Ref. No. : Ex/CE/PE/B/T/422C/2022

B.E. CIVIL ENGINEERING FOURTH YEAR SECOND SEMESTER – 2022

Subject : DYNAMICS IN GEOTECHNICAL ENGINEERING (ELECTIVE) (PART I)

TIME 4 HOURS FULL MARKS 35

USE SEPARATE ANSWERSCRIPT FOR EACH PART

1. Discuss with neat sketches the various soil parameters used in analysis and design of machine foundation by linear elastic weightless spring method. 8

2. Derive the expressions for natural frequencies and amplitudes of a machine foundation for a reciprocating machine subjected to simultaneous vertical, sliding and rocking vibrations by weightless spring method. 12

2. 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 phi $=35^0$ and saturated bulk density 20 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 250 rpm generates
Maximum vertical unbalance force = 2.4kN
Maximum horizontal unbalanced force = 1.8 kN at a height of 0.25m 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. Coefficient of elastic uniform compression $C_u = 3.6 \times 10^4$ kN/m^3
Determine the natural frequencies and amplitude by weightless spring method. 15

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DYNAMICS IN GEOTECHNICAL ENGINEERING

Part – II

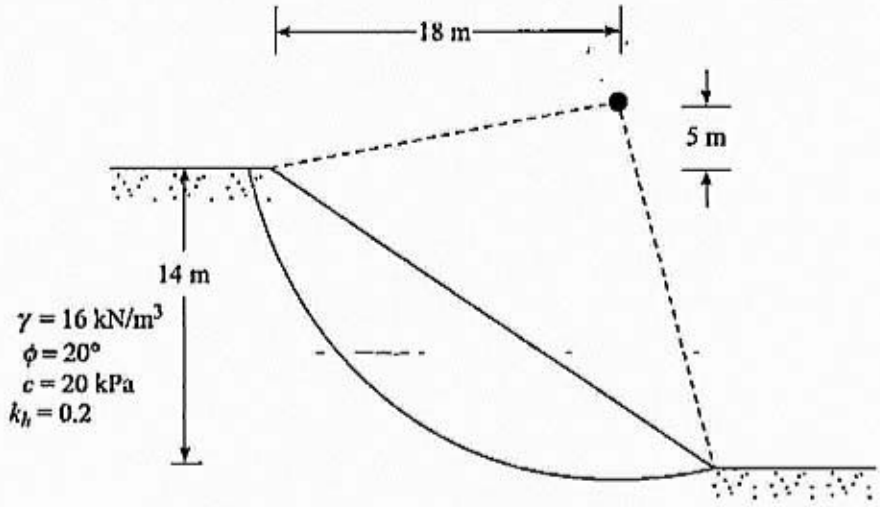
Full Marks = 70

(35 marks for this part)

Question No.	(Answer all the questions.) [Assume any data reasonably if necessary] [Use code: IS 1893 (Part-I): 2016]	Marks

1. [CO4]

A homogeneous slope is shown in Figure below. For the trial failure surface shown, determine the factor of safety against sliding. Use the method of slices. (*Note:* The slope angle is $\beta = 30°$.)



[Ignore the effect of vertical seismic coefficient, *Kv*]

[12]

2. [CO3]

A project site is investigated by carrying out SPT tests at every 0.75 m depth interval in a bore-hole. The measured penetration resistance with depth is given in the table (Table 1) below and the soil profile obtained from the bore-log data is also shown in figure (Figure 2) below. The region is expected to experience an earthquake of magnitude 7.5. The project site is estimated to experience a_{max} of '0.25g' ground shaking under the expected earthquake. Estimate the liquefaction potential of the site at 1.5m depth interval.

Given:

[An automatic trip donut-hammer with an energy efficiency of 60% is used in the SPT testing (i.e., the hammer transfer 60% of free fall theoretical energy of SPT hammer)

Use unit weight of water, $\gamma_w = 10$ kN/m^3 in the calculations]

Assume Water Table at 1m depth]

[15]

Table 1

Depth (m)	0.75	1.5	2.25	3.0	3.75	4.5	5.25	6.0
N-value	6	5	6	10	15	12	18	20

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	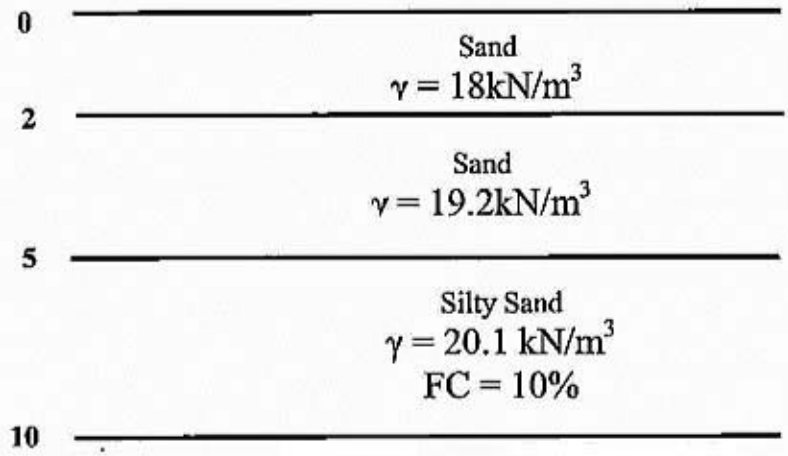 **Figure 2**	
3. [CO2]	Discuss in brief about the steps involved in Deterministic Seismic Hazard Analysis (DSHA)	[8]