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**PRESIDENCY UNIVERSITY
BENGALURU**

**SCHOOL OF ENGINEERING
END TERM EXAMINATION - AUGUST 2024**

Semester : II

Course Code : CIV5013

**Course Name : Design concepts of
substructures**

Program: M.Tech. BCT & II

Date : 12/August/2024

Time :9.30 AM to 12.30 PM

Max Marks :100

Weightage :50%

Instructions:

- (i) Read all questions carefully and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and non-programmable calculator are permitted.
- (iv) Do not write any information on the question paper other than Roll Number.

PART A

ANSWER ANY 4 QUESTIONS

4Q X 5M=20M

- 1 Pier is an underground structure that transmits a more massive load, which cannot be carried by shallow foundations. It is usually shallower than piles. List the advantages of pier foundations. (CO 1) [Knowledge]
- 2 The cone penetration test is carried out to find the resistance value of the cone against the soil that helps us to determine different mechanical properties of soil such as strength, bearing capacity, and so on. List the difference between static and dynamic cone penetration tests. (CO 2) [Knowledge]
- 3 A 60 cm bearing plate settles by 10 mm in the plate load test on cohesion less soil when the intensity of loading is 200 kN/m². Estimate the settlement of a shallow foundation of 1.8 m square under the same intensity of loading. (CO 2) [Knowledge]
- 4 Bridge substructure consists of pier, pier cap and foundations. Explain pier and pier cap of a bridge substructure. (CO 3) [Knowledge]
- 5 Caisson foundation is most often used in the construction of bridge piers & other structures that require foundation beneath rivers & other bodies of water. This is because caissons can be floated to the job site and sunk into place. List the various types of well foundation. (CO 4) [Knowledge]

PART B

ANSWER ANY 4 QUESTIONS

4Q X 10M=40M

- 6 Pier is a structure that transmits a more massive load, which cannot be carried by shallow foundations. Explain the construction procedure of drilled piers. (CO 1) [Comprehension]
- 7 The subsoil exploration should enable the engineer to draw the soil profile indicating the sequence of the strata and the properties of the soils involved. Explain auger and wash boring methods with a neat sketch. (CO 2) [Comprehension]

- 8 A soil exploration program was conducted at site near J P Nagar, Bengaluru. During exploration program, according to ASTM a standard penetration test was conducted. The standard penetration value ie SPT number was found to be $N=25$, rod length is 6m, diameter of bore hole is 200 mm, effective over burden pressure $p_o'=300$ kPa, $E_r=80$ with loose sand without liner. Compute N'_{70} and N'_{60} (CO 2) [Comprehension]
- 9 List the various loads to be considered for the design of foundation of a bridge pier and explain Class AA loading as per IRC: 6 2000. (CO 3) [Comprehension]
- 10 Explain the design concepts of maximum depth of scour and discharge for foundation of bridge pier. (CO 3) [Comprehension]
- 11 Caissons (also sometimes called "piers") are created by auguring a deep hole into the ground, and then filling it with concrete. Explain various types of caisson foundations. (CO 4) [Comprehension]

PART C

ANSWER ANY 2 QUESTIONS

2Q X 20M=40M

- 12 A footing 3 meter square rests on a soft clay soil with its base at a depth of 2 meter from ground surface. Clay stratum is 4 meter thick and is underlain by a firm sand stratum. The clay soil has liquid limit of 30% and $G=2.7$, water content at saturation is 45%, cohesion is 0.5 kg per square centimeter and $\phi=0$. The clay stratum is normally consolidated. Compute the settlement that would result if the load intensity equal to safe bearing capacity of soil were allowed to act on the footing. Natural water table is quite close to the ground surface. For given conditions, $N_C=6.9$, factor of safety as 3. Assume a load spread 2 (vertical) to 1 (horizontal). (CO 2) [Application]
- 13 With a neat sketch explain the various components of well foundation. (CO 4) [Application]
- 14 Well foundations are the substructures and sinking of wells is the most important step involved in well foundation. Explain in detail the sinking of well foundations. (CO 4) [Application]