TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2082 Chaitra

Level	BE	**Full Marks**	80
Programme	BCE	**Pass Marks**	32
Year / Part	IV/ II	**Time**	3 hrs.

Subject: - Rock Slope Engineering *(Elective II) (CE 76507)*

- ✓ *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 Tracing paper and sterionet will be provided.***
- ✓ *Assume suitable data if necessary.*

1. Define rock slope stability and explain the main purposes and goals of conducting slope stability analysis for both natural slopes and man-made slopes. Additionally, describe how slope protection works can be designed and constructed safely and in an environmentally friendly manner in the Nepalese mountainous region, incorporating appropriate resilience measures to minimize and manage hazard risks. [8]
2. List out the methods for rock slope stability analysis. Which methods is/are best appropriate in Nepalese context explain them and how they work fundamentally? Describe the limit equilibrium and probabilistic method and explain its assumptions and limitations. [8]
3. Explain the factors affecting rock slope stability by groundwater and discuss the role of groundwater in triggering slope failures. Describe in brief support method and principles. Suggest protective measures for the control of rock fall with sketches. [8]
4. Discuss the empirical methods used for determination of shear strength parameters of rock mass, including Hoek–Brown, GSI-based method, RMR-based method, and Barton–Choubey criterion. [8]
5. Describe the steps of seismic hazard analysis. List out the parameter, which have greatest influence on stability during earthquakes. What are the graphical techniques for data problem? Differentiate the available techniques. [8]
6. Explain the primary objectives of geological investigations for major civil engineering projects and discuss the potential consequences of failing to properly investigate or interpret geological conditions at a project site. Discuss the fundamental principles of engineering geological mapping. How does it differ from standard geological mapping in terms of its objectives, focus, and the specific data collected for engineering purposes? [8]
7. What are the assumptions of toppling failure? Explain this type of failure with examples relating to Nepalese mountain with example. [8]
8. A rock slope is excavated to a height of 15 meters with a face angle of 65°. The rock mass contains a continuous joint set dipping at 42° out of the face. A tension crack with a depth of 5 meters is located 6 meters behind the crest. Due to recent rainfall, the tension crack is filled with water to a height of 4 meters above the sliding surface. The shear strength parameters of the sliding surface are as follows: [8]
   Cohesion, c = 35kPa
   Friction angle, $\varphi = 32°$
   The unit weight of the rock is 26 kN/m^3, and
   The unit weight of the water is 9.81kN/m^3.
   Calculate the factor of safety of the slope for the conditions given for critical depth of tension crack.
9. Determine the factor of safety for following wedge failure with neat sketch for rock slope. [8+8]

Plane	Dip	Dip Direction	Shear Parameters
A	55	340	$\emptyset_A = 30°, C_A = 45\ kPa$
B	62	105	$\emptyset_B = 28°, C_B = 55\ kPa$
Slope Face	72	050	$\gamma_r = 26\ kN/m^3$, $\gamma_w = 9.81 kN/m^3$, Total Height of the wedge, H = 35m
Upper Surface	15	060	

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2082 Shrawan

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

Subject: - Rock Slope Engineering *(Elective II) (CE 76507)*

- ✓ *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**.*
- ✓ ***Tracing paper and sterionet is attached herewith.***
- ✓ *Assume suitable data if necessary.*

1. What is the importance of rock slope engineering? What are the factors affecting slope stability of rock mass? Explain the effect of water in slope stability with pressure models and also illustrate the Taylors' assumption for the ground water. [8]
2. As an Engineer you encounter the slope stability problems, list the methods that recalls in your mind instantly. Among these methods, describe any two which are more versatile to analysis the stability problem in your opinion. Is the finite equilibrium method being versatile and ability to handle complex scenarios? If so, how it deals? [8]
3. Describe in brief support method and principles. Suggest the protective measures for the control of rock fall with sketches. What are the basic conditions of toppling failure? [8]
4. In rock slope engineering, why is it crucial to accurately determine the shear strength of rock, and what role do empirical methods play in this process? Discuss several commonly used empirical methods for estimating shear strength, outlining their underlying principles, limitations, and appropriate applications with relevant examples. [8]
5. Describe the steps of seismic hazard analysis. List out the parameter which have greatest influence on stability during earthquakes. Explain about the mapping of the Earth seismic waves. [8]
6. List the graphical techniques that are used in evaluation of potential slope problem. What are the differences between them? Describe the procedures for evaluation of potential slope problems. [8]
7. What type of procedure you apply for geological mapping of surface out crops or existing cuts? What are the objectives of geological mapping of surface? Describe the methods of geological investigations. [8]
8. A 22 m high rock slope has been excavated at a face angle of 52°. The rock in which this cut has been made contains persistent bedding planes that dip at an angle of 30° into the excavation. The 5.52 m deep tension crack is 4.85 m behind the crest, and is filled with water to a height of 4.55 m above the sliding surface. Calculate the factor of safety of the slope for the conditions given for critical depth of tension crack. The strength parameters of the sliding surface are as follows: [8]

   Cohesion, $c = 25$ kPa
   Friction angle, $\varphi = 36°$
   The unit weight of the rock is 26 kN/m^3, and
   The unit weight of the water is 9.81 kN/m^3.

9. Determine the factor of safety for following wedge failure with neat sketch. [16]

Plane	Dip	Dip Direction	Shear Parameters
A	60	356	$\emptyset_A = 35°, C_A = 40\ kPa$
B	58	120	$\emptyset_B = 25°, C_B = 50\ kPa$
Slope Face	76	066	$\gamma_r = 25\ kN/m^3$, $\gamma_w = 10\ kN/m^3$, total height of the wedge, H = 30m
Upper Surface	18	076	

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2081 Chaitra

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

Subject: - Rock Slope Engineering *(Elective II) (CE76507)*

- ✓ *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**.*
- ✓ ***Tracing paper and sterionet is attached herewith.***
- ✓ *Assume suitable data if necessary.*

1. Why rock slope engineering is important in Nepalese context? Explain with examples and its objectives. List the factors that affect the slope stability problems in Nepalese mountain. How can you construct the slope protection work safely and environment friendly in the Nepalese mountain considering all the resilience measures to protect from hazard? [8]
2. List the methods of rock slope stability analysis. Which methods are best appropriate in Nepalese context? Explain them. The fast track using high cut; in your opinion which one method is more appropriate and why. [8]
3. What are the effect of ground water in slope stability? Describe ground water pressure models. What are the assumptions of ground water while analyzing the circular failure? How these assumptions are helpful for analysis of slope? [8]
4. What are the factors that reduces the stability of slope? What are the most common empirical methods to determine shear strength list them. Which method is most reliable in comparison? Describe the comparison from the beginning to latest improvements. [8]
5. Earthquakes pose a significant threat to infrastructure, particularly in seismically active regions. Understanding and quantifying this threat is crucial for designing resilient structures and ensuring public safety; describe the steps of seismic hazard analysis. List out the parameters which have greatest influence on stability during earthquakes. What are the graphical techniques for data problems? Differentiate the available techniques. [8]
6. If you are the site incharge of project, what kind of geological investigation preferred to do? Explain about the surface and sub-surface investigation. List the objectives of sub surface investigation with suitable examples relating to site problems. [8]
7. Describe in brief support method and principles. Suggest the protective measures for the control of rock fall with sketches. [8]
8. A 15 m high rock slope has been excavated at a face angle of 65°. The rock in which this cut has been made contains persistent bedding planes that dip at an angle of 35° into the excavation. The 4.35 m deep tension crack is 4.5 m behind the crest, and is filled with water to a height of 3m. [8]

   Cohesion, c = 25 kPa, Friction angle, Φ = 30°, Seismic acceleration, α = 0.08 g

   The unit weight of the rock is 26 kN/m^3, and the unit weight of the water is 9.81 kN/m^3. Calculate the factor of safety of the slope for the conditions given for critical depth of tension crack.
9. Determine the factor of safety for following wedge failure. [16]

   γ_r = 26 kN/m^3, γ_w = 10 kN/m^3, Total Height of the wedge, H = 28m

Plane	Dip	Dip Direction	Shear Parameters
1	60	358	Φ = 30 and c = 50 kPa
2	54	118	
Slope Face	76	060	
Upper Surface	15	070	

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Chaitra

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

Subject: - Rock Slope Engineering *(Elective II) (CE 76507)*

- ✓ 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**.*
- ✓ *Assume suitable data if necessary.*

1. Why study of rock slope is important in Nepal? What are the objectives of slope stability of rock mass? What are the effect of ground water in slope stability? Describe protective measures. [2+2+4]
2. List the methods of rock slope stability analysis. Which methods are best appropriate in Nepalese context explain them and how they work fundamentally? [2+6]
3. What are the factors that reduces the stability of slope? What are the most common empirical methods to determine shear strength list them? Describe briefly how shear strength of discontinuities is determined according to Barton and Choubay (1977). [3+1+4]
4. Describe the steps of seismic hazard analysis. List out the parameter which have greatest influence on stability during earthquakes. Explain about the mapping of the earth Seismic waves. [2+2+2]
5. Describe the procedures for evaluation of potential slope problems graphically. What are the differences between them? What are the condition that are encounter in the toppling failure? [3+3]
6. What are the importance of site investigation? Explain about the surface and sub-surface investigation. List the objective of sub surface investigation with suitable examples. [2+4+2]
7. What are the surface protective measures for potential slope failures? Explain with sketches. List and explain the methods that are used to protect from rock fall. [3+3]
8. A 22m high rock slope has been excavated at a face angle of 64°. The rock in which this cut has been made contains persistent bedding planes that dip at an angle of 34° into the excavation. The 4.62m deep tension crack is 4.85m behind the crest, and is filled with water to a height of 3.45m above the sliding surface. Calculate the factor of safety of the slope for the conditions given for critical depth of tension crack. The strength parameters of the sliding surface are as follows: [7+7]
   Cohesion, c =25kPa

   Friction angle, φ =34°

   The unit weight of the rock is 26kN/m^3, and

   The unit weight of the water is 9.81kN/m^3.
9. Plot and find the data required to calculate the factor of safety for following. [8+8]

Plane	Dip	Dip Direction	Shear Parameters
A	62	340	Φ_A = 30 and C_A = 50 kPa
B	56	130	Φ_B = 32 and C_B = 45kPa
Slope Face	74	066	γ_r = 26 kN/m^3, γ_w = 10 kN/m^3, Total Height of the wedge, H = 38m
Upper Surface	24	070	

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Chaitra

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

Subject: - Rock Slope Engineering *(Elective II) (CE 76507)*

- ✓ 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**.*
- ✓ ***Stereonet chart are attached herewith.***
- ✓ *Assume suitable data if necessary.*

1. What is the importance of rock slope engineering? What are the factors affecting slope stability of rock mass? [4]
2. List the methods for rock slope stability analysis. Describe about limit equilibrium analysis and probabilistic method. [8]
3. How does surface-water and groundwater play role in the stability of a rock slope? [4]
4. Describe briefly how shear strength of planar discontinuities is determined. How are Joint Roughness Coefficient and Joint wall Compressive Strength related to the shear strength of joints? [4]
5. Explain basic aspects of Earthquake. Briefly discuss principle of risk assessment, design and analysis for rock slope stability analysis. What are basic methods for improving the stability of rock slopes? [8]
6. What is stereographic projection? How is it important for evaluating rock slope failure patterns? [4]
7. Explain Toppling Failure in rock mass. Discuss the conditions for sliding and toppling of a block on an inclined plane. Briefly discuss the methods to control the rock falls. [8]
8. Calculate the Factor of Safety of the proposed highway cut slope having following discontinuity sets:

   Joint Set 1: 50/210 degrees (dip/dip direction)
   Joint Set 2: 60/115 degrees (dip/dip direction)
   Joint Set 3: 20/075 degrees (dip/dip direction)

   The proposed cut is to be excavated at dip of 80 degrees with a dip direction of 190 degrees (Cut slope face). It is estimated that the average angle of active friction of the discontinuities is 56 degrees. Orientation of upper slope surface is 18 degrees / 195 degrees (dip/dip direction) .The proposed height is 80 m and Unit weight of rock mass = 26 kN /m^3. [16]
9. Find the Factor of Safety of a potential plane failure slope having active friction angle is 62 degrees, Slope height = 72 m, Slope angle = 56 degree, Inclination of potential failure plane = 36 degree, Unit weight of rock mass = 24 kN/m3, and seismic acceleration $\alpha = 0.3g$. The 4.5 m deep tension crack 4 m behind crest and depth of water is equivalent to 50% depth of crack. It is also required to carry out sensitivity analysis of slopes affected by water pressure and earthquake loading. [16]
10. Why rock stabilization is necessary? Write in brief about different support techniques used for stabilization of an excavated rock slope with sketches where necessary. [2+6]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Chaitra

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

Subject: - Rock Slope Engineering *(Elective II) (CE76507)*

- ✓ 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**.*
- ✓ *Assume suitable data if necessary.*

1. Explain the importance of rock slope engineering. What are the factors affecting slope stability of rock mass. [4]
2. List out the methods of rock slope stability analysis. Describe the deterministic approach. [6]
3. Describe various groundwater pressure models. How groundwater in rock mass effects the stability analysis? [6]
4. Explain basic aspects of Earthquake. Briefly discuss methods for quantification of seismic load for rock slope stability analysis. [6]
5. Explain how shear strength of planner discontinuities is determined according to Borton (1971). Explain the field shear strength test with sketch. [5+3]
6. Explain graphical techniques for geological data problem. List out the advantages and disadvantages of equal area net with respect to equal angle net. [6]
7. Describe the objective of geological investigation. How you can perform the surface and sub-surface investigation? Also mention the objective of sub-surface investigation. [8]
8. Why Rock slope stabilization is necessary in slope stability? What are the different stabilization measures? [6]
9. Explain Toppling failure in rock mass. Discuss the conditions for sliding and toppling of a block on an inclined plane. [6]
10. A 14 m high rock slope has been excavated at a face angle of 55°. The rock in which this cut has been made contains persistent bedding planes that dip at an angle of 33° into the excavation. The 4.75 m deep tension crack is 4 m behind the crest, and is filled with water to a height of 3 m above the sliding surface. The strength parameters of the sliding surface are as follows:
    Cohesion, c = 25 kPa
    Friction angle, $\phi = 35°$
    Seismic acceleration, $\alpha = 0.08$ g
    The unit weight of the rock is 26 kN/m^3 and the unit weight of the water is 9.81 kN/m^3. Calculate the factor of safety of the slope for the conditions given for critical depth of tension crack. [10]
11. Calculate the Factor of Safety for the rock wedge. [14]

Plane	Dip	Dip direction	Shear strength
3	60	360	$\phi_3 = 30°$, $c_3 = 50$ kPa
5	54	118	$\phi_5 = 30°$, $c_5 = 50$ kPa
Slope face	76	060	
Upper surface	15	070	

$\Upsilon_r = 26$ kN/m^3
$\Upsilon_w = 10$ kN/m^3
Total Height of the wedge, H = 28 m.

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Bhadra

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

Subject: - Rock Slope Engineering *(Elective II) (CE 76507)*

- ✓ 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. Explain why study of rock slope is important in Nepal. What are the factors affecting slope stability of rock mass? [4]
2. List out the methods for rock slope stability analysis. Explain types of Numerical Modeling. [8]
3. What are the effects of ground water in slope stability? Give your own view for protecting slopes from the ground water. [4]
4. Describe briefly how shear strength of planar discontinuities is determined according to Barton (1971). Also explain with neat sketches field shear strength test. [8]
5. List the slope parameters that have the greatest influence on stability during earthquakes. Describe the steps of seismic hazard analysis. [6]
6. List out the advantages and disadvantages of equal area net with respect to equal angle net. Describe the procedures for evaluation of potential slope problems. [6]
7. Describe the procedure of geologic mapping of surface out crops or existing cuts. Also mention the mapping of exposed structures. [6]
8. What are the assumptions of plane failure? Explain with neat sketches critical tension crack depth and location. [8]
9. Describe in brief support method and principles. Suggest the protective measures for the control of rock fall with sketches. [6]
10. A 15m high rock slope has been excavated at a face angle of 55°. The rock in which this cut has been made contains persistent bedding planes that dip at an angle of 33°into the excavation. The 4.75m deep tension crack is 4m behind the crest, and is filled with water to a height of 3m above the sliding surface. The strength parameters of the sliding surface are as follows:

    Cohesion, $c = 25$ kPa

    Friction angle, $\Phi = 35°$; Seismic acceleration, $\alpha = 0.08$ g

    The unit weight of the rock is 26kN/m^3, and the unit weight of the water is 9.81 kN/m^3. Calculate the factor of safety of the slope for the conditions given for critical depth of tension crack. [10]
11. Determine the factor of safety for following wedge failure. $\gamma_r = 26$ KN/m^3, $\gamma_w = 10$ kN/m^3. Total Height of the wedge, H = 28m [14]

Plane	Dip	Dip Direction	Shear Parameters
3	60	360	$\Phi = 30$ and $c = 50$ kPa
5	54	118	
Slope Face	76	060	
Upper Surface	15	070	

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05 G TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Bhadra

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

Subject: - Rock Slope Engineering *(Elective II) (CE76507)*

- ✓ 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 charts are attached herewith.***
- ✓ *Assume suitable data if necessary.*

1. What are the factors affecting slope stability of rock mass? Explain with example. [4]
2. List out the methods for rock slope stability analysis. Explain types of Numerical Modeling. [8]
3. Define wedge failure. Write about the conditions for wedge failure with figure. [4]
4. What are the effects of ground water in slope stability? Give your own view for protecting slopes from the ground water. [4]
5. Describe briefly how shear strength of planar discontinuities is determined according to Barton (1971). Also explain with neat sketches field shear strength test. [5+3]
6. Explain how earthquake can be quantified for rock slope stability analysis. Explain earthquake induced stability analysis in brief. [8]
7. How would you execute the diamond drilling in the field? Explain briefly about core orientation. [4]
8. What are the assumptions of plane failure? Explain with neat sketches critical tension crack depth and location. [4+4]
9. Describe in brief support method and principles. Suggest the protective measures for the control of rock fall with sketches. [4+4]
10. A 14.5m high rock slope has been excavated at a face angle of 55°. The rock in which this cut has been made contains persistent bedding planes that dip at an angle of 33° into the excavation. The 4.75m deep tension crack is 4m behind the crest, and is filled with water to a height of 3m above the sliding surface. The strength parameters of the sliding surface are as follows:

    Cohesion, $c = 25$ kPa
    Friction angle, $\Phi = 35°$

    The unit weight of the rock is 26 kN/m^3, and the unit weight of the water is 9.81 kN/m^3. Assuming that the plane slope failure is the most likely type of instability, analyze the following stability conditions. Calculate the factor of safety of the slope for the conditions given [10]
11. Determine the factor of safety for following wedge failure. $\gamma_r = 26$ KN/m^3, $\gamma_w = 10$ kN/m^3; Total Height of the wedge, H = 28m [14]

Plane	Dip	Dip Direction	Shear Parameters
3	60	360	$\Phi = 30$ and $c = 50$ kPa
5	54	118	
Slope Face	76	060	
Upper Surface	15	070	

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05G TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Magh

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

Subject: - Rock Slope Engineering *(Elective II) (CE76507)*

- ✓ 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 Chart is attached herewith.***
- ✓ *Assume suitable data if necessary.*

1. Explain the importance of Rock slope in developing the resettlement areas to the earthquake affected area people. What are the factors affecting slope stability of rock mass? [6]
2. List out the methods for rock slope stability analysis. Explain types of Numerical Modeling. [6]
3. What are the effects of ground water in slope stability? Give your own view for protecting slopes from the ground water. [4]
4. Describe briefly how shear strength of planar discontinuities is determined according to Barton (1971). Also explain with neat sketches field shear strength test. [4+4]
5. List the slope parameters that have the greatest influence on stability during earthquakes. Describe the steps of seismic hazard analysis. [2+4]
6. Nepal's mountains are suffering from the greater landslide each year. Explain in your view about types of failure and what are the conditions for this landslide? [3+5]
7. How would you execute the diamond drilling in the field? Explain briefly about core orientation. [2+2]
8. What are the assumptions of plane failure? Explain with neat sketches critical tension crack depth and location. [4+4]
9. Describe in brief support method and principles. Suggest the protective measures for the control of rock fall with sketches. [4+4]
10. A 14.5m high rock slope has been excavated at a face angle of 54°. The rock in which this cut has been made contains persistent bedding planes that dip at an angle of 32° into the excavation. The 4.85m deep tension crack is 4m behind the crest, and is filled with water to a height of 3.2m above the sliding surface. The strength parameters of the sliding surface are as follows: [10]

    Cohesion, c = 25 kPa
    Friction angle, Φ = 34°

    The unit weight of the rock is 26 kN/m^3, and the unit weight of the water is 9.81 kN/m^3. Assuming that the plane slope failure is the most likely type of instability, analyze the following stability conditions. Calculate the factor of safety of the slope for the conditions given

11. Determine the factor of safety for following wedge failure. γ_r = 26 KN/m^3; γ_w = 10 kN/m^3. Total Height of the wedge, H = 24m [12]

Plane	Dip	Dip Direction	Shear Parameters
3	60	360	Φ = 30°and c = 50 kPa
5	54	118	
Slope Face	76	060	
Upper Surface	15	070	

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5 G TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Magh

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

Subject: - Rock Slope Engineering *(Elective II) (CE 76507)*

- ✓ 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.*

1. What is the importance of rock slope engineering? What are the factors affecting slope stability of rock mass? [4]
2. What are the method of rock slope stability analysis? Describe about limit equilibrium analysis. [6]
3. What are the effects of ground water in slope stability? Give your own view for protecting slopes from the ground water. [4]
4. Explain how shear strength of planner discontinuities is determined according to Borton (1971). Explain the field shear strength test with sketches. [5+3]
5. List the slope parameters that have the greatest influence on stability during earthquakes. Describe the steps of seismic hazard analysis. [4+4]
6. Write the difference between equal area net and equal angle net. On the basis of these describe the procedures for evaluation of potetential slope problems. [3+3]
7. How would you execute the diamond drilling in the field? Explain briefly about core orientation. [6+2]
8. What are the assumptions of plane failure? Explain with neat sketches critical tension crack depth and location. [3+3]
9. Why Rock slope stabilization is necessary in slope stability? What are the different stabilization measures? [8]
10. A 14m high rock slope has been excavated at a face angle of 55°. The rock in which this cut has been made contains persistent bedding planes that dip at an angle of 33° into the excavation. The 4.75m deep tension crack is 4m behind the crest, and is filled with water to a height of 3m above the sliding surface. The strength parameters of the sliding surface are as follows:
    Cohesion, c = 25 kPa
    Friction angle, $\phi = 35°$

    The unit weight of the rock is 26 kN/m^3, and the unit weight of the water is 9.81 kN/m^3. Assuming that the plane slope failure is the most likely type of instability, analyze the following stability conditions.

    a) Calculate the factor of safety of the slope for the conditions given
    b) Design the rock bolt to obtain the factor of safety of 1.8 [8]
11. Determine the factor of safety for the following failure γ_r = 26 KN/m^3; γ_w = 10 KN/m^3. Total height of wedge H = 28m. [14]

Plane	Dip	Dip direction	Shear Parameters
3	60	360	$\phi = 32$ and c = 25 kPa
5	54	118	
Slope face	76	060	

05C TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Bhadra

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

Subject: - Rock Slope Engineering *(Elective II) (CE76507)*

- ✓ 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**.*
- ✓ *Assume suitable data if necessary.*

1. What are the Rock Slope Stabilization and protection works? Explain the deterministic method of Rock Slope Stability analysis. [4+8]
2. List the effects of groundwater on slope stability. How the shear strength of rough surface be quantified? Explain it. [4+6]
3. Write down the process of determination of shear strength of rock mass. How can the earthquake magnitude be determined? [4+4]
4. What are the graphical techniques for data problems? Explain, how can the potential slope problems be evaluated? [4+6]
5. What is geological investigation? Write down the process of mapping of exposed structures. [4+6]
6. A 12 m high rock slope has been excavated at a face angle of 60°. The rock in which this cut has been made contains persistent bedding plane that dip at an angle 30° into the excavation. The 4.25 m deep tension crack is 4 m behind the crest and filled with water upto 3 m. [10]

   Given,

   Cohesion C = 25 kPa
   Friction angle, $\phi = 30°$
   Seismic acceleration, $\alpha = 0.08$ g

   The unit weight of rock is 26 kN/m^3 and the unit weight of water is 9.81 kN/m^3.

   Calculate the factor of safety of the slope for the conditions given for critical depth of tension crack.
7. Consider a 6.5 m high slope with an overhanging face at an angle of 75°. There is a fault dipping at an angle of 15° out of the face at the toe of the slope that is weathering and undercutting the face. A tension crack wider at the top than at bottom has developed 1.8 m behind the crest of the slope indicating that the face is marginally stable. The friction angle of fault is 20° and the cohesion C is 25 kPa. The slope is dry. [12]
   a) Calculate factor of safety of the block against sliding if density of rock is 24 kN/m^3.
   b) What stabilization measure would be appropriate for this slope?
8. What is shotcreting? Write down the methods of support and lining in rock slope. [3+5]

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