ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2023
EXAMINATION CATEGORY: TECHNICAL

PAPER III: SUBJECT SPECIALISATION PAPER FOR FORESTRY

Date	: October 7, 2023
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 **7 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 forest management tool that improves growth rate, health and timber value of the remaining trees;
   a) Thinning
   b) Aviculture
   c) Horticulture
   d) None of the above

2. A floating wood that has been washed up on the shore or riverbed is termed as
   a) Log
   b) Debris
   c) Driftwood
   d) Plank

3. An organism that uses carbon dioxide as its main or sole source of carbon
   a) Heterotroph
   b) Autotroph
   c) Auxin
   d) Autosome

4. The first forest school was established by the Forest Department in Kalikhola or present Lhamoizingkha in the year
   a) 1974
   b) 1965
   c) 1972
   d) 1971

5. There are five major river basins in Bhutan. One of the following major river originates from outside of Bhutan
   a) Wangchhu
   b) Punatsangchhu
   c) Mangdechhu
   d) Drangmechhu

6. Fir, hemlock, spruce, larch and Junipers are found at the higher altitudes of the Bhutan Himalayas while blue pine and chirpine are found at the lower valleys. One of the following conifer species can thrive relatively in a drier site;
   a) *Abies densa*
   b) *Pinus wallichiana*
   c) *Pinus roxburghii*
   d) *Juniperus recurva*

7. The Second National Tiger Survey report 2021-2022 was launched on 29th July 2023 coinciding with the International Tiger Day. The survey report revealed increase in Tiger numbers from 2015 to 2023 by
   a) 20 %
   b) 26%
   c) 18%
   d) 27%

8. Conifer species are ideal for timber due to its fast growth, good wood properties and its availability. One of following conifer species shades leaves annually and not widely used as timber.
   a) *Cupressus corneyana*
   b) *Pinus excelsa,*
   c) *Cyroptomeria japonica*
   d) *Larix griffithii*

9. The second national forestry inventory report was launched on 31st July 2023 coinciding with the World Rangers Day. The total forest area has reduced from 71 % in 2016 to 69.71 % in 2023. One of the reasons of forest cover reduction is
   a) Climate change
   b) Pest and diseases
   c) Increase in forest biomass
   d) Land-use change

10. The forest regeneration assessment was carried out in 2 hectares under conifer forest types. The 2 hectares is equivalent to
    a) 2000 m^2
    b) 25000 m^2
    c) 20000 m^2
    d) 2500 m^2

11. The science which deals with the investigation of physical & chemical processes in the atmosphere, including observation, forecasting and modelling:
    a) Hydrology
    b) Meteorology
    c) Ecology
    d) Climatology

12. Daphne bark is used in making traditional paper. Which one off the following natural polymer is an essential constituents in paper making?
    a) Chitin
    b) Keratin
    c) Cellulose
    d) Elastin

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:
    a) Carbon footprint
    b) Ecological footprint
    c) Human footprint
    d) Climate impact

14. 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

15. During the National Forest Inventory exercise, one of the parameters measured is diameter at breast height of a tree (DBH at 1.3 m). Why DBH data is important?
    a) Age class distribution,
    b) Biomass estimation,
    c) Regeneration dynamics,
    d) All of the above

16. The result of photosynthesis in presence of sun light is starch and oxygen. What is the chemical formula of photosynthesis?
    a) $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$**.**
    b) $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$
    c) $2Na + 2H_2O \rightarrow 2NaOH + H_2$
    d) All of the above

17. The establishment of a forest or stand of trees in an area where there was no recent tree cover;
    a) Plantation
    b) Succession
    c) Reforestation
    d) Afforestation

18. An interaction in population ecology, whereby members of the same species compete for limited resources is called;
    a) Extra-specific competition
    b) Competition
    c) Intra-specific competition
    d) All of the above

19. The part of the Earth's environment in which living organisms are found and with which they interact to produce a steady-state system, effectively a whole-planet:
    a) Biogeocoenosis
    b) Biosphere reserve
    c) Biogenesis
    d) Biosphere

20. The beginning of a seed, spore or other structure usually following a period of dormancy is:
    a) Birth
    b) Phenology
    c) Germination
    d) Dormancy

21. The drying of bamboo occurs after mass flowering and it occurs once in every:
    a) Decade
    b) 25 years
    c) 50 years
    d) None of the above

22. The development of roots on a stem while it is still attached to the parent plant is termed as:
    a) Stem cutting
    b) Root cuttings
    c) Grafting
    d) Air layering

23. The characteristics of populations change through time;
    a) Stagnation
    b) Progression
    c) Selection
    d) Evolution

24. The evolutionary history of a taxonomic group;
    a) Phylogeny
    b) Phycology
    c) Phenology
    d) *Ecology*

25. The functional position of an organism in its environment, comprising the habitat in which the organism lives, the periods of time during which it occurs and is active there, and the resources it obtains there.
    a) Biosphere
    b) Biomes
    c) Ecosystem
    d) Ecological niche

26. Bhutan is located in the humid eastern part of the Himalayas and is blessed with different types of forest. The evergreen oak-laurel forest dominates along the mid altitudes. These forest types are important for the community's livelihood;
    a) Timber and non-timber resource
    b) Fodder and litter for cattle bedding
    c) Main water source
    d) All of the above

27. Which of the following ecosystems would you expect to have the highest biodiversity?
    a) Tropical wet forest
    b) Boreal forest
    c) Sub-tropical desert
    d) Temperate grassland

28. Department of forest is prescribing a clear-fell silviclтural system in an experimental watershed. What would be the effect on the ecosystem dynamics?
    a) Enhance growth of aboveground biomass
    b) Increases the water discharge throughout the year
    c) Increase nutrient export and surface run-off
    d) None of the above

29. Bhutan's protected area network comprises of National Park, Wildlife Sanctuaries, Strict Nature Reserve and Biological Corridors (BC). How many biological corridors are established in Bhutan's PA system?
    a) 7
    b) 8
    c) 9
    d) None of the above

30. The only country in the world with its constitution mandated to keep 60 % forest cover for all time to come.
    a) Belgium
    b) Japan
    c) Korea
    d) 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 is watershed and why watershed management is important particularly in the mountainous country?

2. What is sustainable forest management? Give 3 examples of prescribed silvicultural practices in Bhutan

3. Waste management is a major problem in Bhutan. Why waste management is still a challenge? What are your innovative ideas in tackling the waste management? *Please do not cite the ideas and plans that are already in practice.*

4. What do you understand by the following;
    a) Ecological niche
    b) Species area curve

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: Vegetation pattern of the Bhutan Himalayas and its importance

Bhutan is a mountainous country located in the humid eastern part of the Himalayas with a relatively limited flat-land along the river valleys. These river valleys are so called dry valleys running north-south direction along the mid-altitudes where major settlements are located. These river valleys are distributed from east to west separated by the mountain passes that make up the entire country. Dry valleys are defined by drier conditions along the valley bottoms and moisture conditions increases along the altitudes leading to moist-wet conditions under cloud cover on the mountaintops. These local climatic phenomena are influenced by the mountain-valley wind circulation system. As a result, a unique distribution pattern of vegetation are formed along the altitudinal gradient from humid conifer forest on the mountain top, wet oak-laurel forest along the mid-altitude to dry pine forest at the lower altitude near the valley bottom. Thus, forming an important habitat for different types of lifeforms of the mountain ecosystems.

1. How important are the mountain forest resources to the communities along the downstream river valleys? Briefly state at least two important resources besides timber and non-timber forest resources **(15 marks)**
2. Why are major settlements located along the valley bottom? **(10 marks)**
3. Which forest types are potential for commercial logging along the altitudinal gradient? What are the recommended silvicultural treatments? **(10 marks)**
4. What are the economic and ecological potentials of these mountain forest ecosystems? **(15 marks)**

CASE STUDY II: Gangtey-Phobji RAMSAR site (*Wetland of International importance)*

Gangtey-Phobji wetland is the third RAMSAR site (*wetland of international importance*) declared in 2016. It is located at 2900 m a.s.l. in Wangduephodrang, West-Central Bhutan. Gangtey-Phobji has the largest high-altitude wetland and serves as an important winter roosting habitat for over 300 black-necked cranes (*Grus nigricollis*) every year. The core wetland area occupies the valley bottom while lower slopes were dominated by agricultural fields mainly potato cultivation and buckwheat.

Higher soil moisture contents were recorded on the surrounding mountaintops and decreased towards the lower altitude in the pine forest zone and again soil moisture increased towards the wetland. The major life-form of forests along the North-East were mixed-conifer at the mountain top and Blue Pine Forest at the lower altitude. On the contrary, along the South-West Mountain slopes, the major life-form was mainly Blue Pine Forest stretching from mountain top to the lower altitude.

1. Why Bhutan declared RAMSAR sites when 51.44 % of the total geographical area is already under the protected area system comprising of National Parks, Wildlife Sanctuaries, Strict Nature Reserves and Biological Corridors? Justify your stand. **(20 marks)**
2. What are the wetland conservation benefits to the livelihoods of the local communities? State ecological importance of the wetland conservation? **(15 marks)**
3. How important are the surrounding forests in sustainable management of wetland? And what are the potential threats to wetland conservation and its implication to other biodiversity conservation? **(15 marks)**

TASHI DELEK