Ref No.-Ex/PG/CE/T/127C/2018

MASTER OF ENGINEERING IN CIVIL ENGINEERING EXAMINATION, 2018
(1ST YEAR 2ND SEMESTER)
(1st / 2nd Semester/~~ Repeat/ Supplementary/Spl. Supplementary/Old/ Annual/ Biannual)~~
SUBJECT: SOIL DYNAMICS & MACHINE FOUNDATION(SMFE)
(Name in full)

Time: ~~Two hours~~/Three hours/~~Four hours/ Six hours~~ Full Marks ~~30~~/100

No. of Questions	PART I (MARKS 30)	Marks
	Answer all questions	
Q1	Discuss the factors affecting shear modulus and damping of soil. Show graphically typical variation of shear modulus with void ratio and effective confining pressure for both cohesive and cohesionless soils.	6+4 = 10
Q2	At a particular site top 15.0m soil is overconsolidated clay having dry unit weight of 18kN/m^3. Water table is at a depth of 3m below the ground surface. Specific gravity of clay is 2.67. Plasticity index is 40. OCR = 4. Void ratio, e=0.53. Triaxial tests gave the value of c' = 30kPa and $\varphi' = 27^0$. Determine the variation of shear modulus with depth for the clay deposit. Calculate the magnitude of shear modulus at interval of 3m and draw the variation with depth at an appropriate scale. Use the following expressions : Shear modulus (kN/m^2) = $[3230(2.97 - e)^2/(1+e)](OCR)^k(\sigma^0)^{0.5}$ k for PI = 40 is 0.30.	10
Q3	Discuss briefly the followings : (a) seismic cross-borehole test (b) cyclic plate load test.	5 x 2 = 10

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M.E. CIVIL ENGINEERING FIRST YEAR SECOND SEMESTER EXAM. 2018
SOIL DYNAMICS AND MACHINE FOUNDATION (SMFE)

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 if it is 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)	Deduce the formulation for natural frequencies and amplitudes for coupled rocking and sliding of a Block Foundation	8
b)	A reciprocating machine is symmetrically mounted on a block of size 4mx3mx3.5m high. The soil at the site is sandy ($\Phi=35^0$ and γ = 20 kN/m^3). Water table is at 3m below ground surface. The block is embedded in ground by 2m depth. Machine vibrating at a speed of 450 rpm generates maximum vertical unbalanced force = 3.0 kN. Torque about vertical axis is 4.0 kN-m. Operating speed of machine is 500rpm. Maximum horizontal unbalanced force = 2.0 kN acting 0.3m above top of the block. 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=3.5x10^4 kN/m^3, G= 1.10x10^4 kN/m^2, E=2.98x10^4 kN/m^2, μ=0.35 Determine natural frequencies and amplitudes for different vibration modes (a) vertical, and (b) Coupled rocking and sliding	4+6=10
Q.2	Design a suitable foundation for a 15 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= 800mm Area of piston=0.12m^2 Supply steam pressure =600 kN/m^2 Weight of anvil block=300 kN , Weight of anvil and frame=400 kN Total weight of hammer =400kN Bearing area of anvil = 2.5mx2.5m Permissible amplitude for anvil=1.5mm Permissible amplitude for foundation =1.0mm It is proposed to use a Pine wood pad of thickness 0.5m below the anvil. The modulus of elasticity of pad material is 5x10^5 kN/m^2 and allowable compressive stress in pad is 350 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=2.8x10^4 kN/m^3 for design purpose.	12

M.E. Civil Engg. EXAMINATION, 2018

(1st Year, 2nd Semester)

SOIL DYNAMICS AND MACHINE FOUNDATION

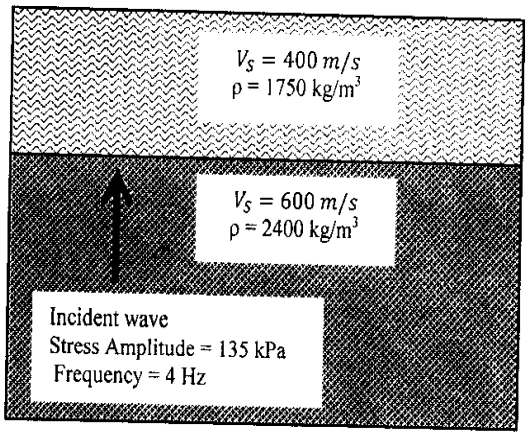
PART-III

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)	Derive the equations of motion for a three dimensional elastic solid.	[12]
(b)	Solve the equations for primary or dilatational wave (V_P) and shear or rotational wave (V_S).	[8]
2. (a)	What is **Rayleigh wave**? Draw a comparison with a neat sketch to show how the Rayleigh wave and body waves propagation velocities vary with Poisson's ratio.	[2+4]
(b)	Distinguish between wave propagation velocity and particle velocity.	[2]
(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.  **Fig. 1**	[7]
d)	Write a short note on '**Radiation damping**'.	[5]