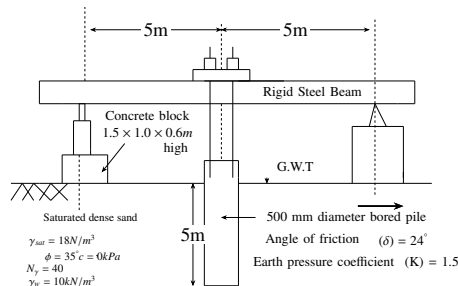


- 49) The magnetic bearing of a line AB was  $N 59^{\circ}30' W$  in the year 1967, when the declination was  $4^{\circ}10' E$ . If the present declination is  $3^{\circ}W$ , the whole circle bearing of the line is
- $299^{\circ}20'$
  - $307^{\circ}20'$
  - $293^{\circ}40'$
  - $301^{\circ}40'$
- 50) Determine the correctness or otherwise of the following **Assertion** [a] and **Reason** [r]:  
**Assertion** [a]: Curvature correction must be applied when sights are long  
**Reason** [r]: Line of collimation is not a level line but is tangential to the level line
- Both [a] and [r] are true and [r] is the correct reason for [a]
  - Both [a] and [r] are true but [r] is **not** the correct reason for [a]
  - Both [a] and [r] are false
  - [a] is false but [r] is true

## Common data questions

### Common data for questions 51 and 52

Examine the test arrangement and the soil properties given below:



- 51) The maximum pressure that can be applied with a factor of safety of 3 through the concrete block, ensuring no bearing capacity failure in soil using Terzaghi's bearing capacity equation without considering the shape factor, depth factor and inclination factor is
- 26.67 kPa
  - 60 kPa
  - 90 kPa

d) 120 kPa

- 52) The maximum resistance offered by the soil through skin friction while pulling out the pile from the ground is
- 104.9 kN
  - 209.8 kN
  - 236 kN
  - 472 kN

### Common data for questions 53 and 54

Following chemical species were reported for water sample from a well:

Species	Concentration(milli equivalent/L)
Chloride( $Cl^-$ )	15
Sulphate( $SO_4^{2-}$ )	15
Carbonate( $CO_3^{2-}$ )	05
BiCarbonate( $HCO_3^-$ )	30
Calcium( $Ca^{2+}$ )	12
Magnesium( $Mg^{2+}$ )	18
pH	8.5

- 53) Total hardness in mg/L as  $CaCO_3$  is
- 1500
  - 2000
  - 3000
  - 5000
- 54) Alkalinity present in the water in mg/L as  $CaCO_3$  is
- 250
  - 1500
  - 1750
  - 5000

### Common data for questions 55 and 56

One hour triangular unit of hydrograph of a watershed has a peak discharge of  $60 \text{ m}^3/\text{sec.cm}$  at 10 hours and time base of 30 hours. The  $\phi$  index is 0.4 cm per hour and base flow is  $15 \text{ m}^3/\text{sec}$

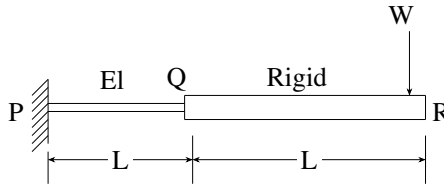
- 55) The catchment area of the watershed is
- $3.24 \text{ km}^2$
  - $32.4 \text{ km}^2$
  - $324 \text{ km}^2$
  - $3240 \text{ km}^2$
- 56) If there is rainfall of 5.4 cm in 1 hour, the ordinate of the flood hydrograph at 15<sup>th</sup> hour is
- $225 \text{ m}^3/\text{sec}$

- b)  $240 \text{ m}^3/\text{sec}$
- c)  $249 \text{ m}^3/\text{sec}$
- d)  $258 \text{ m}^3/\text{sec}$

### Linked answer questions

#### Statement for Linked answer question 57 and 58

In the cantilever beam PQR shown in figure below, the segment PQ has flexural rigidity  $EI$  and the segment QR has infinite flexural rigidity.



57) The deflection and slope of the beam at 'Q' are respectively

- a)  $\frac{5WL^3}{6EI}$  and  $\frac{3WL^2}{2EI}$
- b)  $\frac{WL^3}{3EI}$  and  $\frac{WL^2}{2EI}$
- c)  $\frac{WL^3}{2EI}$  and  $\frac{WL^2}{EI}$
- d)  $\frac{WL^3}{3EI}$  and  $\frac{3WL^2}{2EI}$

58) The deflection of the beam at 'R' is

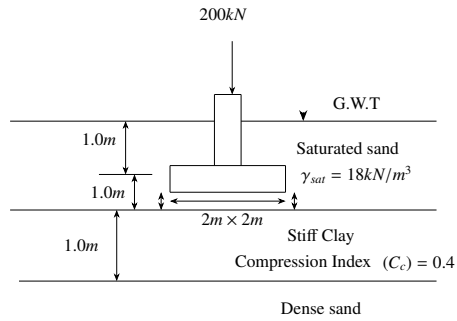
- a)  $\frac{8WL^3}{EI}$
- b)  $\frac{5WL^3}{6EI}$
- c)  $\frac{7WL^3}{3EI}$
- d)  $\frac{8WL^3}{6EI}$

### Linked answer question 59 and 60

59) A saturated undisturbed sample from a clay strata has moisture content of 22.22% and specific weight of 2.7. Assuming  $\gamma_w = 10 \text{ kN/m}^3$ , the void ratio and the saturated unit weight of the clay, respectively are

- a) 0.6 and  $16.875 \text{ kN/m}^3$
- b) 0.3 and  $20.625 \text{ kN/m}^3$
- c) 0.6 and  $20.625 \text{ kN/m}^3$
- d) 0.3 and  $16.975 \text{ kN/m}^3$

60) Using the properties of the clay layer derived from the above question, the consolidation settlement of the same clay layer under a square footing (neglecting its self weight) with additional data shown in the figure below (assume the stress distribution of IH:2V from the edge of the footing and  $\gamma_w = 10 \text{ kN/m}^3$ ) is



- a) 32.78 mm
- b) 61.75 mm
- c) 79.5 mm
- d) 131.13 mm