

**ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2015
EXAMINATION CATEGORY: TECHNICAL**

PAPER III: SUBJECT SPECIALIZATION PAPER for *Forestry*

Date	: 11 October 2015
Total Marks	: 100
Examination Time	: 150 minutes (2.5 hours)
Reading Time	: 15 Minutes (prior to examination time)

GENERAL INSTRUCTIONS:

1. Write your Roll Number clearly and correctly on the Answer Booklet.
2. The first 15 minutes is being provided 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 and SECTION B:
 - **SECTION A** has two parts: Part I - 30 Multiple-Choice Questions
Part II - 4 Short Answer QuestionsAll questions under SECTION A are COMPULSORY.
- **SECTION B** consists of two Case Studies. Choose only **ONE** case study and answer the questions under your choice.
4. 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.
5. Begin each Section and Part in a fresh page of the Answer Booklet.
6. You are not permitted to tear off any sheet(s) of the Answer Booklet as well as the Question Paper.
7. Use of any other paper including paper for rough work is not permitted.
8. You are required to hand over the Answer Booklet to the Invigilator before leaving the examination hall.
9. This paper has 10 printed pages in all, 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 the correct answer chosen in the Answer Booklet against the question number. E.g. 31 (c). Each question carries ONE mark. Any double writing, smudgy answers or writing more than one choice shall not be evaluated.

1. The ecosystem with the highest primary productivity belongs to:
 - a. Sub-tropical forest
 - b. Tropical wet forest
 - c. Boreal forest
 - d. Temperate forest

2. Phibsoo Wildlife Sanctuary is the smallest protected area in the country and was declared as Phibsoo Reserved Forest in the year:
 - a. 1975
 - b. 1977
 - c. 1993
 - d. 1974

3. A type of research which is designed to solve practical problems under the researchers' environment is:
 - a. Basic research
 - b. Adaptive research
 - c. Applied research
 - d. Strategic reserach

4. Some of the main tree species of sub-tropical broad-leaved forest of the Bhutan Himalayas are:
 - a. *Shorea robusta*, *Schima wallichii*, *Bombax ceiba*, *Polyalthia simiarum*
 - b. *Dillenia indica*, *Shorea robusta*, *Quercus griffithii*, *Polyalthia simiarum*
 - c. *Shorea robusta*, *Duabanga grandiflora*, *Quercus lanata*, *Symplocos lucida*
 - d. *Shorea robusta*, *Quercus lamelosa*, *Talauma hodgsonii*, *Larix griffithii*

5. One of the following tree species is an exotic and introduced in Bhutan mainly for its wood quality:
 - a. *Quercus oxyodon*
 - b. *Tectona grandis*
 - c. *Pinus excelsa*
 - d. *Picea spicata*

6. *Arceuthobium minutissimum* caused a common plant disease for blue pine and it is commonly called:
 - a. Bark beetle
 - b. Die-back
 - c. Mistletoe
 - d. Pine looper

7. Shifting cultivation is an aged old farming practice in the Bhutan Himalaya. However, this practice did not continue mainly because of:
 - a. Limited forest land for shifting cultivation practice
 - b. Limited labor force
 - c. Human-wildlife conflict
 - d. None of the above

8. The forest fragmentation as a result of human intervention always resulted in the decline of their quality because of:
 - a. Trees on the edge of the fragments are frequently blown down.
 - b. Weedy species from the deforested areas invade the edge.
 - c. The edges of the forest are exposed to more sunlight, which increases temperature and decreases humidity
 - d. All of the above

9. The 600th Community Forest (CF) in Bhutan was handed over to the Community Forest Management Group (CFMG) by His Excellency Lyonpo Yeshey Dorji, Minister for MoAF, on the 24th of June 2015: The name of the community forest is:
 - a. Goenkha Community Forest, Wangdiphodrang Dzongkhag,
 - b. Kyentshen Community Forest, Haa Dzongkhag
 - c. Gayzore Community Forest, Pemagatshel Dzongkhag
 - d. Geneykha Community Forest, Thimphu Dzongkhag

10. Why does population growth decline as population size approaches carrying capacity?
 - a. Less rainfall and high temperature
 - b. Natural calamity like fire, flood
 - c. Limited available resources
 - d. None of the above

11. Bhutan is a member to the convention of wetland and declared three RAMSAR sites in the country. The three sites are:
- Gangtey-Phobji, Bumdeling, Khotokha
 - Peling-tso, Bumdeling, Khotokha
 - Gangtey-Phobji, Khotokha, Gyetsa
 - Gangtey-Phobji, Bumdleling, Nobtsonapata
12. *Alnus nepalensis* is a pioneer species and colonizes the disturbed sites along the roads and slides. This process of colonization pattern is called;
- Primary succession
 - Regeneration succession
 - Secondary succession
 - Inhibition
13. The comparison between the dry and the wet bulb temperatures enables the:
- Calculation of maximum temperature
 - Calculation of average temperature
 - Calculation of minimum temperature
 - None of the above
14. The area of land that drains to a common body of water, whether a stream, river, or lake:
- Catchment or watershed
 - Sub-catchment
 - Watershed
 - All of the above
15. Significant amount of water originates from the watersheds within the river basins mainly fed by rain during the monsoon. Therefore, the focus of management should be given to protection of the following areas:
- Glaciers in the northern High Himalaya
 - Alpine and Conifer forest
 - Cool and warm temperate broad-leaved forests
 - All of the above

16. It is important to consider integrated watershed management (IWM) approach for sustainable management of the water resources because of mainly:
- Interdependence of issues
 - Avoidance of duplications
 - Community dependence on external inputs
 - All of the above
17. A land unit comprised of numerous sub watersheds and tributaries draining the entire basin past a single point;
- Watershed
 - Catchment
 - River basin
 - All of the above
18. Rainwater that is stored in the soil and that is available for uptake by plants and is the largest fresh water resource on Earth:
- Green water
 - Blue water
 - Atmospheric water
 - None of the above
19. A situation in which a species or other taxonomic group is restricted to a particular geographic region, owing to factors such as isolation or in response to soil or climatic conditions:
- Relict species
 - Primitive species
 - Endemism
 - None of the above
20. A few years back, several incidences of bamboo flowerings were observed from east to west in the Bhutan Himalayas. Such phenomena occur once in every:
- Decade
 - 50 years
 - 100 years
 - None of the above

21. Deysho- a traditional paper was produced from shrub plant species called *Daphne bholua*. Which family does *Daphne bholua* belongs?
- Myrsinasease
 - Thymelaeaceae
 - Araliaceae
 - Daphniphyllaceae
22. When is a behavioral trait adaptive?
- When it is favored by natural selection.
 - When it makes individuals more likely to survive, relative to individuals without the trait.
 - When it helps individuals produce more offspring than individuals without trait
 - All of the above
23. Temperate forests are found in which of the following climate types?
- Wet tropical
 - Mid-latitude cold and humid
 - Subtropical dry
 - Mid-latitude steppe
24. The Intra-montane basin of the Bhutan Himalaya lies in the lee ward side resulting in:
- High temperature
 - Low humidity
 - Less rainfall
 - All of the above
25. Any person appointed by the Royal Government of Bhutan to carry out any of the provisions of Forest and Nature Conservation Act of Bhutan:
- Chief Forestry Officer
 - Forest Range Officer
 - Forest Officer
 - Forest Beat Officer

26. Northern Forest Complex (NFC) of the Bhutan Himalaya mainly consists of three national parks:
- Jigme Dorji National Park, Jigme Singye Wangchuck National Park, Wangchuck Centennial Park
 - Jigme Dorji National Park, Bumdeling Wildlife Sanctuary, Wangchuck Centennial Park
 - Wangchuck Centennial Park, Jigme Dorji National Park, Jigme Khesar Strict Nature Reserve
 - Jigme Khesar Strict Nature Reserve, Bumdeling Wildlife Sanctuary, Wangchuck Centennial Park
27. The major feature of this design is its capacity to simultaneously handle two known sources of variation among experimental units:
- Completely Randomized Design (CRD)
 - Randomized Complete Block Design (RCB)
 - Latin Square Design (LS)
 - None of the above
28. There are seventeen (17) species of conifer of which five (5) are introduced. Which one of the following species is exotic:
- Abies densa*
 - Juniperus recurva*
 - Cupressus corneyana*
 - Ceder deodar*
29. What is an adaptation?
- A trait that improves the fitness of its bearer, compared to individuals without the trait.
 - A trait that changes in response to environmental influence.
 - A trait that existed a long time in the past.
 - A trait that is rudimentary, and no longer functions.
30. What is the only evolutionary mechanism that leads to adaptation?
- Mutation
 - Migration
 - Selection
 - Genetic drift

PART II – Short Answer Type Questions (20 Marks)

Answer ALL the questions. Each question carries 5 marks. Mark for each sub-question is indicated in the brackets.

1. How Sokshing (traditional forest management practice) helps in the management of secondary forest? **Keywords:** human wildlife conflict, biodiversity, conservation, buffer forest. (5)
2. Which is the smallest protected area in Bhutan? When was it established and where? Why this protected area is important? (5)
3. Define wetland? Why do we need to protect wetland? How many RAMSAR SITES are there in Bhutan, name them? (5)
4. What do you understand by the term ecological foot print? Please discuss. (5)

SECTION B

Case Study

Choose either Case 1 or Case 2 from this Section. Each Case carries 50 marks. Mark for each sub-question is indicated in the brackets.

CASE STUDY I: Conservation of sub-tropical broad-leaved forest of the Bhutan Himalayas.

Broad-leaved forests of the Bhutan Himalayas constituted about 52% of the country's total forest area. Sub-tropical broad-leaved forest zones stretched from Samdrupjongkhar in the East to Samtse in the West along the southern Bhutan. These forests are under sever human threats and required attention for its protection.

The study along three series (Gomtu, Pasakha & Dechling) revealed a total of 168 species. *Schima wallichii*, a sub-tropical element belonging to evergreen broad-leaved species was appeared as the most common dominant in all the three series of Pasakha, Gomtu & Dechling. Gomtu series was mainly dominated by *Shorea robusta* in a relatively shallow soil while other sites were dominated by diverse tree species. The dominants along Pasakha series were *Aphanamixis polystachya*, *Duabanga grandiflora*, while Dechiling series were mainly dominated by *Syzygium cumini*, *Persea minutiflora*, and *Altingia excelsa*. Dendrogram showed 6 different forest types of the sub-tropical belts. 1) Riverrine, 2) True Oak-Laurel, 3) *Schima-Castanopsis* (Evergreen broad-leaved forest), 4) *Shorea robusta* (sub-tropical deciduous forest), 5) *Salix tetrasperma* (deciduous wetland forest), and 6) *Altingia excelsa* (refuge relic evergreen broad-leaved forest).

The information generated from this study serves as an important baseline data for the development of good management plan of the subtropical broad-leaved forest in the Bhutan Himalayas.

Briefly answer the following questions:

Q1. Human wildlife conflict is a major problem in the southern foothills of Bhutan. Yet we still insist to protect and conserve the habitats of the wildlife. Using your skills and knowledge, how would you justify the conservation of sub-tropical broad-leaved forest while human-wildlife conflict is a serious issue? (10 marks)

Q2. Some researchers stated that grazing is an integral part of the broad-leaved forest management. Discuss using your ecological knowledge if grazing and subtle human interventions are threat to the broad-leaved forest management. (10 marks)

Q3. In managing the broad-leaved forest, what silviculture system would you apply for sustainable management? (10 marks)

Q4. Altitudinal forests along the southern hills are found to be ecologically critical. However, there are several strong human interventions taking place in these areas. Why these forests are important? (15 marks)

Q5. Write three (3) importance of broad-leaved forest other than timber? (5 Marks)

CASE STUDY II: Water Resources of the Bhutan Himalayas

It is believed that the nature is composed of four elements (*jung-wa-zhi*) which are revered: soil (*sa*), water (*chu*), fire (*mey*) and air (*luung*). As a revered abundant renewable resource, water has not only helped to sustain its cultural heritage but also helped in earning much needed capital for nation building, a true lifeline for Bhutan. Water has an explicit significance to ecological, social, cultural, economic and political spheres of Bhutan. However, with the development, besides agriculture, the economy is largely dependent on the development of hydropower generation and these hydropower plants contribute significantly to the overall GDP growth (17.61 %) of economy.

The per capita availability of water per annum is more than 100000 m³. The total hydropower generation potential of the country is estimated at 23,765 megawatt (MW). The sustainable harvesting of these resources depends a lot on the health and quality of the country's watersheds.

However, with the construction of network of roads, hydropower dams, loggings and many more developmental activities taking place in the country, there is a risk that watersheds may degrade. Land-use change, pollution, and fragmentation of agriculture land are some of the risks associated to human activities that lead to low water retention capacity, low soil fertility, landslides and floods. Therefore, development of watershed management plans becomes vital for proper management of the watersheds in the country.

Briefly answer the following questions:

Q 1. Why is it important to use integrated watershed management approach to protect the watersheds for sustainable water resources in the country? (Marks 10)

Q 2. Sub watersheds are found to be playing an important role in securing water resources. On this account, please discuss how forest plays an important role in conserving and recharging the ground water. (15 Marks)

Q 3. It is also believed that many scientist found that more trees means more consumption of water from the ground through transpiration, evapo-transpiration etc. In this regard, we may get more water by taking all the timber resources from the watersheds. Justify your stand. (10 Marks)

Q. 4. How sustainable is our hydropower considering, increasing pressure from all sides such as roads, dams, etc in addition to increasing temperature that leads to receding of glaciers. (15 Marks)

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