

**ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2022
EXAMINATION CATEGORY: TECHNICAL**

PAPER III: SUBJECT SPECIALISATION PAPER FOR FORESTRY

Date	: October 9, 2022
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. The cultivation of forest trees, or woodland management for timber and other wood products is:
 - a) Aviculture
 - b) Agro-forestry
 - c) Silviculture
 - d) Forest ecology
2. A branch of science which deals with the trees and its association with the non-woody perennial:
 - a) Agro-forestry
 - b) Forest management
 - c) Plantation forestry
 - d) Forestry
3. A process used to predict the environmental consequences or effects of a proposed major developmental project and to plan appropriate measures to reduce the effects:
 - a) Environment and social safeguard systems (ESS)
 - b) Environmental impact assessment (EIA)
 - c) Forest clearance approval
 - d) None of the above
4. The onset of Monsoon South Asia starts from West to East along the Himalayan Range and Bhutan is located in the midst of eastern Himalayas. The monsoon reaches Bhutan annually in the month of:
 - a) May
 - b) July
 - c) August
 - d) June
5. Bhutan has four major river systems and several smaller tributary rivers and streams. The sources of water feeding into the river system comes from:
 - a) Glaciers
 - b) wetlands
 - c) Forest watersheds
 - d) All of the above
6. The evergreen board-leaved forest constitutes major forest types of Bhutan. Among many species of Oak (*Quercus*), one of the following oak is a deciduous and serves as useful resource for the people:
 - a) *Quercus lanata*
 - b) *Quercus semecarpifolia*
 - c) *Quercus lamellosa*
 - d) *Quercus griffithii*

7. The International Day of Forests is observed on March 21 every year. The Theme for International Day of Forests of this year (2022) is:
 - a) Forest restoration: a path to recovery and well-being
 - b) Forest and Education
 - c) Forest & Biodiversity
 - d) Forests and sustainable production and consumption
8. Owing to the geographical setting of the country, Bhutan has different forest types from sub-tropical along the southern foothills to dry-pine dominated along the valley bottom slopes of the inner river valleys to alpine types in the northern high mountains. Among the following conifer species, which conifer is relatively drought resistant?
 - a) *Tsuga dumosa*
 - b) *Pinus excelsa*,
 - c) *Abies densa*
 - d) *Pinus roxburghii*
9. The Department of Forest and Park Services has recently completed the second National Forest Inventory. During the inventory one of the parameters measured was diameter at breast height (DBH) of a tree. What is the importance of measuring DBH (diameter) of a tree?
 - a) Understand the population dynamics of a forest
 - b) Estimate the biomass
 - c) Calculate the forest diversity
 - d) All of the above
10. Bark beetle is one of the most destructive forest pests in Bhutan. The 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). The spread of bark beetle infection can be controlled through
 - a) keeping the infected trees in the forest ecosystem.
 - b) selectively felling the infected trees.
 - c) buried the infected logs under the soil.
 - d) felling and extracting the infected trees from the site.
11. Altitudinally, Bhutan extends from about 100 m a.s.l. along the southern foothills to more than 7000 m a.s.l. in the northern high Himalayas. The growth of trees is limited by climatic conditions and hence the upper limit of the tree growth is accepted above:
 - a) 4000 m a.s.l
 - b) 3500 m a.s.l
 - c) 4800 m a.s.l
 - d) 5000 m a.s.l
12. Trees are felled for various purposes besides as timber. Natural raw materials extracted from plants are widely used in manufacturing paper. Which of the following natural polymer is used in paper making?
 - a) Chitin
 - b) Keratin
 - c) Cellulose
 - d) Elastin

13. The establishment of vegetation in an open barren area through natural process is termed as:
 - a) Reforestation
 - b) Natural regeneration
 - c) Secondary succession
 - d) Primary succession
14. The impact of a person or community on the environment, expressed as the amount of land required to sustain their use of natural resources:
 - a) Ecological footprint
 - b) Carbon footprint
 - c) Foot print
 - d) None of the above
15. Blue pine and Chir pine are the dominant conifers in the mid dry valleys of Bhutan Himalayas. These two pines are known to have colonized the disturbed, abandoned and fallow land after the inaction of Forest Act of 1969. The colonization pattern is called:
 - a) Primary succession
 - b) Regeneration succession
 - c) Secondary succession
 - d) Inhibition
16. A total of 8.61 % of the total land area of Bhutan falls under the biological corridors (BCs) which provides linkages and connectivity between the various protected areas. The 8 BCs were declared as gift to the earth and people of Bhutan in:
 - a) 1998
 - b) 1997
 - c) 2001
 - d) 1999
17. An interaction in population ecology, whereby members of the same species compete for limited resources are called:
 - a) Extra specific competition
 - b) Competition
 - c) Intra specific competition
 - d) None of the above
18. Introducing of alien (exotic) plants/trees are not encouraged by the law and may lead to environmental challenges in the ecosystems if introduced. One of the following plant species is introduced species and is of ecological concern in Bhutan:
 - a) *Populus ciliata*
 - b) *Salix babylonica*
 - c) *Cryptomeria japonica*
 - d) *Pinus roxburghii*

19. A successional change, usually from an existing climax community, leading to a less diverse and less structurally complex community is called:
- Retrogressive succession
 - Allogenic succession
 - Progressive succession
 - All of the above
20. Mass bamboo flowering was observed since 2008 in Bhutan. The three gregarious flowering of bamboos in Bhutan were observed viz.; *Borinda grossa*, *Thamnocalamus spathiflorus* and *Yushania microphylla*, a temperate bamboo species along Dochula, Pelela and Yotongla respectively. The drying of bamboo is a natural phenomenon and it occurs once in every:
- Life time
 - Decade
 - 50 years
 - Every alternate year
21. The protected area (PA) network of Bhutan constitutes 51.44 % of the total land area; The PA network consists of National Parks, Wild life Sanctuaries, Strict Nature Reserve and Biological corridors. The total number of PAs in the country is:
- 10
 - 20
 - 17
 - 18
22. Bhutan has total forest coverage of 71 % of the country's total geographical area. Yet the timber prices in the market are still high. This is because of
- limited saw mills.
 - limited logging area.
 - high cost of logging.
 - All of the above
23. Dwarf mistletoe (*Arceuthobium minutissimum*) is a leafless parasitic plant considered as the the smallest known dicotyledonous plant. It is very common to occur on the following tree species:
- Pinus roxburghii*
 - Picea spinulosa*
 - Tsuga dumosa*
 - Pinus wallichiana*
24. Habitat improvement and waterhole managements are considered as an important activity for Tiger conservation in Bhutan. Why tiger is important in the ecosystem when this very particular animal preys on the domestic livestock?
- Represents power and strength
 - Revered creature
 - Represents health of ecosystem
 - All of the above

25. What distinguishes a keystone predator?
- It is extremely abundant.
 - It regulates its prey below the carrying capacity of the habitat.
 - It is a specialist, meaning that it preys on only one species.
 - It has a large impact on the community, even though it is not particularly abundant.
26. Which of the following ecosystems would you expect to have the highest productivity?
- Tropical wet forest
 - Boreal forest
 - Sub-tropical desert
 - Temperate grassland
27. In an experimental watershed under clear-cutting of vegetation, what effect do you expect on the ecosystem dynamics?
- It increased aboveground biomass.
 - It increased secondary production.
 - It increased nutrient export.
 - It increased the pool of soil organic matter.
28. Which one of the following tree species falls under Schedule-1 of the Forest and Nature Conservation Act of Bhutan, 1995?
- Cupressus coryneyana*
 - Tectona grandis*
 - Aquilaria malaccensis*
 - Shorea robusta*
29. Tseri (Shifting cultivation) is one of the agricultural systems practiced widely in the sub-tropical and the broad-leaved forests of Bhutan in the past. Why tseri practice is phased out in Bhutan?
- Lower crop yield
 - Labor intensive
 - Poor soil
 - None of the above
30. When forested habitats are fragmented, why does their quality decline?
- Trees on the edge of the fragments are frequently blown down
 - The edges of the forests are exposed to more sunlight, which increases temperatures and decreases humidity
 - Weedy species from the deforested areas invade the edge.
 - 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.

1. Biological corridors (BCs) constituted 8.61% of the total land area and connect the protected areas. State 2 reasons why BCs are important?
2. Payment for environmental services (PES) is adopted as means to reward upland land managers/communities for ecosystem services provided. Is this mechanism sustainable?
3. Waste management is a big challenge in Bhutan such as leachate, open burning, littering, drainage blockage etc. Besides already existing strategies, can you suggest innovative alternative options that can help to tackle the waste management in Bhutan?
4. Define the following terms;
 - a) Nurse log
 - b) Primary 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 I: Blue pine forests and its resources.

Blue pine forests are distributed along the mid-altitude temperate forests of Bhutan such as Bumthang, Phobjikha & Khotokha in Wangduephodrang, Thimphu, Paro, Haa and a part of Trongsa & Chukha Dzongkhag covering an area of 800.24 km² (LCMP, 2010). Blue pine forest appear as transitional forest between human use landscape and natural mixed conifer forest, and are monospecific (single species dominant) and occasionally mixed with oak, hemlock, spruce with understory of *Lyonia*, *Rosa*, *Pieris*, *Berberis* spp etc. Blue pine timbers are one of the most widely used timber in the construction sectors. Ecologically, blue pine regenerates profusely on a newly disturbed landscapes and clear-felled sites within its ecological range.

Blue pine is prone to attack by mistletoe such as *Arceuthobium minutissimum* and *Taxilus kampiferi*. The mistletoes infested trees are weaken and are prone to secondary attacks by insects, including bark beetle.

1. What are the silvicultural practices recommended for the improvement of blue pine timber quality? **(15 Marks)**
2. What is the scientific name of blue pine and why blue pine timber is widely used in construction sectors? Name any three *Pinus* species found in Bhutan. **(15 Marks)**
3. As a trained forester, do you recommend to create blue pine plantation on a large scale to meet the timber demand? **(10 Marks)**
4. Blue pine forests are prone to forest fire and most of fire cases are reported from the pine zones. What management options do you recommend to mitigate such incidences? **(10 Marks)**

CASE II: Forests and climate

Bhutan is located in the midst of eastern Himalayas and is a mountainous country with limited arable land along the river valleys. Bhutan is the only country with its constitution mandated to keep 60 % forest cover for all time to come and currently Bhutan has 71 % forest cover. Bhutan emits 3.8MT CO₂_e-yr (GHG) and sequesters 9.4 MT CO₂_e yr and is currently carbon negative.

However, mountainous terrain coupled with the climate change and considering the sensitivity of the fragile mountainous ecosystem, Bhutan is likely to impact severely if our developmental activities are not carefully planned with effective mitigation plans in place.

1. What are the recommended strategies to balance Bhutan's economic development and its conservation measures? **(15 Marks)**
2. Human wildlife conflict is a serious challenge to address and is always blamed on the strong conservation polices. How can you justify this statement? **(15 Marks)**
3. Bhutan is a carbon negative country. How can Bhutan benefit from being carbon negative? **(10 Marks)**
4. Bhutan committed to remain carbon neutral during the COP 21 in 2015. What do you understand by carbon neutral and what is international treaty on climate change? **(10 Marks)**

TASHI DELEK