Basavarajeswari Group of Institutions
BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT
(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

USN ☐☐☐☐☐☐☐☐☐☐   Course Code | 2 | 1 | C | V | 6 | 3 |

Sixth Semester B.E. Degree Examinations, September/October 2024
APPLIED GEOTECHNICAL ENGINEERING

Duration: 3 hrs   **Max. Marks: 100**

Note: *1. Answer any **FIVE** full questions choosing ONE full Question from each Module.*
          2. Missing data, if any, may be suitably assumed

Q. No		*Question*	*Marks*	*(RBTL:CO:PI)*
		Module-1		
1.	**a.**	What is sub-surface exploration? What are the objectives of sub-soil exploration?	**06**	(2 :1: 1.2.1)
	b.	With a neat sketch explain the seismic refraction method. What are its limitations?	**08**	(2 :1: 1.2.1)
	c.	Explain briefly the spacing, depth and location of borehole adopted for various civil engineering projects.	**06**	(2 :1: 1.2.1)
		(OR)		
2.	**a.**	List and explain different types of samplers used in soil sampling	**06**	(2 :1: 1.2.1)
	b.	Determine the area ratios for the following soil samplers and comment on the nature of samples obtained in each of the samplers. (i) Core cutter 185 mm outer diameter 135 mm inner diameter (ii) Split barrel 51 mm outer diameter 45 mm inner diameter (iii) Shelby tube 51 mm outer diameter 49 mm inner diameter	**06**	(3 :1: 2.1.3)
	c.	Establish the location of groundwater in a clayey stratum. Water in the borehole was bailed out to a depth of 10.5 m below the ground surface, and the rise of water was recorded at 24-hour intervals as follows: $h_1 = 0.63$ m, $h_2 = 0.57$ m, $h_3 = 0.51$ m	**08**	(3 :1: 2.1.3)
		Module-2		
3.	**a.**	Explain the classification of foundation settlements?	**06**	(2 :2: 1.2.1)
	b.	A normally consolidated clay layer is 18 m thick. Natural water content is 45 %, saturated unit weight is 18 kN/m³, grain specific gravity is 2.7 and liquid limit is 63 %. The vertical stress increment at the centre of the clay layer due to the foundation load is 9 kPa. The groundwater table is at the surface. Determine the settlement.	**08**	(3 :2: 2.1.3)
	c.	Using Boussinesq's equation, construct an isobar of intensity 0.25 Q, where Q is the point load acting on a surface.	**06**	(2 :2: 1.2.1)
		(OR)		
4.	**a.**	Explain: (i) Pressure distribution on the Horizontal plane (ii) Pressure distribution on the vertical plane	**06**	(2 :2: 1.2.1)

Note: (RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI– Performance Indicator)

b.	A load of 1000 kN acts as a point load at the surface of a soil mass. Estimate the stress at a point 3 m below and 4 m away from the point of action of the load by the Boussinesqs formula. Compare the value with the result of Westergaard's theory.	**06**	(3 :2: 2.1.3)
c.	Explain the stress distribution on a vertical plane due to point load from Boussinesqs theory.	**08**	(2 :2: 1.2.1)

Module-3

5.	**a.**	Define with neat sketches at rest, active and passive earth pressures.	**06**	(2 :3: 1.2.1)
	b.	Explain the culmann's graphical method of finding out active earth pressure.	**06**	(2 :3: 1.2.1)
	c.	A retaining wall is 10 m high, with its back face smooth and vertical has the following properties. G = 2.65, e = 0.65, ϕ = 30˚, water tube lies at 3 m depth. The surface of the backfill is horizontal and carries a surcharge of intensity of 14 kN/m^2. Draw a lateral active earth pressure distribution diagram. Determine total active pressure and its point of application.	**08**	(3 :3: 2.1.3)

(OR)

6.	**a.**	Explain the causes of slope failure and list the modes of finite slope failure.	**06**	(2 :3: 1.2.1)
	b.	Explain Fellinious method of obtaining the centre of critical slip surface in the case of stability analysis of c-ϕ soil.	**06**	(2 :3: 1.2.1)
	c.	A new canal is excavated to a depth of 5m below ground level, through soil having the characteristics c = 14 kN/m^2; ϕ = 15˚, e = 0.8, G = 2.70. The slope banks 1H: 1V. Calculate the FOS with respect to cohesion when the canal runs full. If the canal suddenly emptied what will be the FOS? Take S_n = 0.083 for submerged case; S_n = 0.122 for drawdown case	**08**	(3 :3: 2.1.3)

Module-4

7.	**a.**	With the help of neat sketches, explain the effect of the water table and eccentric loading on the bearing capacity of the soil.	**06**	(2 :4: 1.2.1)
	b.	Explain different modes of shear failure with the help of neat sketch.	**06**	(2 :4: 1.2.1)
	c.	A square footing 2.25 m × 2.25 m is built on a homogeneous bed of sand of density 18 kN/m^3 having an ϕ=0˚. The depth of the foundation is 1.2 m below the ground surface. Calculate the safe load that can be applied on the footing with a factor of safety of 3. Take C = 30 kN/m^2 bearing capacity factors as N_c = 5.7, N_q = 1, $N\gamma$ = 0.	**08**	(3 :4: 2.1.3)

(OR)

8.	**a.**	Define the terms (i) Ultimate bearing capacity (ii) Net ultimate bearing capacity (iii) Net safe bearing capacity (iv) Gross safe bearing capacity	**06**	(2 :4: 1.2.1)
	b.	Explain the test procedure for conducting plate load test as per Indian Standards.	**06**	(2 :4: 1.2.1)

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	c.	The footing of a column is 2 m square and is founded at a depth of 1.5 m on a sandy soil. The unit weight of soil above water table is 18 kN/m^3 and saturated of soil is 20 kN/m^3. Determine the ultimate bearing capacity of soil if (i) Water table is well below the foundation level. (ii) Water table is base of the footing (iii) Water table is at ground surface. Take N_c= 50.5, N_q= 37.7, and N_γ = 48.	**08**	(3 :4: 2.1.3)

Module-5

9.	**a.**	Justify with a neat sketch, how the static formula summarize the load transfer mechanism in pile foundation.	**06**	(2 :5: 1.2.1)
	b.	What is group efficiency? Find the group efficiency for 3, 5, 9, 16 group of piles Feld's rule.	**06**	(2 :5: 1.2.1)
	c.	In a group of 16 pile diameter is 450mm and centre to centre spacing of the square group is 1.5 m. If $C = 50$ kN/m^2 determine whether the failure would occur with a pile acting individually, or as a group? Neglect the bearing at the tip of pile. All piles are 10 m long. Take the adhesion factor as 0.75 and FOS = 2.5. Also find the safe allowable load.	**08**	(3 :5: 2.1.3)

(OR)

10	**a.**	Explain (i) negative skin friction in pile foundation. (ii) Group capacity of piles.	**10**	(2 :5: 1.2.1)
	b.	Explain with the neat sketch of (ii) under-reamed pile (ii) settlements of piles.	**10**	(2 :5: 1.2.1)

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