

**ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2021
EXAMINATION CATEGORY: TECHNICAL**

PAPER III: SUBJECT SPECIALISATION PAPER FOR FORESTRY

Date	: October 31, 2021
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 **8 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. A process in which the natural resources including trees of an area is diminished by external factor or by a combination of factors is
 - a) Forest degradation
 - b) Deforestation
 - c) Forest logging
 - d) All of the above

2. Establishment of forest by any woody plant in and around settlements providing both ecological and aesthetic values:
 - a) Urban forest
 - b) Secondary forest
 - c) Primary forest
 - d) Village forest

3. The treatment of seedlings in the nursery by slowly exposing to the adverse environment conditions in the field:
 - a) Standardization
 - b) Damping off
 - c) Rooting process
 - d) None of the above

4. The reduction of gaseous molecular nitrogen and its incorporation into nitrogenous compounds:
 - a) Nitrification
 - b) Nitrogen cycle
 - c) Nitrogen fixation
 - d) Fertilization

5. The planting of young trees within a forest that is being degraded either by natural cause or after depletion by resource extraction:
 - a) Enrichment plantation
 - b) Bio-engineering plantation
 - c) Mixed plantation
 - d) Rehabilitation/restoration plantation

6. The loss of water vapour from a plant to the outside atmosphere:
 - a) Evapo-transpiration ratio
 - b) Evapo-transpiration
 - c) Evaporation
 - d) Transpiration

7. The International Day of Forests is observed on March 21 every year. The Theme for International Day of Forests 2021 was
- Forest restoration: a path to recovery and well-being.
 - Forest and Education,
 - Forest & Biodiversity.
 - Climate Change.
8. The ecology of individual organisms and populations, including physiological ecology, animal behavior and population dynamics:
- Synecology
 - Ecological niche
 - Autecology
 - Ecotone
9. Parasitism is an interaction of species populations in which one, typically small, organism lives in or on another, from which it obtains food, shelter, or other requirements. Which one of the following is an example of parasitism?
- Nitrogen-fixing bacteria and leguminous plants.
 - The bees and flowers.
 - Ants and plants.
 - Dwarf mistletoe and pine.
10. Outbreak of bark beetle in the mixed conifer forests of Bhutan was reported as early as 1975 from the western part of Bhutan (Schmutzenhofer 1988, Chhetri 1990). Which one of the following is an enabling factors leading to this outbreak?
- Human activity
 - Strict regulation
 - Sustainable harvesting
 - Rugged terrain (Geographical terrain)
11. White bellied heron (WBH) is a critically endangered bird in the world. In Bhutan there are about 27 individuals along different river systems and RSPN is annually spending millions of Ngultrums in conserving WBH
- mainly to study the flying pattern.
 - because of its rarity and loosing habitats.
 - because its economically useful bird.
 - because its religiously and culturally important bird.
12. Springs are considered as clean water source and religiously treated as holy water. A sample of spring water is collected from one of the holy springs and tested for its chemical properties. The holy water sample showed pH of 0.7 and Electrical Conductivity (EC) of 29 mS/m. The holy spring is
- slightly alkaline and consumable.
 - the water sample is slightly acidic and consumable.
 - the water sample is polluted and not consumable.
 - None of the above.

13. The impact of a person or community on the environment, expressed as the amount of land required to sustain their use of natural resources:
- Carbon footprint
 - Ecological footprint
 - Ecological niche
 - Ecological barrier
14. Exotic trees are not encouraged to introduce in Bhutan. However, one of the following trees is introduced in Bhutan and now excepted as valuable timber:
- Shorea robusta* (sal)
 - Tectona grandis* (teak)
 - Cryptomeria japonica*
 - Daubanga grandiflora* (Lambatey)
15. The region of the Earth where life can be found, including soil, water, and air is termed as
- Biome
 - Biosphere
 - Biosphere reserve
 - Ecosystem
16. Bhutan's per capita water availability is more than 100,000 cubic meters per year and is one of the highest in the region. The significant water sources are from
- Glaciers and glacial lakes.
 - High altitude lakes.
 - Forest watersheds (springs & streams).
 - None of the above.
17. Forest occupies a total of 2,730,889 hectares which is 71% of the total geographical area of the country (National Forest Inventory, NFI vol. 1, 2016). The forest definition adopted in NFI is
- All vegetation measuring 1.3 m (ht) and above.
 - Trees with a canopy cover of 10 % and a height above 1.3 m.
 - All woody plants with a height above 1.3 m and covering 50 %.
 - None of the above
18. None Wood Forest Produce/t (NWFP) are goods and services derived from forest other than timber. The most valuable NWFP for commercial use is
- Paris polyphylla*
 - Cane
 - Fiddlehead
 - Fodder
19. The process of capturing and storing of atmospheric carbon dioxide (greenhouse gas) in the underground, the ocean or the terrestrial biosphere. This process is
- Carbon sequestration
 - Carbon emission
 - Carbon cycle
 - None of the above

20. Forest fires damage significant area of forest every year. Which one of the following forest type is prone to forest fire?
- Abies* (Fir) forest above 3000 m a.s.l
 - Shorea* (Sal) forest below 1000 m a.s.l
 - Picea* and *Tsuga* forest above 2500 m a.s.l
 - Pinus* forest type (chirpine & bluepine) around 1000-2500 m a.s.l
21. The Wet Land of International importance is called RAMASR sites and Bhutan currently declared 3 sites. Besides the roosting habitats for Black Necked Crane for its conservation, what benefits the communities derive by declaring the site as RAMSAR site?
- Road construction and river protection
 - Area protected for their common use
 - Construction of hotels or resorts
 - Introduction of high yielding varieties of crops
22. Watershed management recognizes the hydrologic (water) cycle as the pathway that integrates
- Physical
 - Chemical
 - Biological processes
 - All of the above.
23. Which one of the following is not a carbon pool?
- Plant biomass
 - Oceans
 - Soil carbon
 - Deforestation
24. Measurement of a tree diameter at breast height (DBH at 1.3 m) above the ground is important during the field inventory to determine the forest
- Biomass and carbon sequestration.
 - Floristic composition.
 - Access the timber resource potential of a site.
 - All of the above
25. Shifting cultivation (Tseri) is an aged old agriculture practice to sustain and supplement the food requirement. Which of the following is a contributing factor to its phasing out in Bhutan?
- Reduction in fallow period
 - Introduction of invasive weeds
 - Low crop yield
 - Labor intensive
26. Bhutanese traditional papers are made from bark of a shrub of two species commonly known as Dhey-kap and Dhey-nap. The two economically important shrub species are
- Daphne bholua* & *Daphne surel*
 - Edgeworthia gardneri* & *Daphne bholua*
 - Daphne bholua* & *Ficus nerfolia*
 - All of the above

27. Which one of the following oaks (*Quercus* spp) is a deciduous oak and is used for growing Shitake mushroom in Bhutan?
- Quercus semecarpifolia*
 - Quercus griffithii*
 - Quercus glauca*
 - Quercus lanata*
28. Forest succession follows several stages after disturbances such as road construction, mining & quarries along the mid-altitude forests (1000-2500 m a.s.l.) of the Bhutan Himalayas. Which one of the following species is a pioneer species that occupies after disturbance?
- Quercus glauca*
 - Alnus nepalensis*
 - Castanopsis tribuloides*
 - Altingia excels*
29. Growth and preference of forest tree species depends on the availability of humidity (moisture) and temperature. Which of the following tree species is relatively drought resistant?
- Tsuga dumosa*
 - Quercus glauca*
 - Abies densa*
 - Pinus roxburghii*
30. Which of the following is the scientific method for measuring the amount of water entering, stored within, and leaving a watershed?
- Hydrologic budget
 - Water flow
 - Stored water
 - All 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.

- Forest fires whether natural or man-made are found to be one of the major drivers of forest degradation. Do you agree with the statement and why?
- Article 5.3 of the Constitution of the Kingdom of Bhutan states that “*The Government shall ensure that, in order to conserve the country's natural resources and to prevent degradation of the ecosystem, a minimum of sixty percent (60%) of Bhutan's total land shall be maintained under forest cover for all time*”. With the rapid economic development and expansion of road connectivity including hydropower developments, is it feasible to maintain and uphold the mandates of the Constitution for all time to come?

3. “Thousands of timber logs left unsold amid the pandemic, timber piled up without demand” etc....as stated in the recent media. On the other hand, there are cases reported on timber shortages and illegal loggings. What are the causes of these two contrasting events?
4. Define the following;
 - a) Silvo-pastoral practice
 - b) Watershed management

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 I: Plantation and its status after establishment.

Plantations are carried out every year in the country by the relevant agencies. However, success of plantation is not encouraging especially along the mid-altitude river valleys. One such example is the plantation carried out every year along Pachu-Wangchu valley between Paro and Thimphu. Plantations were carried out several times along the same stretch but the success of the plantation is still not significant.

For example; A total land area of about 497 hectares were planted in the mid-80s by the Department of the Forest with a funding support from the donor agencies over a period of 10 years (Project Report, 1984-1997). The main objective of the plantation project was to convert the degraded barren land into a productive forest and to reduce the soil erosion. The species planted comprised of mainly three conifer species of *Pinus wallichiana* (bluepine), *Pinus roxburghii* (Chirpine) and *Cupressus* sp. (Tsenden).

Since then, periodic die-backs were observed five times in nearly one and a half decade (1992-2008) in the established plantations particularly during the early spring months of 1994, 1999, 2001, 2003 and 2008. The pine die-back problem was investigated by the visiting scientists from Japan, Europe and South Africa and found out no indication of biotic factors (disease, pest including nematodes or any out breaks). Similarly, the entomological and pathological investigation also ruled out the biotic factor for Pachu-Wangchu Plantation pine die-back (Chhetri, 1999; 2001; Chhetri and Gurung, 2002). Yet plantations are still being carried out in similar sites every year.

1. What are the likely causes of failure of plantation success along these sites? (15 marks)
2. What are your recommendations for similar sites in the country? (15 marks)
3. As a technical expert, do you still recommend to create plantation in this area? (10 marks)
4. What are the best alternative options in such scenario? (10 marks)

CASE II: Payment for Environmental Services (PES)

Payment for Environmental Services is an incentive-based direct approach to conservation of natural resources whereby service providers receive payments that are conditional on acceptable conservation performance. It is based on the beneficiary-pays rather than the polluter-pays principle. The core principles of PES schemes are that those who provide environmental services should be rewarded for doing so, and those who use the services should pay for their provision. In this line the RGoB has recognized PES as an important alternative financing mechanism to improve Environmental Services in the country.

Currently there are four pilot PES schemes established in the country mainly focusing on the drinking water as the main service. The service providers comprised of community forest groups or watershed management groups with the downstream service beneficiaries either municipalities or hoteliers or industries. These pilot schemes need to be evaluated and the contract term to be renewed once the contract term expires. Such schemes are initiated as a paradigm shift in managing the natural resources including the forest ecosystem in the testing times of global pandemic.

1. State the process in setting up of the PES scheme? (10 marks)
2. What are the necessary conditions for establishing the PES scheme? How can PES help in managing the fragile ecosystem? (20 marks)
3. What are the other potential areas where PES can be upscaled in Bhutan? (10 marks)
4. Name at least 2 Pilot PES schemes established in Bhutan. State your opinion on the future of PES in the country? (10 marks)

TASHI DELEK