CBCS SCHEME

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15MN741

Seventh Semester B.E. Degree Examination, Dec.2018/Jan.2019

Open Pit Slope Analysis and Design

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Illustrate "Pit slope vis-à-vis mine economics" by increasing pit slope from 30° to 60° with an interval of 5° and depth from 100 m to 400 m with an interval of 100 m. **(10 Marks)**

b. What are the conditions suitable for plane failure? Illustrate your answer with neat sketch. **(06 Marks)**

OR

2 a. Identify and interpret the factors/parameters that influence the stability of slopes. **(08 Marks)**

b. Derive an mathematical expression to estimate factor of safety for wedge failure, assuming cohesion is equal to zero. **(08 Marks)**

Module-2

3 a. What are the geotechnical data you, as a geotechnical engineer, will be looking for highwall slope stability studies? **(04 Marks)**

b. Describe any four important geotechnical parameters in relation to highwall slope stability studies. **(12 Marks)**

OR

4 a. What are the geological data required to be collected for stability studies of highwall slopes? **(04 Marks)**

b. Describe spacing, persistence, roughness and aperture in relation to discontinuities and its role in slope stability studies. **(12 Marks)**

Module-3

5 a. Describe filled discontinuities in the context of discontinuity shear strength. **(10 Marks)**

b. Describe various tests available for Joint Roughness Coefficient (JRC) measurement. **(06 Marks)**

OR

6 a. Explain Barton criterion to predict and describe the peak shear strength of rock discontinuities. **(08 Marks)**

b. Estimate (using Barton criteria) the shear strength of a rock discontinuity based on the following information:
Normal stress (σ) : 0.052 MPa
Joint Roughness Coefficient (JRC): 7.8
Compressive strength of joint wall (JCS): 50 MPa
Basic friction angle (ϕ_b) : 30°
Ratio of Schmidt hammer rebound on weathered to unweathered surface is 0.75. **(08 Marks)**

Module-4

7 a. Describe the characteristics of water flow in a porous media. **(06 Marks)**

b. In order to determine the average permeability of a bed of soil 12.5 m thick overlying an impermeable strata, a well was sink through the soil and a pumping test was carried out. After some time the discharge was 850 kg/minute and the drawdown in observation wells 15.2 m and 30.4 m from the pump were 1.625 m and 1.360 m respectively. If the original water table was at a depth 1.95 m below ground level, find the permeability of the soil in mm/s. **(10 Marks)**

OR

8 a. Describe water flow characteristics in discontinuous media. **(04 Marks)**

b. Illustrate flow lines, equipotential lines and hydraulic gradient in relation to flow of water through a soil. **(06 Marks)**

c. Derive an expression to calculate seepage quantity from a flow net. **(06 Marks)**

Module-5

9 a. A slope has sliding surface and tension crack in its upper surface. Both tension crack and sliding surface strike parallel to the slope surface. Tension crack is vertical and filled with water to certain depth. Water enters the sliding surface along the base of the tension crack and seeps along the sliding surface, escaping at atmospheric pressure. Derive a mathematical expression to determine factor of safety under above said conditions. **(08 Marks)**

b. A 30.48 m high slope with a face angle of 60° is found to have a bedding plane running through it at a dip of 30°. A tension crack occurs 8.8392 m behind the crest of slope and, from an accurately drawn cross-section of the slope, the tension crack is found to have a depth of 15.24 m. The unit weight of rock is 2563 kg/m^3. Assuming that the cohesive strength of the bedding plane 4880 kg/m^2 and the friction angle 30°, find the factor of safety if height of water in tension crack is 9.144 m. **(08 Marks)**

OR

10 a. Describe finite element, finite difference and distinct element methods for slope stability assessment. **(12 Marks)**

b. The cohesion and friction angle in a slope stability analysis have been modeled as random variable and have been used to estimate probability density function (PDF) of the factor of safety. The PDF of factor of safety have been found to be normally distributed. The mean and standard deviation of the normally distributed factor of safety have been found to be 1.3 and 0.2 respectively. Determine reliability index of the slope. **(04 Marks)**

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