Name: **Enrolment No:**	

UPES
End Semester Examination, May 2025

Course: Engineering Geology **Semester: VI**
Programme: B. Sc. – H (Geology) **Time: 3 hrs.**
Course Code: PEGS 3033 **Max. Marks: 100**
Instructions: All questions are compulsory

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Explain the difference between physical and chemical weathering	**4**	**CO1**
Q 2	How would a civil engineer use geological information when planning a tunnel?	**4**	**CO2**
Q 3	Describe the following Index Properties of rock in Short. (a) Durability (b) Permeability	**4**	**CO2**
Q 4	List important Metamorphic rock used in the engineering application with suitable example.	**4**	**CO3**
Q 5	How do rock joints influence slope failure?	**4**	**CO2**

SECTION B
(4Qx10M=40Marks)

Q 6	(a) In a rock core sampling method at site, the total length of drilling was 1.0 m in rocky strata. There were five intact pieces of rocks of lengths 150 mm, 200 mm, 75 mm, 50 mm, and 200 mm were collected. Determine the value of RQD of rock sample. (b) Explain the following classification of Earthquakes. (i) Based on Depth (ii) Based on Magnitude **OR** Design a basic community safety plan for a village at risk from landslides and earthquakes.	**10**	**CO3**
Q 7	Analyze the connection between rainfall, soil saturation, and landslides in geologically weak areas.	**10**	**CO4**
Q 8	A geotechnical engineer is evaluating a site for tunnel construction. Based on field and lab data, the following observations are made:	**10**	**CO2**

<table>
<tr><td></td><td>
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<tr><th>Parameter</th><th>Description</th><th>Rating Assigned</th></tr>
<tr><td>Rock type</td><td>Massive granite</td><td>16</td></tr>
<tr><td>Rock weathering</td><td>Slightly weathered</td><td>10</td></tr>
<tr><td>Joint spacing</td><td>Greater than 2 m</td><td>20</td></tr>
<tr><td>Joint orientation</td><td>Favorable</td><td>10</td></tr>
<tr><td>Groundwater condition</td><td>Dry</td><td>10</td></tr>
<tr><td>Joint surface condition</td><td>Rough and unweathered</td><td>14</td></tr>
</table>
Calculate the RSR value and classify the rock quality.
</td><td></td><td></td></tr>
<tr><td>Q 9</td><td>Discuss the following testing methods in detail.
a) Compressive Testing
b) Braxillian Testing</td><td>10</td><td>CO1</td></tr>
<tr><td colspan="4">SECTION-C
(2Qx20M=20Marks)</td></tr>
<tr><td>Q 10</td><td>Illustrate the Deere and Miller Classification of Intact Rock in detail.

OR

Estimate the rock mass rating (RMR) of the rock sample by describing various parameters and develop an interrelation between RMR and Q.</td><td>20</td><td>CO1</td></tr>
<tr><td>Q 11</td><td>A small cavern will be excavated with a mass of limestone with UCS of 39 MPa. The Characteristics of Rock mass are as follows:
• The RQD is 60%.
• The rock mass containing one joint set controlling stability plus a subset of random joint.
• Joints are smooth and planar.
• Rock walls contact before 10 cm shear. Strong over consolidation. There are thin continuous fillings of non-softening clay minerals.
• The excavation intersects multiple weakness zones containing non swelling clay minerals and disintegrated rocks.
• There is a large hydraulic inflow with substantial outwash of joint filling.
What is the rating of this joint mass in the Q-system. Use the table given below for rating. (Assume a suitable value wherever required)</td><td>20</td><td>CO4</td></tr>
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	STRESS REDUCTION FACTOR	
A	No shear, faults, dyke or weakness zone	1
B	One shear, fault, dyke or weakness zone	2.5
C	One shear, fault, dyke or weakness zone with blocky ground conditions	4
D	Curved joints or dome structure approaching a pothole, reef roll or OPL's	7.5
E	Curved joints or dome structure approaching a pothole, reef roll, OPL's with blocky ground conditions	8
F	Many faults, dyke and weakness zones.	9
G	Wide shear zone	10

	JOINT ALTERATION NUMBER	
A	Tightly healed, hard rockwall joints, no filling	0.5
B	Slight infill, coating < 1mm	1
C	Joint filling > 1 mm	2
D	Joint filling > 3 mm	4
E	Zones or bands of disintegrated or crushed filling, open joints.	8

	JOINT SET NUMBER	
A	Massive, no to few joints	1
B	One joint set	2
C	One joint set plus random joints	3
D	Two joint sets	4
E	Two joint sets plus random joints	6
F	Three joint sets	9
G	Three joint sets plus random joints.	12
H	Four or more joint sets, random, heavily jointed.	15
I	Crushed rock	20

	JOINT WATER	
A	Dry	1
B	Dripping water	0.5

	JOINT ROUGHNESS NUMBER		
A	Discontinuous joints		4
B	Rough or irregular	undulating	3
C	Smooth	undulating	2
D	Slickensided,	undulating	1.5
E	Rough or irregular	planar	1.5
F	Smooth	planar	1
G	Slickensided	planar	0.5

	Conditions	SRF
	(a) Weakness zones intersecting excavation, which may cause loosening of rock mass when tunnel is excavated	
A	Multiple occurrences of weakness zones containing clay or chemically disintegrated rock, very loose surrounding rock (any depth)	10.0
B	Single-weakness zones containing clay or chemically disintegrated rock (depth of excavation $\leq$50 m)	5.0
C	Single-weakness zones containing clay or chemically disintegrated rock (depth of excavation >50 m)	2.5
D	Multiple-shear zones in competent rock (clay-free), loose surrounding rock (any depth)	7.5
E	Single-shear zones in competent rock (clay-free) (depth of excavation $\leq$50 m)	5.0
F	Single-shear zones in competent rock (clay-free) (depth of excavation >50 m)	2.5
G	Loose, open joints, heavily jointed or "sugar cube," etc. (any depth)	5.0