

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

PAPER III: SUBJECT SPECIALISATION PAPER FOR ARCHITECTURE

Date	: October 5, 2024
Total Marks	: 100
Writing Time	: 150 minutes (2.5 hours)
Reading Time	: 15 Minutes (prior to examination 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 the 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 the Section, Part and Question Number will NOT be evaluated and no marks will be awarded.
6. Begin each Section and Part on 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 to 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. Which architectural style is characterized by pointed arches, ribbed vaults, and flying buttresses?
 - a) Romanesque
 - b) Gothic
 - c) Baroque
 - d) Renaissance

2. What is the function of a lintel in a building structure?
 - a) To provide additional floor space
 - b) To serve as a decorative element
 - c) To support the load above openings like doors and windows
 - d) To enhance ventilation

3. Which timber joint is known for its strength and is typically used in traditional woodworking to join a horizontal member to a vertical member?
 - a) Dovetail joint
 - b) Scarf joint
 - c) Mortise and tenon joint
 - d) Finger joint

4. What is the primary relationship described by Hooke's Law?
 - a) Stress is inversely proportional to strain
 - b) Stress is directly proportional to strain within the elastic limit
 - c) Strain is independent of stress
 - d) Stress is equal to strain

5. In sustainable architecture, how does thermal mass contribute to indoor comfort in a climate with high diurnal temperature variation?
 - a) By allowing rapid cooling during the night
 - b) By storing heat during the day and releasing it at night
 - c) By preventing any temperature fluctuations
 - d) By reflecting sunlight away from the building

6. Which construction method involves the use of components assembled on-site?
 - a) Cast-in-place concrete
 - b) Masonry construction
 - c) Prefabrication
 - d) Timber framing

7. Which orientation is generally best for a building in a temperate climate to optimize passive solar heating?
 - a) North-South
 - b) East-West
 - c) Diagonal to prevailing winds

- d) Facing directly into prevailing winds
8. In the context of structural materials, what does the term "ductility" refer to?
- The ability to withstand compression
 - The ability to deform under tensile stress
 - The ability to resist shear forces
 - The ability to return to original shape after deformation
9. Which of the following is not the typology of rabsey in traditional Bhutanese architecture?
- Gomang Gocham
 - Parop Rabsey
 - Gyesargo Rabsey
 - Zhubor rabsel
10. Which of the following materials is most effective at absorbing sound and reducing noise within a space?
- Glass
 - Concrete
 - Carpet
 - Metal
11. Which typology is predominant vernacular houses in western part of Bhutan?
- Stone masonry walls with internal timber frames and openings
 - Timber frame structure
 - Rammed earth walls with internal timber frames and openings
 - None of the above
12. The architectural order from the base to top of kachen is:
- Phue-Raep-Chem-Drey-Zhu-Kaden
 - Kadhen-Raep-Chem-Drey-Phue-Zhu
 - Kadhen-Chem-Raep-Drey-Zhu-Phue
 - Kadhen-Chem-Drey-Zhu-Phue-Raep
13. The Parthenon, a famous temple in Athens, Greece, is an example of which architectural order?
- Doric
 - Ionic
 - Corinthian
 - Tuscan
14. Which of the following is NOT a passive design strategy for managing solar heat gain?
- Using deciduous trees for seasonal shading
 - Incorporating deep roof overhangs
 - Installing photovoltaic panels on the roof
 - Orienting windows to avoid direct sunlight
15. Which component of an HVAC system is responsible for removing heat from indoor air?
- Air handler
 - Furnace
 - Condenser
 - Evaporator coil

16. What style of architecture is the building shown in the photo?

- a) Gothic
- b) Renaissance
- c) Neoclassical
- d) Postmodern



17. 1 inch = _____ cm

- a) 3.54
- b) 2.54
- c) 3.45
- d) 2.45

18. In structural engineering, what does the term "factor of safety" refer to?

- a) The ratio of the maximum load to the allowable load
- b) The ratio of the dead load to the live load
- c) The ratio of the material strength to the design strength
- d) The ratio of the ultimate load to the yield load

19. Which of the following is not the category of heritage sites in Bhutan?

- a) Cultural landscape
- b) Heritage building
- c) Cultural site
- d) Archaeological sites

20. The tools shown in the picture are used by which of the following craftsman?

- a) Zow
- b) Paap
- c) Do-zo
- d) Jizo



21. In painting a surface, the first coat applied is:

- a) Primer
- b) Undercoat
- c) Topcoat
- d) Base

22. How does the concept of "defensible space" in architecture aim to influence social behaviour within a community?

- a) By creating private areas that prevent social interactions
- b) By designing spaces that promote territoriality and natural surveillance
- c) By minimizing the use of public spaces to reduce interaction
- d) By focusing solely on aesthetic appeal without considering social dynamics

23. Which of the following is a sustainable building material known for its ability to regulate indoor humidity and reduce energy consumption?

- a) Gypsum board
- b) Bamboo
- c) PVC
- d) Aluminium

24. The significance of heritage sites is determined by the assessment of _____

- a) Authenticity
- b) Cultural Heritage Value
- c) Integrity
- d) Buffer zone

25. Which property of bricks makes them particularly suitable for use in load-bearing walls?

- a) High thermal insulation
- b) Low compressive strength
- c) High compressive strength and durability
- d) Flexibility and light weight

26. The traditional carpentry tool shown in the picture is _____

- a) Taam
- b) Daw
- c) Tari
- d) Ara

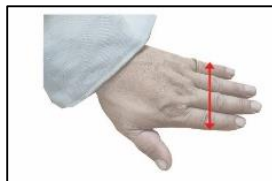


27. What type of stress is produced when a material is subjected to axial loading?

- a) Shear stress
- b) Bending stress
- c) Torsional stress
- d) Normal stress

28. What is the name of the traditional measurement shown in the picture?

- a) Lalep-gang
- b) Chatho-gang
- c) Gi-gang
- d) Tho-gang



29. What is the name of the heritage sites shown in the picture?

- a) Kyichu Lhakhang
- b) Jambay Lhakhang
- c) Tamzhing Lhakhang
- d) Jangsa Lhakhang



30. Which of the following combinations is not correct?
- Kachen~zhu.
 - Boh~phana.
 - Mago~shamig.
 - Pem~chotseg.

PART II – Short Answer Questions [20 marks]

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

1. Explain your understanding of sustainable architecture. Identify two sustainable design strategies that you would incorporate into a residential project, and support your explanation with sketches. **(2+5 marks)**
2. Discuss the significance of site analysis in architectural design. What are the key factors you consider during a site analysis, and how do they impact your design decisions? Include a graphic representation to illustrate your response. **(3+2 marks)**
3. Describe and sketch the characteristics of a traditional vernacular house in Bhutan. **(3+2 marks)**
4. Design and sketch a floor plan for a toilet in a low-income housing unit, with a maximum area of 2.8 square meters. Clearly label all fixtures, and provide accurate wall-to-wall measurements as well as the relative dimensions of the fixtures from the internal walls. **(5 marks)**

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

Question 1

Sketch the section of traditional gable roof of farmhouse in Bhutan and level all the elements **(15 marks)**

Question 2

Describe the process of documentation and research in heritage conservation, emphasizing the methods and tools used to document a site before commencing conservation efforts. Include examples of how documentation of site can help to deduce the cultural heritage value of the sites with case examples. Provide illustrations where necessary. **(10 marks)**

Question 3

Ludwig Mies van der Rohe once stated, “Architecture is the will of an epoch translated into space.” Dzongs, as the pinnacle of Bhutanese architecture, embody the spirit and values of different historical phases, reflecting the unity, stability, and socio-political conditions of our country. Discuss the role of Dzong architecture in unifying Bhutan, focusing on the design, form, and architectural expression of

these structures. Provide a chronological overview of how Dzong architecture has evolved in response to changes in the country's socio-political system. Highlight three distinct architectural typologies with examples of specific Dzongs and include sketches of their layouts, identifying key spaces within them. (25 marks)

CASE II

You are invited to participate in a design competition based on the following brief. Please design according to the specified requirements, utilizing the provided site plan. Refer "deliverables" for the outputs required for the assignment. (50 marks)

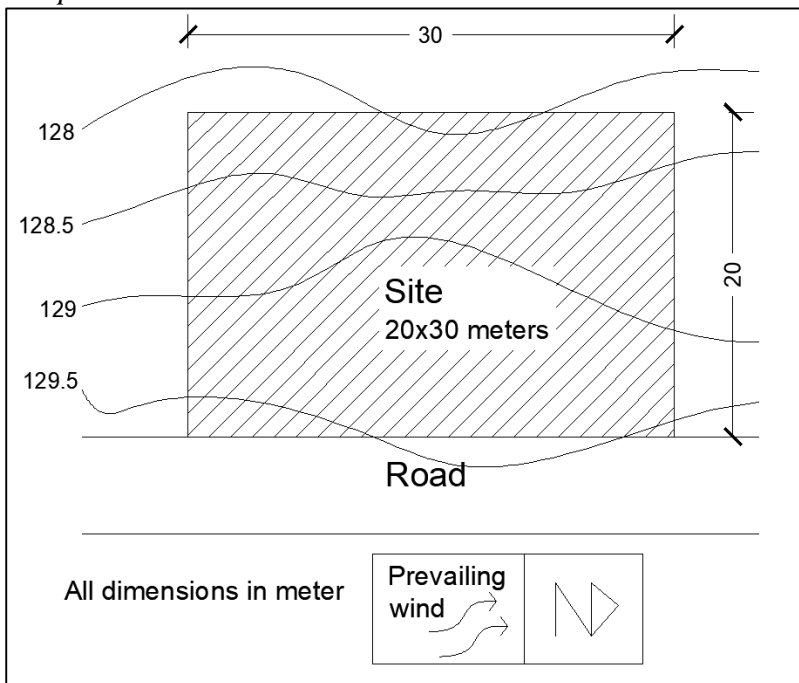
Design brief

Project Title: Design of a Green Duplex Residence in Bebena, Thimphu

Location: UV-2 Zoning Area, Bebena, Thimphu, Bhutan

Plot Size: 600 square meters

Site plan:



Project Overview:

We seek an innovative and environmentally conscious design for a duplex. The project aims to create a modern, sustainable living space that harmonizes with the natural environment while fulfilling the functional requirements of a family home. The design should incorporate elements of green and biophilic design, ensuring a connection with nature and promoting a healthy, comfortable living environment.

Program Requirements:

1. Bedrooms:

- 2 master bedrooms with en-suite bathrooms
- 2 bedrooms
- 1 guest room

2. *Living Spaces:*
 - *A spacious sitting room*
 - *A dining area*
 - *An open-plan kitchen*
 - *Two common toilets*
3. *Choeshum for spiritual practices*

Design Considerations:

1. *Green Design:*
 - *Energy Efficiency: The design should incorporate passive solar design, natural ventilation, and high-performance insulation to minimize energy consumption.*
 - *Water Conservation: Use rainwater harvesting systems, low-flow fixtures, and sustainable landscaping to reduce water usage.*
 - *Sustainable Materials: Select locally sourced, sustainable, and low-impact materials for construction.*
2. *Biophilic Design:*
 - *Natural Light: Maximize natural light in living spaces through strategic placement of windows and skylights.*
 - *Connection to Nature: Integrate natural elements such as indoor plants, green walls, and views of the surrounding landscape into the design.*
 - *Indoor-Outdoor Flow: Create a seamless connection between indoor and outdoor spaces, particularly in the sitting room and open terrace.*
3. *Site-Specific Design:*
 - *Consider the local context of Bebena, Thimphu, ensuring the design is appropriate for the UV-2 zoning area.*
 - *The design should be sensitive to the local culture and aesthetics while incorporating modern elements.*

Deliverables:

- *Brief description on the concept (100-200 words).*
- *Sketches to support the concept.*
- *Basic drawings (site plan clearly showing the site and building dimensions, floor plans, section (min. 2) and elevations (min. 4))*
- *Descriptions of any other features.*

TASHI DELEK