12.54	12.62	12.70
15	12.78	12.86	12.95	13.03	13.11	13.20	13.28	13.37	13.45	13.54
16	13.63	13.71	13.80	13.90	13.99	14.08	14.17	14.26	14.35	14.44

- iii. For a given month, a 121-ha lake has $0.43 \text{ m}^3/\text{s}$ of inflow, $0.37 \text{ m}^3/\text{s}$ of outflow, and the total storage increase of 1.97 ha-m . A USGS gauge next to the lake recorded a total of 3.3 cm precipitation for the lake for the month. Assuming that infiltration loss is insignificant for the lake, determine the evaporation loss, in cm over the lake for the month (50 Marks).

2.

- i. Distinguish between the different forms of precipitation (20 Marks)
- ii. Outline sources of error when recording readings and record-keeping by precipitation gauge (20 Marks)
- iii. What is the relationship between intensity, duration and frequency of rainfall? (20 Marks)
- iv. The following are the monthly pan evaporation data (Jan-Dec) at Mapalana in 2020 year in cm.
17.7, 15.3, 18.8, 26.0, 29.6, 22.4, 17.7, 17.7, 17.7, 22.4, 17.7, 17.7, ~~17.7~~.

The water spread area in a lake nearby in the beginning of January in that year was 2.80 km^2 and at the end of the December it was measured as 2.55 km^2 . Calculate the loss of water due to evaporation in that year. Assume a pan coefficient of 0.7 (40 Marks)

3.

 - i. Define climatology (10 marks)
 - ii. Distinguish the difference between climatology and meteorology (20 marks)
 - iii. State examples of application of climatology (20 marks)
 - iv. List climate elements (10 marks)
 - v. Briefly describe climate factors that control climate elements (20 marks)
 - vi. Explain Solstice and Equinox (20 marks)

4.

 - i. Define peak runoff. (10 marks)
 - ii. Briefly explain factors affecting runoff. (10 marks)
 - iii. What are commonly used runoff estimation methods? (10 marks)
 - iv. For a small catchment of 100 km^2 area, following are the observations of flow from a 4-hr. duration storm. The values of base flow are given. Derive and plot 4-hour unit hydrograph. Calculate the rainfall excess (Direct runoff depth) due to the storm. (70 marks)

Date	Hour	Flow (cumec)	Base flow (cumec)
Day 1	0000	7	7
	0400	80	7
	0800	120	7
	1200	185	7
	1600	150	7
	2000	110	7
Day 2	0000	75	7
	0400	40	7
	0800	20	7
	1200	7	7

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