

**SECTION A (40 MARKS)**  
**ANSWER ALL QUESTIONS**

**Question 1**

**a) For each question, there are four alternatives A, B, C and D. Choose the correct alternative and circle it. Do not circle more than ONE alternative. If there are more than one circled, NO score will be awarded. [15]**

- i. The branches and leaves of dominant trees that shade the layers below is the
  - A canopy.
  - B understory.
  - C forest floor.
  - D emergent layer.
- ii. Xerosere is a plant succession that occurs in the
  - A dry land.
  - B saline area.
  - C marshy land.
  - D organic environment.
- iii. In ecological succession, aggregation of species takes place after the
  - A arrival of seeds and spores.
  - B elimination of some species.
  - C colonization of species in new area.
  - D species attain maturity and stability.
- iv. ‘Carbon footprint can be assessed by classifying the components into five major classes’.

Which of the following does not fall under the five major classes?

- A food
- B travel
- C housing
- D industries

- v. The purpose of scoping in Environmental Impact Assessment (EIA) is to
  - A determine the requirement of EIA.
  - B identify the potential environmental impacts.
  - C mitigate the adverse impacts on the environment.
  - D provide information about environmental impacts.

vi. A farmer uses chemical fertilizers to increase crop production.  
What is the effect of nitrate leaching on the soil?  
A salinization  
B alkalization  
C acidification  
D desertification

vii. As an environmental officer, you are assigned to address an urgent and immediate adaptation needs against adverse impact of climate change. How would you plan the process?  
A observation – planning – assessment – implementation – monitoring  
B planning – observation – assessment – monitoring –implementation  
C assessment – planning – observation – implementation – monitoring  
D observation – assessment – planning – implementation – monitoring

viii. ‘The main motive behind coming up with the Druk Gyalpo’s Relief Kidu is the deep concern of His Majesty the King for those who have been directly affected by the pandemic’.

(Source: [www.bbs.bt](http://www.bbs.bt), April 14, 2020)

Which phase of disaster management does the above excerpt describe?  
A Response  
B Recovery  
C Prevention  
D Preparedness

ix. Polar bear is endemic to the Arctic region. Which of the species below is endemic to Bhutan?  
A Python  
B Peacock  
C Takin  
D Lynx

x. Name the coordinating agency that promotes the biodiversity management in Bhutan.  
A National Biodiversity Centre  
B Convention on Biological Diversity  
C National Biodiversity Strategies and Action plan  
D Bhutan Trust Fund for Environmental Conservation

xi. Study the picture.



What type of water conservation practices in agriculture does the picture depict?

- A special tilling
- B strip cropping
- C terrace farming
- D contour ploughing

xii. A device which works by passing hydrogen gas through the anode to generate electricity involving electrochemical reactions is

- A fuel cell.
- B hydrogen energy storage .
- C battery storage technology.
- D photo-voltaic (PV) cell.

xiii. 'Rapid increase in the population has led to urbanization resulting in alteration of social, economic and environment domains'

What other factor has caused urbanization?

- A health issue
- B water scarcity
- C climate change
- D business opportunities

xiv. Reduce, recycle and reuse waste generated after construction and demolition are the characteristics of green

- A energy.
- B tourism.
- C building.
- D transport.

xv. ‘Sustainable development goals (SDGs) have been developed towards providing focused assistance to least developed countries’.

What does SDG 4 represent?

- A no poverty
- B zero hunger
- C gender equality
- D quality education

**b)** Write TRUE or FALSE for the following statements. Rewrite the false statements in their correct forms in the space provided.

[5]

- i. Edge-effect is a region of transition between two biological communities.
- ii. Secondary succession occurs in a place that was previously uninhabited.
- iii. 97% of total water on the earth is saline ocean water.
- iv. Bhutan absorbs less carbon gas than what she produces.
- v. Brown economy is rapid economic growth achieved through over-exploitation of environment.

c) Match each item under column A with the most appropriate item in column B. Rewrite the correct pairs by writing the alphabet against the number in the space provided. [5]

Column A	Column B
i. Regain equilibrium and maintain homeostasis	a) Trickle irrigation
ii. Assessment of vegetation change	b) Carrying capacity
iii. Build back better and avoid relapses	c) Phibsoo
iv. Identified Ramsar site in Bhutan	d) Light Emitting Plasma
v. Save water and fertilizers with zero water logging	e) MAPS
vi. Inverse relation of ecological footprint	f) Modelling (Erosion-Model)
vii. Orange plant flowers late every year in Tsirang	g) Early recovery
viii. Provide measurable trends, baselines and targets to conserve biodiversity	h) Biotic stability
ix. Energy efficient devices that consume lesser amount of energy	i) Hypothesis
x. Common approach to implement sustainable development goals	j) Khothokha
	k) Biodiversity management system(BMS)
	l) Emergency relief

Column A	Column B	
i.		
ii.		
iii.		
iv.		
v.		
vi.		
vii.		
viii.		
ix.		
x.		

**d) Fill in the blanks with appropriate word/s.**

**[5]**

i. The mitigation where there are physical changes or acts of protection from disaster or hazards is called as _____ mitigation.	
ii. The cross-cultural studies of how people perceive and manipulate their environment is known as _____.	
iii. The mandate to maintain 60% of forest coverage in Bhutan is an example of _____ value.	
iv. Developmental activities are considered unsustainable when _____ footprint exceeds the biocapacity.	
v. The gradual settling of land as a result of excessive withdrawal of _____ is known as land subsidence.	
vi. The conservation of _____ diversity is one of the main objectives of CBD.	
vii. Hydrogen can be stored in a gas form at a high pressure and in a liquid form at a _____ temperature.	
viii. _____ rate is one of the challenges of our country to achieve sustainable development goals.	
ix. The degree to which a system is at risk and unable to adjust with adverse effect of climate change is known as _____.	
x. An indigenous Bhutanese custom which restricts the harvest of forest resources for a certain period of time is termed as _____.	

**e) Answer the following questions briefly.**

i. Snow leopard is considered as a keystone species in the mountain ecosystem of Bhutan. Do you agree? Justify with **ONE** point.

**[1]**


ii. The level of PM 10 ( $150 \mu\text{g}/\text{m}^3$ ) emitted at a silicon industrial site in S/Jongkhar is  $300 \mu\text{g}/\text{m}^3$  in a particular day. Calculate the Air Quality Index of S/Jongkhar.

**[2]**



iii. Conservation and poverty alleviation often go together. Do you think biodiversity conservation can alleviate poverty? Justify with a reason. [1]


iv. Bhutan receives one of the highest average of yearly water supply per capita in South Asia, yet some of the localities do not have access to safe, affordable and sufficient water. Give **TWO** reasons. [2]


v. Genetically Modified Organisms cause environmental pollution. Do you agree? [1]  
Why? Support your answer with **ONE** reason.


vi. The Department of Disaster Management (DDM) encourages on the establishment of disaster-resilient community in your locality.

Suggest **TWO** ways to accomplish this objective. [2]


vii. Bhutan and West Bengal have renewed their commitment to pursue the Golden Jubilee Railway from Hashimara to Bhutan.

(Source: *kuneselonline.com* October 6, 2015)

What would happen if Bhutan decides to build railways in the country? Give a reason to support your answer. [1]


**SECTION B (60 MARKS)**  
**ANSWER ANY SIX QUESTIONS**

**Question 2**

a) State **TWO** characteristics of pioneer community.

[2]


b) Complete the following table with the most appropriate words.

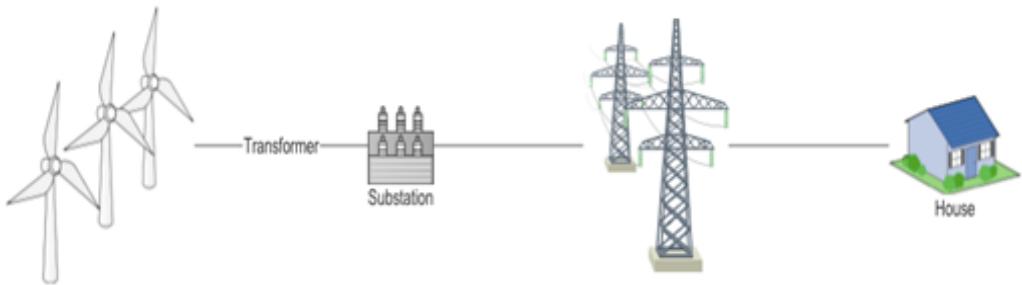
[2]

<b>Service type</b>	<b>Characteristics</b>
1.....	Raw materials
Supporting services	2.....

c) What do you understand by Aquifer Ecosystem? Mention any **TWO** points and explain them.

[2]


d) Study the figure and answer the following questions.



i. Name the alternative source of energy device. [0.5]


ii. What is the source of energy for such type of devices? [0.5]


iii. Identify **TWO** challenges on the use of such a technology in Bhutan. [1]


e) 'The Human-Wildlife Conflict committees also known as gewog environment conservation committees are formed with an initial seed money of Nu 0.5 million from the government to compensate in some form the loss of livestock or crops to wild animals.

*(Source: kuenselonline.com, January 21, 2017)*

Do you think providing compensation is sustainable? Give **TWO** reasons. [2]



**Question 3**

a) How is ecological footprint different from carbon footprint? Explain with an example [3] each.

<b>Ecological footprint</b>	<b>Carbon footprint</b>

b) The pictures below depict, incident of four men stuck in the middle of the Mao River above the *GelegphuThromde* water treatment plant. The river was swollen because of the continuous rainfall since the day before.

(Source: *bbs.bt*, 20 July, 2020)



As a member of preparedness team, devise **TWO** ways to reduce the risk of such a disaster.

[1]


c) 'Bhutan says that by 2025, Increased Hydroelectricity will let the country offset up to 22.4 million tons of carbondioxide per year in the region'.

(Source: *www.cnn.com* Oct 11, 2018)

i. What mechanism does the above statement describe? Explain.

[1]



ii. Give examples of **TWO** other technologies used to reduce the greenhouse gas emission. [2]


d) The Royal Government of Bhutan adheres strongly to a policy of 'High Value, Low Impact' tourism which serves the purpose of creating an image of exclusivity and high- yield for Bhutan.

(Source: [www.tourism.gov.bt](http://www.tourism.gov.bt))

Do you think it is a good policy for Bhutan? [1]


e) Briefly describe **TWO** challenges for Bhutan in achieving Sustainable Development Goals (SDGs). [2]


**Question 4**

a) How is hedonic pricing method different from benefit transfer method in ecosystem service valuation? Support your comparison with an example each.

[2]

Hedonic pricing	Benefit transfer

b) After planning stage, implementation is one of the important components of adaptive process in mitigating climate change.

Why is implementation stage important in the adaptive process?

[2]


c) Write down the mitigation measure carried out for each of the physical disaster mentioned in the table below.

[2]

Physical Disaster	Mitigation	
GLOF		
Windstorm		

d) Name any **TWO** alternative sources of energy apart from wind energy.

[2]


d) Bhutan is a member of various international treaties and conventions related to biodiversity management.

What are some of the benefits Bhutan enjoys being part of these treaties and conventions?

[2]


### Question 5

a) Complete lockdown was enforced in Bhutan with one COVID-19 positive case outside the quarantine facility on August 11, 2020.

List and explain **THREE** advantages of this lockdown.

[3]



b) Government offers incentives to a farmer or landowner for managing their land to provide ecological services.

What is an ecological service?

[1]


c) According to the global economic index released in 2016, Sweden topped in green economy as per its data released from countries across the world based on evaluation from experts.

i. What is green economy?

[1]


ii. Suggest any **TWO** possible sectors that could contribute to the development of green economy.

[2]


d) Surface irrigation is one of the popular irrigation practices in Bhutan. Do you think so? Give a justification. [1]


e) Write the abbreviation of RSPN and BTFEC. [2]


### Question 6

a) Define the following terms:

i. Phenology

[1]


ii. Biological disasters

[1]


b) Among the many ecosystem services available, provisioning services is mostly utilized in Bhutan. Is it true? Support with **TWO** attributes. [2]

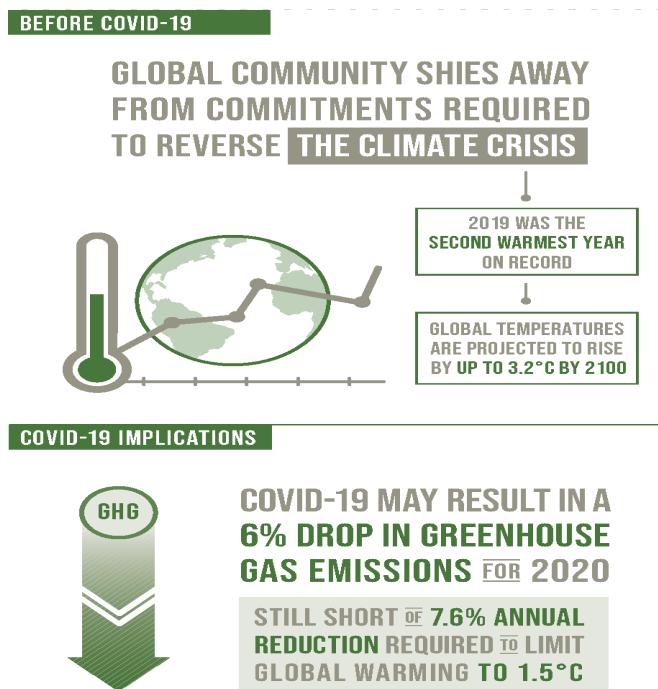

c) The rate of infection of recent pandemic is exponentially increasing in other countries. Any other disaster if not mitigated on time can cause a national tragedy in Bhutan. Do you agree? Justify with **TWO** reasons. [2]


d) Our ancestors were dependent on biodiversity for their sustenance and health. Even today we derive most of our food, medicines and industrial products from the components of biodiversity. The proper management of biodiversity is essential for the sustainability of biodiversity.

How did our ancestors live in harmony with this ecological diversity? Explain with **TWO** reasons. [2]



e) The following diagram illustrates the implications of COVID-19 on climate, which is the 13<sup>th</sup> goal of SDGs (Climate action).

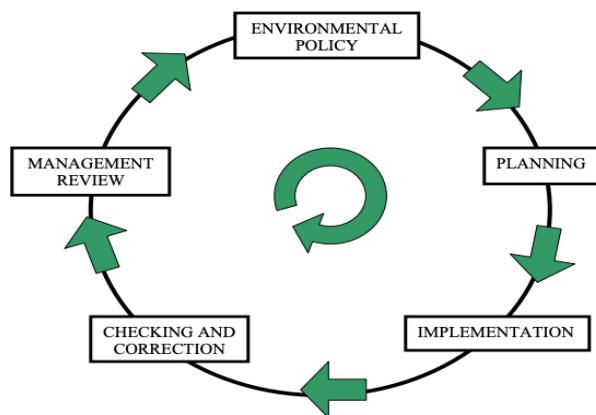


How did COVID-19 influence climate change?

[2]


### Question 7

a) Study the diagram given below and answer the questions that follow.



i. What does the diagram represent? [1]


ii. Planning is one key aspect in this system. Explain why? [2]


b) Write **THREE** differences between Basin Irrigation and Furrow Irrigation. [3]

Basin irrigation	Furrow irrigation

c) Diversity of species is essential for the functioning of the ecosystem. Justify with **ONE** point. [1]


d) List **TWO** ways to minimize home and work place hazards.

[1]


e) What would happen if the climax community does not form in the process of succession?

[2]


### Question 8

a) Citarum river in Indonesia has been called the worst and most polluted river in the world. 5 million people live on the river basin and they rely on it for their water supply.

(Source: [bbc.com](http://bbc.com) May 27,2015)

What measures can be suggested to solve the water pollution? Mention **TWO**.

[2]


b) When is consumption pattern considered as unsustainable?

[2]


c) The pressure on land in Bhutan is growing with the rapid economic development and population growth. The population density taken over arable and settlement areas soars to about 85 persons per square kilometer (NEC, 2011).

Explain any **TWO** causes of land degradation in Bhutan.

[2]


d) As a qualified consultant working in the department of geology and mines, Dorji was asked to propose possible solutions for land reclamation by Kangkhu Marble Mining at Paro. What **TWO** measures could be proposed?

[2]


e) Bhutan has committed to remain carbon neutral during the United Nations COP-15 at Copenhagen, Denmark.

i. What do you understand by carbon neutral?

[1]


ii. Mention **ONE** measure Bhutan has adopted to remain carbon neutral.

[1]
