Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER II– EXAMINATION – WINTER - 2016

Subject Code: 2724309 **Date: 19/11/ 2016**

Subject Name: Soil Structure Interaction

Time: 2:30 pm to 5:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Explain contact pressures based on theory of elasticity. Differentiate contact pressures under perfectly flexible footings and perfectly rigid footings in detail. Support your answer with neat sketches for sand and clay.	**07**
	(b)	Enlist the various factors affecting the magnitude of the coefficient of subgrade reaction (kv and kh). Explain the influence of width B **or** depth D on coefficient of horizontal soil reaction in detail. Support your answer with necessary plots.	**07**
Q.2	**(a)**	Explain soil-line and beam-line method in detail with necessary equation and plots.	**07**
	(b)	Calculate the foundation pressure and moments for the simply supported beam with point load of 200000kg acting at the centre of 40m span. Assume K = 5 x 10^5 kg/m^2 and E = 2 x 10^9 kg/m^2. Assume necessary coefficients if required.	**07**
		OR	
	(b)	Three columns 500mm x 500mm size are placed 5.5m centre to centre in one line. The length of the footing is not to exceed 11.5m. The column loads are 15 x 104kg for side columns and 10 x 10^4 kg for central one. The bearing capacity of soil is 6 x 10^3 kg/m^3. K-values at centre and corner are 5 kg/m^3 and 1.5 kg/m^3 respectively. Determine the design moments by soil line method. Assume necessary coefficients wherever required.	**07**
Q.3	**(a)**	Explain rigid method and elastic plate method for the analysis of mat foundation. State the recommendations given by ACI for mat foundation analysis.	**07**
	(b)	What do you mean by Winkler foundation and derive its equation for finding slope, deflection, moment, shear and load for a beam resting on elastic foundation.	**07**
		OR	
Q.3	**(a)**	Estimate the immediate settlement of a concrete footing 1.5m x 1.5m in size founded at a depth of 1m in silty soil whose modulus of elasticity is 90kg/cm2. The footing is expected to transmit a unit pressure of 200 kN/m^2. Take μ = 0.35, I_f = 0.82 for rigid footing.	**07**
	(b)	What do you mean by foundation settlement? What are the components of total settlement? Explain elastic settlement based on theory of elasticity in detail.	**07**
Q.4	**(a)**	A steel pipe pile of outside diameter 610mm and wall thickness of 25mm is driven into saturated cohesive soil upto a depth of 20m. The undrained cohesive strength of the soil is 20kPa. The submerged unit weight of soil is 9kN/m3. Construct (p-y) curves for static loadings at depth of 2,6 and 10 metres. Take ε_{50} = 0.02, $P_u = (3+\gamma' x/c_x + 0.5x/d)c_x d$.	**07**
	(b)	A steel pile of 610mm outside diameter and 560mm inside diameter is driven into medium dense sand under submerged condition which is	**07**

having relative density 60% and angle of internal friction is 380. Compute the ultimate resistance of the pile by Broms method. Assume the yield resistance of the pile section as $1.3f_yZ$. Assume f_y = 2800kg/cm^2, submerged unit weight of the soil as 8.75kN/m^3, e/d = 0, ultimate resistance moment = 462 and ultimate lateral resistance = 80.

OR

Q.4 **(a)** A 300mm square wooden pile is driven 5m below ground level in pre-loaded clay. The load to be applied is 1m above the ground. Determine the ultimate load that can be applied on a pile with Mu = 110kNm. Assume Kh = 16 MN/m^2, E = 10 X 10^2 MN/m^2 and cohesion of clay = 1kg/cm^2.Assume e/R = 1.83, Zf/R = 1.42, m = 0.62. Use IS 2911 method only. **07**

(b) A steel pipe pile of outside diameter 610mm and wall thickness of 25mm is driven into medium dense sand under submerged condition to a depth of 20m. The relative density of sand is 30%. Take EI of the pile as 4.35 x 10^{11} kg.cm^2. The coefficient of soil modulus variation η_h is 6MN/m3. Compute lateral deflection for lateral load of 268kN applied at a height of 2m above the ground level for free head condition using Poulos method. Take l/d 33, I'_{yp} = 250, k_N = 2.26 x 10-5 and I'_{ym} = 1600. Assume any other data if required. **07**

Q.5 **(a)** What do you mean by curved failure surfaces? Explain logarithmic spiral method for determining passive earth pressure of sand with neat sketch. **07**

(b) Explain in detail Poulos-Davis-Randolph approach for assessing vertical bearing capacity of piled raft foundation. **07**

OR

Q.5 **(a)** Discuss in detail Barkans method and Pauw's analogy for foundation soil system. **07**

(b) Explain the concept of Elastic half space method for analysis of machine foundation based on F.E.Richart. Enlist the various conditions of analysis and discuss any one condition only in detail with necessary equations. **07**

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