

**ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2024
EXAMINATION CATEGORY: TECHNICAL**

PAPER III: SUBJECT SPECIALISATION PAPER FOR FORESTRY

Date	: October 5, 2024
Total Marks	: 100
Writing Time	: 150 minutes (2.5 hours)
Reading Time	: 15 Minutes (prior to writing time)

GENERAL INSTRUCTIONS:

1. Write your Registration Number clearly and correctly on the Answer Booklet.
2. The first 15 minutes is to check the number of pages of Question Paper, printing errors, clarify doubts and to read the instructions. You are NOT permitted to write during this time.
3. This paper consists of **TWO SECTIONS**, namely SECTION A & SECTION B:
 - **SECTION A** has two parts: Part I - 30 Multiple Choice Questions
Part II - 4 Short Answer Questions
All questions under SECTION A are **COMPULSORY**.
 - **SECTION B** consists of two Case Studies. Choose only **ONE** case study and answer the questions of your choice.
4. All answers should be written on the Answer Booklet provided to you. Candidates are not allowed to write anything on the question paper. If required, ask for additional Answer Booklet.
5. All answers should be written with correct numbering of Section, Part and Question Number in the Answer Booklet provided to you. Note that any answer written without indicating any or correct Section, Part and Question Number will NOT be evaluated and no marks would be awarded.
6. Begin each Section and Part in a fresh page of the Answer Booklet.
7. You are not permitted to tear off any sheet(s) of the Answer Booklet as well as the Question Paper.
8. Use of any other paper including paper for rough work is not permitted.
9. **You must hand over the Answer Booklet to the Invigilator before leaving the examination hall.**
10. This paper has **9 printed pages**, including this instruction page.

GOOD LUCK

SECTION A

PART I

Multiple Choice Questions [30 marks]

Choose the correct answer and write down the letter of your chosen answer in the Answer Booklet against the question number e.g. 31 (d). Each question carries ONE mark. Any double writing, smudgy answers or writing more than one choice shall not be evaluated

1. The interaction between individuals of the same species or different species at the same trophic level, in which the growth and survival of one or all species or individuals is adversely affected:
 - a) Compensation point
 - b) Competitive exclusion principle
 - c) Competitive release
 - d) Competition

2. The region of the Earth where life can be found, including soil, water, and air is termed as:
 - a) Biome,
 - b) Biosphere,
 - c) Biosphere reserve
 - d) Ecosystem

3. Bhutan's protected area network comprises of National Parks, Wildlife Sanctuaries, Strict Nature Reserve, Botanical Park and Biological Corridors. The Protected Area network constituted;
 - a) 51.44 % of the forest area,
 - b) 52 % of the forest area,
 - c) 60 % of the forest area,
 - d) 51 % of the forest area,

4. The biological corridors were introduced to connect all protected areas into a single uninterrupted area. The main purpose of biological corridor is to;
 - a) Increase or maintain the wildlife population,
 - b) Increase the protected area,
 - c) Provide free movement of wildlife,
 - d) All of the above

5. A successional change, usually from an existing climax community, leading to a less diverse and less structurally complex community is called;
 - a) Retrogressive succession
 - b) Allogenic succession
 - c) Progressive succession
 - d) All of the above

6. Which of the following natural polymer is used in paper making?
- Chitin
 - Keratin
 - Cellulose
 - Elastin
7. The national tiger survey report revealed the increase in Tiger numbers from 103 in 2015 to 131 tigers in 2023. The significant increase in Tiger population indicates;
- Global warming,
 - Increased developmental activities,
 - Increased poaching activities,
 - Healthy ecosystems
8. The natural rejection of plant organs such as leaves, flowers and fruits in order to help adapt to nutrient limitation is called:
- Senescence
 - Die-back
 - Plant disease
 - Abscission
9. Evolutionary mechanism that leads to adaptation is;
- selection
 - mutation,
 - migration,
 - genetic drift,
10. The forest fire damaged about 4 hectares of chirpine forest in Wangduephodrang dzongkhag. The 4 hectares of chirpine forest area is equivalent to:
- 4000 m²
 - 45000 m²
 - 40000 m²
 - 20000 m²
11. Selecting good seeds is critical in raising seedlings in the nursery. Seeds contain following:
- Pollen grains & sporophytes
 - Male sporophyte and embryo
 - Embryo and nutritive tissue
 - Mature sporophyte and nutritive tissue
12. Dey-sho (Traditional paper) is known for its durability and raw materials are locally available. The source of the raw material is bark from a shrub plant referred to as;
- Daphne bholua*
 - Edgeworthia gardneri*
 - Pieris formosa*
 - Morus alba*

13. A scientific instrument used to measure atmospheric pressure is:
- Pressure meter,
 - Hydrometer
 - pH meter
 - Barometer
- 1.
14. Forest watersheds are the main sources of spring water in Bhutan. A sample from one of the spring water is collected and tested for its chemical properties. The holy water sample showed a pH of 0.8 and not fit for drinking.
- The spring is slightly alkaline
 - The spring water is neutral
 - The spring water is slightly acidic
 - None of the above
15. Forest Inventories are carried periodically to understand the status of forest coverage, health of the forest and its potential resources. The latest inventory result showed 2.68 million ha of forest area equivalent to;
- 70.0 % forest coverage,
 - 71.5 % forest coverage,
 - 72 % forest coverage,
 - 69.71 % forest coverage
- 2.
16. Broad-leaved forest constitutes 67.99 % of the total forests and are mainly hardwood (angiosperm trees). The properties of hardwood are:
- Non-porous and presences of vessels
 - Heartwood and non porous
 - Simple structure and porous wood
 - None of the above
17. Starch and oxygen are the results of photosynthesis. What is the formula of plant photosynthesis?
- $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$
 - $2Na + 2H_2O \rightarrow 2NaOH + H_2$
 - $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$
 - None of the above
18. *Pinus* species normally colonized the abandoned and fallow land. The colonization pattern is called;
- Primary succession
 - Regeneration succession
 - Secondary succession
 - Inhibition

19. The Royal Government of Bhutan made a commitment at the conference of parties-15 (COP-15) of United Nation Framework Convention on Climate Change (UNFCCC) in 2009;
- to remain carbon neutral,
 - to remain carbon negative,
 - to reduce use of fossil fuel,
 - to increase forest cover
20. The Ramsar Convention on Wetlands of International Importance was signed in 1971 in the city of Ramsar in Iran. Bhutan declared 3 RAMSAR sites;
- Gantey-Phobji, Buli & Bumdeling
 - Peling-tsho, Gangtey-Phobji, Khotokha
 - Khotokha, Bumdeling & Gaytsa
 - Gangtey-Phobji, Khotokha & Bumdeling
21. Bhutan with abundant fresh water resources with per capita availability of about 94,000 cubic meters per person annually, one of the highest in the world. However, recently there are reports of water shortage in many places in Bhutan. The reasons of water shortage are;
- Drying up of springs and streams,
 - Flash floods and sediments due to intense rainfall,
 - Lack of design and climate proof infrastructure,
 - All of the above
22. Environmental Impact Assessment (EIA) is one of the fundamental processes of developmental projects. EIA is carried out to;
- Reduce the impacts on the environment,
 - Identify and propose mitigation measures,
 - Help protect critical resources from degradation,
 - All of the above
23. A type of relationship where one of the organisms benefits greatly from the symbiosis. In other words, this is a one-sided symbiotic relationship;
- Symbiosis
 - Commensalism
 - Parasitism
 - Mutualism
24. Bhutan's protected area network comprises of National Parks, Wildlife Sanctuaries, Strict Nature Reserves, Botanical Park and Biological Corridors. How many wildlife sanctuaries are established in Bhutan?
- Three (3),
 - Five (5),
 - Two (2),
 - None of the above

25. Forest fragmentation is a major issue in managing and conserving the forest resources resulting in;
- Human-wildlife conflict,
 - Decrease biodiversity,
 - Encroachment of invasive species,
 - All of the above
26. Blue pine is a coniferous evergreen needle leaved tree native to the Himalayas. Blue pine is known by the scientific name;
- Pinus roxburghii*,
 - Pinus bhutanica*,
 - Pinus wallichiana*,
 - Pinus patula*
27. Any disease that results in rapid decay or death of young succulent seedlings of both coniferous and broad-leaved species due to high humidity, moist soil, high organic matter and shade:
- Leaf Spot,
 - Needle blight,
 - Die-back,
 - None of the above
28. The lowest altitude of Bhutan is around 100 m a.s.l. along the southern foothills and highest peak is more than 7000 m a.s.l. in the northern high Himalayas. The distribution of trees is limited by the low temperature at higher altitudes. The generally accepted tree line is:
- 3500 m
 - 4500 m
 - 5000 m
 - 4000 m
29. Royal Government of Bhutan discouraged introducing exotic trees in the country due to its invasiveness characteristics. However, one of the following exotic tree species is introduced in past as valuable timber;
- Thuja orientalis*,
 - Tectona grandis*,
 - Cryptomeria japonica*
 - Eucalyptus*
30. How many biological corridors are established in Bhutan that connects the Protected Area network?
- 7
 - 8
 - 9
 - None of the above

PART II

Short Answer Questions [20 marks]

This part has 4 Short Answer Questions. Answer ALL the questions. Each question carries 5 marks.

1. What do you understand by the following:
 - a. Afforestation
 - b. Reforestation
2. Define the following:
 - a. Temperate forest
 - b. watershed
3. What is Forest thinning and why it is important in forest management?
4. Differentiate between primary succession and secondary succession?

SECTION B
Case Study [50 marks]

Choose either Case I OR Case II from this section. Each case study carries 50 marks. Mark for each sub-question is indicated in the brackets.

CASE STUDY I: Forest structural attributes.

Forest inventory team carried out vegetation survey in a sample plot measuring 40 m by 40 m plot size. All individual trees occurring within the plots attaining a height greater than 1.3 m ($H \geq 1.3$ m) were identified, measured and recorded for total height (m) and diameter at breast height (DBH, at 1.3 m above ground). The measured attributes were analyzed to understand the forest diversity, structural traits and forest types. The sample plot showed Shannon diversity index (H') of 3 with diverse life-forms.

Diameter class distribution is analyzed and depicted as shown in the figure below. Please study carefully and answer the following questions.

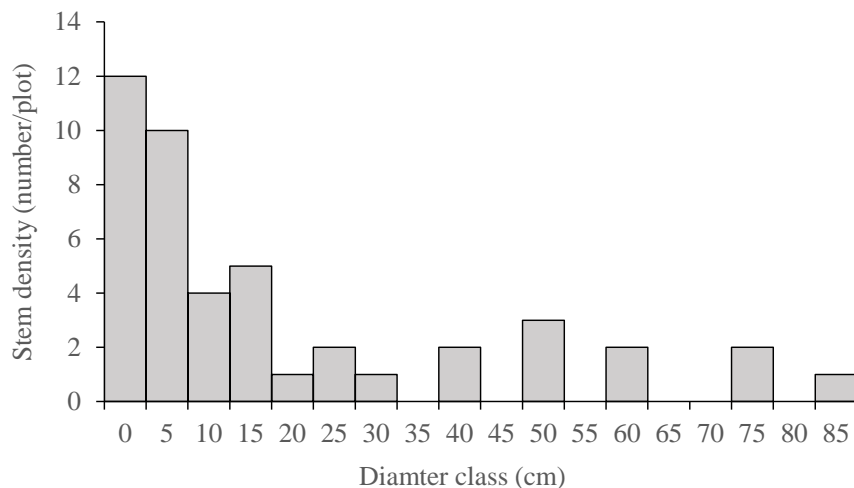


Figure 1. Diameter class distribution of a typical forest type

- Q1. Study and describe the type of forest depicted by the figure above? (15 marks)
- Q2. Explain the regeneration structure and the diversity of the sample forest plot. (15 marks)
- Q3. What role can this type of forest play in a mountainous country? (10 marks)
- Q4. Is this type of forest potential for logging? (10 marks)

CASE STUDY II: Forest-water nexus.

National Forest Inventory report (2023) stated that Bhutan has a total forest coverage of 69.71 % of which 67.99 % of the total forest area are broad-leaved forest and coniferous forest constituted 32.01 %. The cool broad-leaved forest is the most dominant forest types accounting to 28.18 %.

Similarly, the assessment and mapping of water sources in Bhutan (2021) collected data from 7399 water sources across the country. Out of 7399 water sources recorded, springs are recorded as the highest water sources with 67.6 % (5001) followed by streams with 25.7 % (1898). The major rivers are flowing along the valleys.

Owing to the geographical terrain of the country, settlements are mostly located along the mountain slopes. Thus, there is a strong relationship between the forest and water sources originating from the forest watersheds.

Q1. What are the factors affecting water sources in Bhutan? What mitigation measures need to be incorporated into the plan? (10 marks)

Q2. High forest coverage means high evapo-transpiration ratio which ultimately lead to reduction in the ground water. Do you agree with this statement? (10 marks)

Q3. The glaciers and glacier lakes store huge volume of water. Can the communities living down streams entirely depend on these water sources? Which river basin is highly vulnerable to Glacial Lake Outburst Flood? (15 marks)

Q4. How important are the forest watersheds and its relation to monsoon rain? Name at least five major rivers of Bhutan (15 marks)

TASHI DELEK