ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2013
EXAMINATION CATEGORY: TECHNICAL

PAPER III: SUBJECT SPECIALIZATION PAPER for *MINING*

Date	: 14 October 2013
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 Questions
     All 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 **09** 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. **Which of the following is correct?**
   (a) Check dam is a small dam constructed across a minor channel, swale or a ditch to reduce the flow of water and control soil erosion
   (b) Check dam is the wall constructed in the mine to arrest the loose material from rolling down the slope
   (c) Check dam is used to retain the overburden waste dumped in the dump yard
   (d) All of the above

2. **Suppose you are an engineer in a mine. When there is a misfire occurring out of fuse blasting, the first step you will do is:**
   (a) Make sure no person enter the place of blasting until 30 minutes
   (b) Inform the mines manager
   (c) As an engineer you will immediately inspect the site and verify the situation
   (d) Fire a relieving hole immediately

3. **Which of the following machinery is best suited for mining in Bhutan?**
   (a) Dragline
   (b) Bucket-wheel-excavator
   (c) Back-hoe shovel
   (d) Shearer

4. **Amongst many method of wining materials in surface mining, the one commonly used in Bhutan is:**
   (a) Manual mining
   (b) Drilling and blasting
   (c) Sluicing
   (d) Placer mining

5. **The term 'lead distance' in mining is best defined by:**
   (a) It is the one sided distance travelled by dumper in the process of dumping ore body from working face to the processing plant/stack yard
   (b) It is the to-and-fro distance travelled by dumper in the process of dumping ore body from working face to the processing plant/stack yard

(c) It is the distance travelled by the dumper in a day
(d) It is the distance between mine and the office for an engineer to travel

6. The specific gravity of quartz mineral is about:
(a) 1.7
(b) 2.0
(c) 2.75
(d) 4.9

7. The selection of method of mining is dependent on number of factors. Which one of the following is the least important factor?

(a) Depth of the ore body
(b) Shape and dimension of the ore body
(c) Topography and the environment
(d) Market

8. The ultimate slope angle in an opencast mine is designed to be 45^0. The reason for this is:
(a) Stability of the slope
(b) To get maximum recovery of mineral
(c) It is mandated by mining Act and its regulations
(d) None of the above

9. As per the Moh's Scale of Hardness, the softest mineral is:
(a) Calcite
(b) Gypsum
(c) Talc
(d) Apatite

10. The colour of the mineral in powder form is termed as:
(a) Luster
(b) Streak
(c) Cleavage
(d) Colour

11. Suppose you have explored massive deposit of sand at Trongsa and got a contract to supply huge quantity of sand to the major hydropower projects of the country. You have the following machineries available with you. Which machine will you choose to deploy to extract the sand efficiently?
(a) Back-hoe Shovel
(b) Bull dozer

(c) Bucket wheel excavator
(d) Loader

12. There is a coal seam deposited in a hilly terrain and is having overburden of about 100 m thick. Traces of coal deposit are exposed at the base of the hill. Which of the following mining methods will be most suitable to extract the coal deposit efficiently?
(a) Shaft mining
(b) Incline mining
(c) Adit mining
(d) Opencast mining

13. Which of the following statement is correct?
(a) Dragline is used in Rishore coal mine
(b) There is not a single underground mine in Bhutan
(c) Surface miner is used in Khotakpa Gypsum Mine
(d) Limestone is the raw material for ferrosilicon plant

14. Ultimate pit slope angle in an open pit mine is defined by the angle between the horizontal and the line joining the:
(a) Toe of the upper most bench and the toe of the lower most bench
(b) Crest of the upper must bench and the crest of the lower most bench
(c) Toe of the upper most bench and the crest of the lower most bench
(d) Crest of the upper most bench and the toe of the lower most bench

15. The mine plan showing details of the mine workings and every surface features will be the best if prepared in scale:
(a) 1: 1000
(b) 1: 5000
(c) 1:10000
(d) 1:50000

16. The bench height of the mine will depend on:
(a) Physical characteristics of the deposit
(b) The degree of selectivity required in separating the ore and the waste with loading equipment
(c) Climatic condition
(d) All of the above

17. Which one of the following is true with regards to underground mining?

(a) Bord-and-pillar is the oldest underground mining technique
(b) Longwall mining revolutionized the underground mining as it is safer, cost effective and manages large scale extraction
(c) Block-caving is the newer technique in the underground mining
(d) All of the above

18. ANFO is:

(a) A primary explosive
(b) A secondary explosive
(c) A tertiary explosive
(d) A detonator

19. The following are all entrance to mine, except:

(a) Shaft
(b) Abutment
(c) Adit
(d) Box cut

20. Which of the following is not mining equipment?

(a) Drill
(b) Tiller
(c) Conveyor
(d) Pump

21. The government has established the Royalty and Mineral Rent payable for construction material very low comparing to other minerals, i.e Nu. 2.20 and Nu. 0.55 respectively as domestic rate. Which of the following could be the main reason?

(a) There is not much profit from construction materials
(b) It is government policy to make available the construction materials at affordable price
(c) There are lots of stone quarries in the country and we can collect substantial revenue even though the Royalty and Mineral Rent is low
(d) None of the above

22. A deposit at a shallow depth in a summit can be mined using:

(a) Open pit method
(b) benching method
(c) Slicing method
(d) None of the above

23. A dumper takes 10 minutes to travel from crusher point to working face when empty and 15 minutes to travel the other way around with load. It takes 1 minute to position to get loaded and another minute to position and unload the material at crusher site. If the loader takes 3 minutes to load the dumper, how many trips can it make in a shift of 8 hours?

(a) 15 trips
(b) 16 trips
(c) 17 trips
(d) 18 trips

24. Section 116 of the Mines and Minerals Management Regulations, 2002 states "a detonator may only be taken out from its container when it is required for immediate use". This is because:

(a) Decorators are very sensitive to air and it may not function properly if exposed to air for long
(b) Detonators exposed to air for long may self ignite
(c) Decorators are very sensitive to ignition and such rules will reduce the risk of accident
(d) The container of the detonator consists of chemicals to keep it fresh and new

25. As per the MMMR 2002, in opencast working in soft rocks such as alluvial soil, clay debris, gravel or similar ground, the sides shall be sloped at an angle not exceeding

(a) 45 degrees from the horizontal
(b) 50 degrees from the horizontal
(c) 55 degrees from the horizontal
(d) 60 degrees from the horizontal

26. The permissible gradient of road for trucks and dumpers in the mine is _____ except for small stretch where the gradient can be 1 in 10:

(a) 1 in 12
(b) 1 in 14
(c) 1 in 16
(d) 1 in 18

27. Which of the following is not part of production drilling?

(a) Percussion
(b) Rotary
(c) Rotary Percussion
(d) Circular

28. A dumper in a mine has a volumetric capacity of 270 cft. The specific gravity of the mineral is 2.4. Considering a void loss of 20% the weight of mineral it can carry is:

(a) 15.3 MT
(b) 14.7 MT
(c) 13.1 MT
(d) 12.7 MT

29. Which of the following, by geological definition, is not a rock?

(a) Gypsum
(b) Limestone
(c) Granite
(d) Quartzite

30. Stripping ratio is defined as a ratio of:

(a) Volume of overburden removed to tonnage of mineral extracted
(b) Volume of overburden removed to volume of mineral extracted
(c) Tonnage of overburden removed to volume of mineral extracted
(d) Tonnage of overburden removed to tonnage of mineral extracted

PART – II : Short Answer Questions (20 marks)

Answer ALL the questions. Each question carries 5 marks.

1. Draw a diagram to explain the geometry of blast hole.
2. What are the factors affecting blasting in mining?
3. Write at least 5 disadvantages of surface mining.
4. Minerals at shallow depths are extracted opencast. Justify why?

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 1

Assume that you are a mining engineer working for Druk Satair Corporation Limited. The company intends to operate a stone quarry located at Kamichu, Wangdue. The site was assessed to be feasible for operation and has got the following details.

- Mineable reserve of the quartzite deposit is 5 million MT
- Average thickness of overburden is 10m distributed over an area of 300 X 100m^2.
- The site was accessible by a farm road till its base and an additional access road of 1 km is required to be constructed to reach the top of the deposit.
- The proposed site is a gently sloping protruding ridge with dry depression on both the side.

You are assigned the work to process and prepare a preliminary plan. Explain your work based on the following questions.

1. What are the process you will go through to complete formalities of mine lease as required by the Mines and Minerals Management Act, 1995 and the Mines and Minerals Management Regulations, 2002? Briefly describe how you will handle each processing steps. (15)

2. Draw a plan layout and cross section, and explain the working plan (the height of benches should be of 5 m and the width no less than the height). (10)

3. Assume a suitable place as dump yard (ideal dump yard) and illustrate the dumping design with an appropriate diagram. Explain why you have chosen such location. (10)

4. You have Punatsangchu I and II as the potential markets which need a supply of at least 3000 MT of materials per day from your quarry. Explain the number and kind of machineries you are going to deploy to efficiently operate the quarry and supply the materials. How long do you need to operate the quarry approximately? Show your work. Make your own assumptions where necessary. (10)

5. Calculate the quantity of overburden and the stripping ratio. (5)

CASE 2

Consider the same quarry in case 1. Assume that all the processing formalities of the quarry are complete and the work order to start operation of the quarry is issued.

The company has all the manpower and the machineries ready to commence operation. You are appointed as the mines manager by the company. You will have to start the operation of the new quarry. Answer the following questions related to operation of the quarry.

1. List and explain the systematic working order, till excavation of construction materials, of your new mine. (10)

2. Explain the material wining method and the machines you are going to deploy to extract the materials. You may also include machine cycle time and design the work accordingly. You can make your own assumptions if necessary. (10)

3. Bhutan is a country of GNH and environmental conservation is one of the underpinning principles. Explain how you are going to make the quarry operation environment friendly and what plan are you going to implement. Assume there is a public complain on dust generation and noise pollution. How are you going to address this? Use appropriate diagrams if necessary. (10)

4. How are you going to plan the restoration/reclamation of the quarry after the expiry of the lease term? Explain it in detail. Use appropriate diagram(s) if necessary. (10)

5. What are the problems you are likely to face in operating the quarry? How will you overcome such problems? (5)

6. What is OHS and what is its importance in mining? How will you ensure proper OHS in your quarry? (5)