THE OPEN UNIVERSITY OF SRI LANKA

Bachelor of Technology (Civil) - Level 5

CEX5232 – Engineering Geology

120

Final Examination –2009

Date: 08-03-2009 (Sunday) Time Allowed: Three(03) hours

Answer Five (05) questions out of Eight (08) questions.
Answers should be illustrated with sketches and diagrams with assumptions stated, clearly and neatly

(Q1) Understanding about Rock forming Minerals is imperative for Civil Engineers.

(i) Explain the above statement with examples and if necessary with case studies in real world.
(ii) List down five (05) Basic Rock Forming Minerals in Sri Lanka and explain briefly how you can identify minerals in the laboratory using their physical properties.
(iii) There is new a road trace that is going to come up connecting two remote areas in the highlands of Sri Lanka. The geological information has revealed that the proposed road trace is running on top of a thick Feldspar formation. The topography of the area is having a moderately higher slope condition. Comment on the feasibility of the road trace and possible effects that may arise if construction proceeds with the same road trace.

(Q2) Write short Accounts on following,

(i) Schist
(ii) Chert
(iii) Dolomite
(iv) Fold
(v) Fault

(Q3) (i) The earthquakes are categorized into two major types depending on its cause of occurrence. Briefly describe each type and causes behind
(ii) Depending on the formation, The Mountains can be categorized into several types. Name them and briefly describe each formation process.
(iii) Propose design considerations that may put in carrying out a construction in seismically affected area.

(Q4) (i) What are the parameters that are investigated in the assessment of Rock mass competency using the Rock Mass Rating (RMR) System?
(ii) 'Q' system of rock mass assessment is generally used in the Tunnel support design. Name all the factors that are considered in this "Q' system
(iii) For a given rock mass following data were obtained from both field in-situ tests and Laboratory tests. Calculate the Rock Mass Rating for the particular rock mass using the **provided standard chart attached** .

Investigated Parameter	Value
1. Average Uni-axial strength of core samples	124 MPa
2. Average length of core samples recovered after drilling 10.00m in the rock	6.35m
3. Average length of core samples recovered which are greater than 10.00cm in length and obtained after drilling 10.00m in the rock	2.14m
4. Average spacing of the discontinuities	0.003m
5. Condition of the discontinuities	Discontinuities are having rough surfaces with the filled by clay and are separated by 2.30mm.
6. Groundwater condition	Discontinuities are completely wet and an average rate of 12 literes/mm run groundwater flow rate is observed

(Q5) (i) Differentiate between 'marshy land ,'swamp' and 'peat'.

(ii) What are the basic Engineering parameters that should tested for soils/rock, if there is a multistoried building that is going to be come up in a marshy land area.

(iii) Propose a field in-situ testing program in order to evaluate the above mentioned Engineering parameters.

(Q6) (i) Explain the Engineering geological aspects that should be considered in designing of a road on a hilly mountain area.

(ii) Describe how the fracture pattern of the underlying and surrounding rocks are influenced to the stability of Dams and Reservoir structures.

(iii) What are the methods (Field In-situ) that can be adopted to detect fracture zones and their intensities in the Field? .

(Q7) (i) Write down the assumptions that are made in rock slope analysis of Plane type failures.

(ii) A slope is having height of 100m with a face angle of 60^0 found to have a bedding plane running through it at a dip angle of 30^0. A tension crack occurs on the of the crest of the slope and from an accurately drawn cross section of the slope, the tension crack is found to have a depth of 50m. The unit weight of material in the rock slope (γ_b) = 24.30 Mg/m^3 and the shear strength parameters of the bedding plane as Angle of internal friction; $\phi = 30^0$ and cohesion/adhesion; c= 100 kN/m^2 . If the tension crack is filled with water to a height of 15m, determine the factor of safety of the particular slope using classical plane failure analysis techniques and comment on the stability of the slope at this position. You may assume that the unit weight of water ; $\gamma_w = 9.18$ Mg/m^3.

(Q8) (i) Briefly explain the process of formation of Sedimentary rocks.

(ii) Briefly describe different types of metamorphisms and the causative factors behind this phenomenon.

(iii) State the Engineering Geological aspects that should be considered in designing a foundation for a proposed heavily loaded Jetty at Kanakasanthurai sea port in Jaffna.

Classification Parameters and their ratings

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PARAMETER			RANGES OF VALUES						
1	Strength of intact rock material	Point – load Strength index	>10 MPa_a	4-10 MPa_a	2-4 MPa_a	1-2 MPa_a	For this low range –uniaxial compressive test is preferred		
		Uniaxial compressive strength	>250 MPa_a	100-250 MPa_a	50-100MPa_a	25-50 MPa_a	5-25 MPa_a	1-5 MPa_a	<1 MPa_a
	Rating		15	12	7	4	2	1	0
2	Drill core Quality RQD		90%-100%	75%-90%	50%-75%	25%-50%	<25%		
	Rating		20	17	13	6	3		
3	Spacing of discontinuities		>2m	0.6-2m	200-600mm	60-200mm	60mm		
	Rating		20	15	10	8	5		
4	Condition of discontinuities		Very rough surfaces Not continuous No separation Unweathered wall rock	Slightly rough surfaces Separation < 1mm Slightly weathered walls	Slightly rough surfaces Separation < 1mm Highly weathered walls	Slickensided surfaces OR Gouge <5 mm thick OR Separation 1-5 mm Continuous	Soft gouge > 5mm thick OR Separation > 5 mm Continuous		
	Rating		30	25	20	10	0		
5	Group Water	Inflow per 10 m tunnel length	None OR	<10 litres/mm OR	10-25 litres/mm OR	25-125 litres/mm OR	> 125 litres/mm OR		
		Ratio = joint water pressure / Major principal stress	0 OR	0.0 - 0.1 OR	0.1 -0.2 OR	0.2 -0.5 OR	>0.5 OR		
		General Conditions	Completely dry	Damp	Wet	Dripping	Flowing		
	Rating		15	10	7	4	0		