Ref No.-Ex/PG/CE/T/127C/2017

MASTER OF ENGINEERING IN CIVIL ENGINEERING EXAMINATION, 2017
(1ST YEAR 2ND SEMESTER)
(1st / 2nd Semester/ ~~Repeat/ Supplementary/Spl. Supplementary/Old/ Annual/ Biannual~~)
SUBJECT: SOIL DYNAMICS & MACHINE FOUNDATION
(Name in full)

Full Marks ~~30~~/100

Time: ~~Two hours~~/Three hours/~~Four hours/ Six hours~~

No. of Questions	PART I (MARKS 30)	Marks
	Answer all questions	
Q1	Explain the difference between triaxial tests under monotonic loading and cyclic loading highlighting the parameters measured from cyclic triaxial tests. Show graphically variation of shear modulus and damping ratio with strain amplitude for sandy soils tested under different confining pressure.	5+5 = 10
Q2	At a particular site top 15.0m soil is fine grained sand having dry unit weight of 17kN/m^3. Water table is at a depth of 3m below the ground surface. Specific gravity of sand is 2.68. Direct shear test gave the value of angle of shearing resistance for the sand as 32^0. Determine the variation of shear modulus and also shear wave velocity with depth for the sand deposit. Calculate the magnitude of both the parameters at interval of 3m and draw the variation with depth at an appropriate scale. Use the following expressions : Shear wave velocity (m/s) = $(11.36 - 5.35\ e)\ (\sigma_0)^{0.5}$ Shear modulus (kN/m^2) = $[3230(2.97 - e)^2/\ (1+e)](\ \sigma^0)^{0.5}$	15
Q3	Discuss briefly seismic cross-borehole test used for determination of dynamic soil properties.	5

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MASTER OF CIVIL ENGINEERING 2nd SEMESTER. 2017

(2ndSemester)

SUBJECT: SOIL DYNAMICS AND MACHINE FOUNDATION

Time: Three hours **Full Marks: 100**

Use a separate Answer-Script for each part

1. Answer ALL questions.
2. Maintain neatness. Assume reasonable values of data appropriately if not supplied.
3. No code etc. will be needed to answer the questions of this part
4. Notations used bear their usual meanings

No. of Question	Part –II (30 Marks)	Marks
Q.1 a)	Illustrate the concept of elastic half space method for design of a block foundation under vertical vibration.	8
b)	A reciprocating machine is symmetrically mounted on a block of size 5mx4mx4m high and is made of M30 concrete. The soil at the site is normally consolidated silty clay (c_u=50 kN/m^2 and γ = 20 kN/m^3). Water table is not encountered within 5m depth below ground surface. The block is embedded in ground by 2m from bottom. The machine vibrating at a speed of 250 rpm generates maximum vertical unbalanced force = 3.5 kN. Torque about vertical axis is 4.0 kN-m. Operating speed of machine is 350rpm. Machine weight is small in comparison to weight of foundation. Limiting amplitude of machine is 150 micron. Dynamic elastic constants are as follows: c_u=3.62x10^4 kN/m^3 and μ=0.45 Determine natural frequencies and amplitudes for vertical Vibration with and without embedment effect.	10
Q.2	Design a suitable foundation for a 20 kN forging hammer which is proposed to be installed at an industrial complex. The relevant specification and design data are as follows: Maximum tup stroke= 900mm Area of piston=0.15m^2 Supply steam pressure =700 kN/m^2 Weight of anvil block=400 kN , Weight of anvil and frame=500 kN Total weight of hammer =400kN Bearing area of anvil = 2.1mx2.1m Permissible amplitude for anvil=1.0mm Permissible amplitude for foundation =0.75mm The modulus of elasticity of pad material is 5x10^5 kN/m^2 and allowable compressive stress in pad is 400 kN/m^2. The soil at the site is sandy and water table lies at 2.5m below ground surface. Allowable soil pressure is 225 kN/m^2 Based on results of Block Vibration Test carried out at the site recommended value of c_u=2.5x10^4 kN/m^3 for design purpose and allowable soil pressure is 200kN/m^2.	12

M.E. Civil Engg. EXAMINATION, 2017

(1st Year, 2nd Semester)

SOIL DYNAMICS AND MACHINE FOUNDATION

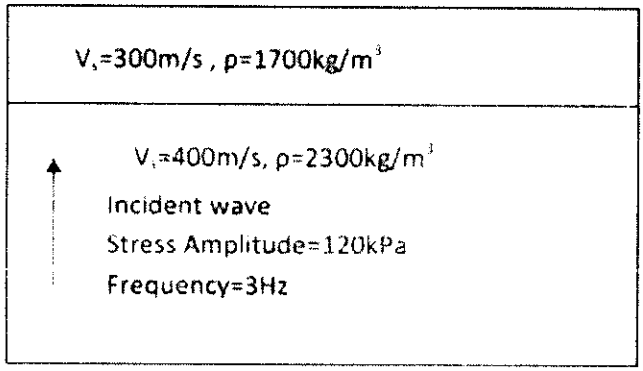
PART-III

Time: Three Hours

Full Marks 100
(40 marks for this part)

Use a separate Answer-Script for each part

[Answer all the question & Assume data reasonably wherever necessary]

Question No.	(Answer all the questions)	Marks
1. (a)	Define **Impedance ratio** (α_z).	1
(b)	Explain $\alpha_z = 0$ and $\alpha_z = \infty$ scenarios of wave propagation.	3
(c)	A vertically propagating shear wave travels upward through a layered soil deposit. Compute the displacement amplitudes of the **reflected** and **transmitted** waves that develop when the shear wave reaches the boundary shown in Figure 1.  **Figure 1**	6
2. (a)	Derive one-dimensional **longitudinal wave propagation equation**. Write assumptions involved in its derivation.	6
(b)	Write a short note on '**Dispersion of surface waves**'.	4
3.	It is plan to construct a seven storeyed residential building. The building frame has 3 spans of 7m each in both the directions. The bore logs indicate that the soil at the site consists of medium sand to great depth. It was found that interior columns were heaviest loaded. A interior column had: Axial static load = 3950 kN Static moment=9 kN-m Static shear force = 35 kN Additional moment due to earthquake = ± 450 kN-m Additional shear force due to earthquake = ± 160 kN It was decided to rest the column on piles of 500 mm dia and length 16 m.	20

NAME OF THE PAPER SETTER

M.E. Civil Engg. EXAMINATION, 2017

(1st Year, 2nd Semester)

SOIL DYNAMICS AND MACHINE FOUNDATION

PART-III

Time: Three Hours

Full Marks 100
(40 marks for this part)

Use a separate Answer-Script for each part

[Answer all the question & Assume data reasonably wherever necessary]

Vertical pile load test performed on a test pile indicated that the capacity of the pile may be adopted as 1100 kN. A lateral load test was also carried out on this pile. Table below shows the data obtained from static lateral load test.

Lateral Load (kN)	5	10	15	20	25	30
Horizontal Deflection (mm)	0.03	0.06	0.13	0.34	0.53	0.8

Determine the **maximum moment** in a pile by **Pseudo Static** analysis.

[Coefficients A_y, A_m and B_y, B_m for long piles (Free Head) are provided below]

Z	A_y	A_m	B_y	B_m
0	2.435	0.00	1.623	1
0.2	2.112	0.198	1.293	0.999
0.4	1.796	0.379	1.003	0.987
0.6	1.496	0.532	0.752	0.960
0.8	1.216	0.649	0.540	0.914
1.0	0.962	0.727	0.364	0.852
1.2	0.738	0.767	0.223	0.775
1.4	0.544	0.772	0.112	0.688
1.6	0.381	0.746	0.029	0.594
1.8	0.247	0.696	-0.030	0.498
2.0	0.142	0.628	-0.070	0.404