TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Ashwin

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Rock Engineering *(Elective I) (CE72508)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Sterionet and tracing paper are attached herewith.*
- ✓ *Assume suitable data if necessary.*

1. What are the important of rock engineering in hydropower development?Draw a layout of hydropower plant with its main element. [4]
2. Define joint set. What do you mean by joint mapping? List the physical characteristics of rock and explain any three with example. [8]
3. What do you mean by rock stress? Discuss the origin and magnitude of rock stress situation surrounding underground openings. [4]
4. Calculate the water flow into tunnel for following conditions: [8]
   Length of tunnel = 1230 m
   Active head = 0.65 MPa
   Distance between length axis and groundwater table = 65m.
   Unit weight of water = 10 $kNmm^3$
   Equivalent radius = 3.25m
   Hydraulic conductivity = 10^{-13} m/s
5. Discuss briefly, problems caused by water in designing underground structures. Do you think it is important part for design of underground structures? [4]
6. What are the objectives of engineering geological investigation? List the activities that should be carried out during preconstruction and construction phase investigation. [8]
7. Define rock mass classification and its objectives. What are commonly used methods in rock classification describe them? [8]
8. Write difference between shallow seated and deep seated opening for underground opening. Also mention the main goals of design consideration for underground openings. [6]
9. Why support and lining are necessary during underground excavation? Describe briefly the rock support methods that are commonly used in underground structure. [6]
10. What are the factors affecting slope stability?What type of the main slope failure occurs in Nepal? Describe them with neat sketches. [6]
11. What are the major points to be considered in designing low cost hydropower plants? [6]
12. The three discontinuity sets represents an area (ref. table below). Find mode of failure direction of failure and angle of potential failure plane if angle of slope face is 66 degree in the dip direction of 342 degree. [12]

Table: Discontinuity sets.

Joint set number	Dip/Dip direction (Degree)	Joint Spacing (cm)	Roughness
1. Foliation (J_1)	65/185	1-2	Planner to undulating
2. Joint (J_2)	72/355	18-40	Undulating
3. Joint (J_2)	75/280	8-30	Undulating

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04G TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Rock Engineering *(Elective I) (CE72508)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ ***Necessary Equal Area Net and Tracing Paper (A4 size)are attached herewith.***
- ✓ *Assume suitable data if necessary.*

1. Define rock mass. Why it is important to know the physical properties of the rock mass? Explain in brief the different physical properties associated with rock mass. [8]
2. Define in-situ and induced rock stresses. Explain the origin of in-situ rock stresses and stress around circular opening with neat sketch. [3+5]
3. What are the different discontinuities present in the rock mass? Categorizes the discontinuity with its distinguishing features. [8]
4. From the parameter given, find the magnitude of stresses surrounding the underground opening (tangential) at the roof and the wall of an unlined pressure shaft using roof factor as 3.9, wall factor as 2.8 and vertical stress of 20MPa. Assume Poisson's ratio of 0.25. [6]
5. What is the potential mode of failure, direction of failure and angle of potential failure plane using stereopolt for the given following discontinuity sets if angle of slope face is 60 degree with dip direction of 325 degree? [10]

Features	Dip/ Dip direction in degree
Sheet joint	55/280
Joint set 1	55/335
Joint set 2	80/050
Joint set 3	70/330

6. What is Q-system in quality rating and support system estimation? Write down the RMI-support method in brief. [6+4]
7. Explain the characteristic of shallow – seated and deep – seated underground openings. What are the problems associated with shallow seated underground opening? Also explain the solution to such problems. [10]
8. Describe briefly the rock support methods that are commonly used in underground structure. [6]
9. What are the objectives of engineering geological investigation? List the activities that should be carried out during preconstruction and construction phase investigation. [4+6]
10. Why hydropower construction is being costly in Nepal. [4]

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06E TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Shawan

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Rock Engineering I *(CE72505) (Elective I)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ ***Necessary figures are attached herewith.***
- ✓ *Assume suitable data if necessary.*
- ✓ *Provide A-4 size Tracing paper and copy of stereonet.*

1. Define shallow seated and deep seated opening for underground structure? Describe the main engineering design procedure for underground opening. (8)

2. Estimate the magnitude of tangential stress at a roof and wall of an unlined pressure shaft using following input parameters (6)

   Roof factor =3

   Wall factor =2.5

   Vertical stress =18 **MPa**

3. a) Recently you completed an engineering geological survey of an area. Write down contents that should be incorporated in the report. (4)

   b) What are the comments the classification system for rock support estimates. (4)

4. Calculate the water flow into a tunnel in lit/minute for following situations. (8)

   Length of tunnel =350 m

   Specific permeability=10^{-15} m^2

   Active head =3MPa

   Equivalent radius = 4.0 m

   Distance between the length axis of excavation and ground water table =20m

5. Write the main goals of engineering geological investigation. List the activities which should be carried out during preconstruction and construction phase investigation. (8)

6. Explain stress surrounding circular underground opening. (6)

7. Discuss support methods which are commonly used in underground structures (6)

8. Write short notes on: (6*2)

   a) Q- method for rating of the rock mass quality

   b) Design criteria for unlined high pressure tunnel and shaft (two rules of thumb).

9. The three discontinuity sets represents an area (ref. table 1). Find mode of failure and angle of potential failure plane if angle of slope face is 65^0 in the dip direction of 185^0 (10)

Table 1 Discontinuity sets

Joint set number	Dip/Dip direction	Joint spacing (cm)	Roughness
Foliation (J_1)	58/168	1-2	Planar to undulating
Joint (J_2)	52/342	18-40	undulating
Joint (J_3)	58/276	8-30	undulating

10. Plot the joint Rosette with following dip/dip direction (degrees) of discontinuities (ref table 2) (8)

Dip/dip direction

40/300	55/07	15/290
25/025	70/075	78/340
20/29	15/330	65/08
75/165	25/280	22/285
10/280	12/280	83/09
80/100	70/08	75/140
65/07	75/200	75/190
80/190	30/290	80/340
80/200	20/330	20/320
75/060	68/070	78/060
75/240	25/290	78/200
15/290	82/160	22/280
78/090	30/290	80/110

Table 2

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