Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER– 2 • EXAMINATION – WINTER - 2023

Subject Code:3724312 Date: 05 Jan 2024

Subject Name:Dymanics of Soils & Foundations

Time:10:30 AM TO 01:00 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)** A reciprocating machine is symmetrically mounted on a block of size 4.0m x 3.0m x 3.5m high. The soil at the site is sandy in nature having Ø = 35° and γsat=19 kN/m^3. The water table lies at a depth of 3.0m below the ground surface. The block is embedded in the ground by 2.0m depth. The machine vibrating at a speed of 260rpm generates, Maximum vertical unbalanced force = 2.8kN Torque about Z-axis = 4.0 kNm Maximum horizontal unbalanced force= 2.5kN at a height of 0.2m above the top of the block. The machine weight is small in comparison to the weight of foundation. Limiting amplitude of the machine is 150 microns. Determine the natural frequencies and amplitudes by Elastic half space theory. Take, Cu = 3.62 x 104 kN/m^3 , G = 1.1 x 104 kN/m^2 , E = 2.98 x 104 kN/m^2 , μ= 0.36, C_τ = 1.82 x 104 kN/m^3, $C_Ø$ = 6.28 x 104 kN/m^3, C_ψ = 2.73 x 104 kN/m^3.Assume any other data if required. **07**

(b) Derive the equation of motion (response) of the **07**

(i) Free un-damped single degree of freedom system

(ii) Free damped single degree of freedom system

Q.2 **(a)** A mass attached to a spring of stiffness of 10 N/mm has a viscous damping device. When the mass was displaced and released, the period of vibration was found to be 2.0s and the ratio of the consecutive amplitudes was 10/3. Determine the amplitude and phase angle when a force F= 3sin 4t acts on the system. The unit of the force is Newton. **07**

(b) Differentiate between Active & Passive isolation and also mention their significance? Enlist the various methods to determine it. **07**

OR

(b) A rectangular foundation has a length of 2.5m. It is supported by a dense sand with unit weight of 17kN/m^3. The sand has an angle of friction 35°. The depth of foundation is 0.75m. The foundation may be subjected to a dynamic load of 1000kN increasing at moderate rate. Using FOS equal to 2, find the width of foundation. **07**

Q.3 **(a)** Write short notes on: (a) Resonant Column test (b) SASW test **07**

(b) Design a suitable isolation system for keeping the amplitude of the foundation of a reciprocating machine less than 0.025 mm. The weight of the machine is 25 kN and it produces sinusoidal varying unbalanced force of 4kN in the vertical direction. The operating speed of machine is 800 rpm. The dynamic shear modulus of the soil is 2.5 x 10^4 kN/m^2.Assume necessary data required. **07**

OR

Q.3 **(a)** Differentiate between horizontal block resonance test and vertical block resonance test. **07**

(b) At a particular site, the top 10.0 m soil is medium grained soil having dry unit weight as 17 kN/ m^3. The water table is 6.0 m below the ground surface. The value of specific gravity of soil grains is 2.67. The direct shear test gave the value of Φ as 36°. Determine **07**

the value of shear modulus of the soil at depth of 7.0 m below ground surface.

Q.4 **(a)** Define the following: coefficient of elastic uniform compression, coefficient of elastic uniform shear, coefficient of elastic non-uniform compression, coefficient of elastic non-uniform shear, damping ratio, resonance. Also state their equations. **07**

(b) Discuss the use of each laboratory test to determine dynamic soil properties. Also write limitations for each. **07**

OR

Q.4 **(a)** Define liquefaction and explain its mechanism with reference to effective stress principle. Enlist the various factors affecting liquefaction potential of a soil. Also discuss anti-liquefaction measures **07**

(b) Enlist the methods for predicting liquefaction potential. Explain one any in detail. **07**

Q.5 **(a)** A rectangular footing of size 1.5m* 3.0m is provided at the depth of 1.0 m below the ground surface. The soil properties are c = 10kN/m^2, ϕ= 30˚ and γ= 17.5 kN/m^3.Determine (i) Ultimate static bearing capacity (ii)Ultimate bearing capacity for horizontal and vertical accelerations 0.3g and 0.2g respectively, using Meyerhof's method and Rangwala et al. method. (Take N_{cs}= 30.14, N_{qs}= 18.4, $N_{\gamma s}$=22.40).Assume necessary data if required **07**

(b) Differentiate between seismic up-hole survey test and seismic cross-borehole survey test. **07**

OR

Q.5 **(a)** Discuss the various types of machines that generate periodic forces. Explain the general requirements of machine foundations. **07**

(b) Discuss the special considerations taken for better performance of a turbo-generator foundation. List the loads acting on it with their brief description. **07**