Basavarajeswari Group of Institutions

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

USN										Course Code	2	1	C	V	5	3

Fifth Semester B.E. Degree Examinations, April/May 2024

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.**	With the help of 3-phase diagram for soil and indicating the volumes and weights, Define: (i) Void ratio (ii) Specific gravity (iii) Degree of saturation (iv) Water content.	**06**	(2 :1: 1.2.1)
	b.	With usual notations, derive the relationship, $\gamma_d = (1-n_a)\, G\, \gamma_w / (1+ wG)$	**08**	(2 :1: 1.2.1)
	c.	Draw the volume Vs water content for a fine grained soil and Define the Liquid limit, Plastic limit and Shrinkage limit.	**06**	(2 :1: 1.2.1)
		(OR)		
2.	**a.**	Explain the determination of specific gravity of solids by pyconometer method.	**06**	(2 :1: 1.2.1)
	b.	With usual notations, derive the relationship, Se= WG	**06**	(2 :1: 1.2.1)
	c.	A clayey soil was tested for liquid and plastic limits and the following were the results. Find (i) liquid limit (ii) plasticity index (iii) flow index (iv) toughness index. The Plastic Limit of soil was found to be 28%.	**08**	(3 :1: 2.1.3)

Number of blows	**34**	**23**	**18**	**12**
Water content (%)	**44.6**	**49.4**	**51.4**	**55.6**

		Module-2				
3.	**a.**	Explain different types of soil structures.	**06**	(2 :2: 1.2.1)		
	b.	Explain the three common clay minerals.	**08**	(2 :2: 1.2.1)		
	c.	Determine the relative compaction of soil, if the field density is 18.51 kN/m^3; whose maximum dry density is 22 kN/m^3 and optimum moisture content is 13%. Comment on that.	**06**	(3 :2: 2.1.3)		
		(OR)				
4.	**a.**	Write a note on 'Proctor needle' test and its procedure.	**06**	(2 :2: 1.2.1)		
	b.	Briefly explain the factors effecting compaction in detail.	**06**	(2 :2: 1.2.1)		
	c.	The following data refers to compaction test as per IS (light compaction), volume of the mould =1000 cc and specific gravity G=2.7. Plot (i) compaction curve and obtain MDD and OMC (ii) Plot 100% saturation line	**08**	(3 :2: 2.1.3)		

Water content (%)	**8.5**	**12.2**	**13.75**	**15.5**	**18.2**	**20.2**
Weight of wet sample (kg)	**1.5**	**1.94**	**2.0**	**2.05**	**2.03**	**1.98**

Module-3

5.	**a.**	Derive an expression to obtain the coefficient of permeability under (i) constant head (ii) falling head condition.	**08**	(2 :3: 1.2.1)
	b.	Define Darcy's law. Derive an expression to relate discharge velocity and seepage velocity	**06**	(2 :3: 1.2.1)
	c.	List the characteristics of flow nets.	**06**	(2 :3: 1.2.1)

(OR)

6.	**a.**	Explain the determination of phreatic line by Casagrande's method– with toe filter	**08**	(2 :3: 1.2.1)
	b.	In a falling head test the time taken for fall in head from h_1 to h_2 is equal to that from h_2 to h_3. Deduce the relation between h_1, h_2 and h_3.	**06**	(2 :3: 1.2.1)
	c.	Compute the quantity of water seeping under a weir per day for which the flow net has been satisfactorily constructed. The k is 2×10^{-2} mm/s, nf = 5 and nd = 18. The difference in water level between upstream and downstream is 3 m. The length of the weir is 60 m.	**06**	(3 :3: 2.1.3)

Module-4

7.	**a.**	Derive the relation $\sigma_1 = \sigma_3 \tan^2 \alpha + 2c \tan \alpha$	**10**	(2 :4: 1.2.1)
	b.	In a direct shear test, the normal stress for a sand sample was 200 kN/m^2 and shear stress was 120 kN/m^2. Draw the Mohr circle and strength envelope. Determine: (i) The angle of shearing resistance (ii) The magnitude of major and minor principal stresses (iii) Orientation of principal stresses.	**10**	(3 :4: 2.1.3)

(OR)

8.	**a.**	Explain the Mohr-Coulomb failure theory of soils.	**08**	(2 :4: 1.2.1)
	b.	A consolidated undrained test was conducted on a clay sample and the following results were obtained: Determine the shear strength parameters for Effective stresses C' and ϕ'	**12**	(3 :4: 2.1.3)

Cell Pressure (kN/m^2)	**150**	**300**	**450**	**600**
Deviator stress at failure (kN/m^2)	**102**	**200**	**304**	**405**
Pore water pressure at failure (kN/m^2)	**80**	**164**	**246**	**325**

Module-5

9.	**a.**	What is pre-consolidation pressure? Explain by Casagrandes graphical method.	**06**	(2 :5: 1.2.1)
	b.	Explain the determination of coefficient of consolidation by Square root of time fitting method.	**06**	(2 :5: 1.2.1)
	c.	A 30 cm thick sample of clay reached 30 % consolidation in 15 minutes with drainage both at top and bottom. How long will it take the clay layer from which the sample was obtained to reach 50% consolidation? The clay layer has one-way drainage and was 6 m thick.	**08**	(3 :5: 2.1.3)

(OR)

10	**a.**	Explain the determination of coefficient of consolidation by logarithmic of time fitting method.	**06**	(2 :5: 1.2.1)
	b.	Enumerate the assumptions and limitations of Terzaghis consolidation theory.	**06**	(2 :5: 1.2.1)
	c.	A saturated soil layer 5 m thick lies above an impervious stratum. Below a pervious stratum it has Cc =0.25, k = 3.2×10^{-10} m/s. Its void ratio of effective stress at 147 kN/m^2 is 1.9. Calculate (i) Change in void ratio due to increase in effective stress to 196 kN/m^2 (ii) M_v (iii) C_v (iv) time taken for 50 % consolidation	**08**	(3 :5: 2.1.3)

** ** **

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