CE 2011 Q14-26

EE24BTECH11002 - Agamjot Singh

1) A normal depth in a wide rectangular channel is increased by 10%. The percentage increase in the discharge in the channel is:
   a) 20.1
   b) 15.4
   c) 10.5
   d) 17.2
2) The transplantation of rice requires 10 days and total depth of water required during transplantation is 48 cm. During transplantation, there is an effective rainfall (useful for irrigation) of 8 cm. The duty of irrigation water (in hectares/cumec) is
   a) 612
   b) 216
   c) 300
   d) 108
3) A settling tank in a water treatment plant is designed for a surface overflow rate of $30\frac{m^3}{day \cdot m^2}$. Assume specific gravity of sediment particles = 2.65, density of water (ρ) = $1000 kg/m^3$, dyanmic viscosity of water (μ) = $0.001 N \cdot s/m^2$, and Stoke's law is valid. The approximate minimum size of particles that would be completely removed is:
   a) 0.01 mm
   b) 0.02 mm
   c) 0.03 mm
   d) 0.04 mm
4) A student began experiment for determination of 5-day, 20°C BOD on Monday. Since the 5^{th} day fell on Saturday, the final DO readings were taken on next Monday. On calculation, BOD (i.e.7 day, 20° C) was found to be 150 mg/L. What would be the 5-day, 20° C BOD (in mg/L)? Assume value of BOD rate constant (k) at standard temperature of 20°C as 0.23/day (base e). _____
5) Elevation and temperature data for a place are tabulated below: Based on the above data, lapse rate can be referred as:

Elevation, m	Temperature, ° C
4	21.25
444	15.70

   a) Super-adiabatic
   b) Neutral
   c) Sub-adiabatic
   d) Inversion
6) The percent voids in mineral aggregate (VMA) and percent air voids (V_v) in a compacted cylindrical bituminous mix speciment are 15 and 4.5 respectively. The percent voids filled with bitumen (VFB) for this specimen is:
   a) 24
   b) 30
   c) 54
   d) 70
7) Following bearings are observed while traversing with a compass. After applying the correction due to local attraction,

Line	Force Bearing	Back Bearing
AB	126°45′	308°00′
BC	49°15′	227°30′
CD	340°30′	161°45′
DE	258°30′	78°30′
EA	212°30′	31°45′

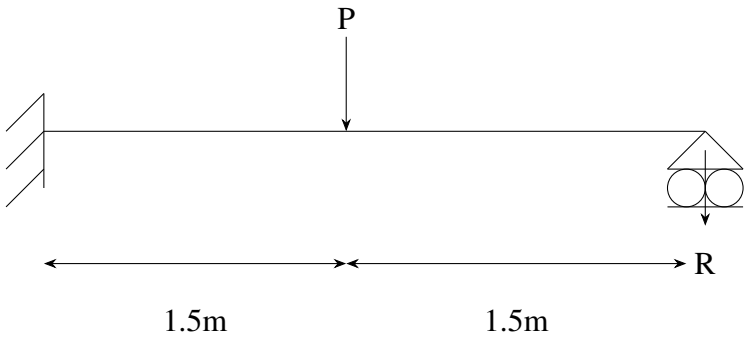
   the corrected fore bearing of line BC will be
   a) 48°15′
   b) 50°15′

c) 49°45′
d) 48°45′

8) A theodolite is set up at station A and a 3 m long staff is held vertically at station B. The depression angle reading at 2.5 m marking on the staffis 6°10′. The horizontal distance between A and B is 2200 m. Height of instrument at station A is 1.1 m and R.L. of A is 880.88 m. Apply the curvature and refraction correction, and determine the R.L. of B (in m). _____

Common Data for Questions 48 and 49

A propped cantilever made of a prismatic steel beam is subjected to a concentrated load P at mid span as shown.



9) If load P = 80 kN, find the reaction R (in kN) (correct to 1-decimal place) using elastic analysis. _____
10) If the magnitude of load P is increased till collapse and the plastic moment carrying capacity of steel beam section is 90 kNm, determine reaction R (in kN) (correct to 1-decimal place) using plastic analysis. _____

Common Data for Questions 50 and 51

For a portion of national highway where a descending gradient of 1 in 25 meets with an ascending gradient of 1 in 20, a valley curve needs to be designed for a vehicle travelling at 90 kmph based on the following conditions.

a) headlight sight distance equal to the stopping sight distance (SSD) of a level terrain considering length of valley curve ¿ SSD.
b) comfort condition with allow ablerate of change of centrifugal acceleration = 0.5 m/sec^3.

Assume total reaction time = 2.5 seconds; coefficient of longitudinal friction of the pavement = 0.35; height of head light of the vehicle = 0.75 m; andbeam angle = 1°.

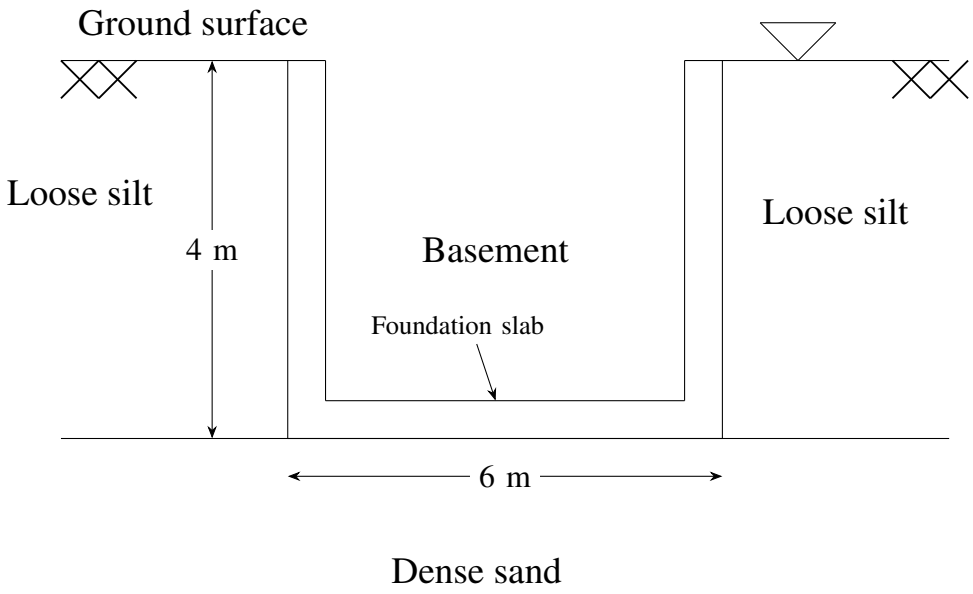
11) What is the length of valley curve (in m) based on the head light sight distance condition? _____
12) What is the length of valley curve (in m) based on the comfort condition? _____

Common Data for Questions 52 and 53

A multistory building with a basement is to be constructed. The top 4 m consists of loose silt, below which dense sand layer is present up to a great depth. Ground water table is at the surface. The foundation consists of the basement slab of 6 m width which will rest on the top of dense sand as shown in the figure. For dense sand, saturated unit weight = 20 kN/m^3, and bearing capacity factors N_q = 40 and N_γ = 45. For loose silt, saturated unit weight = 18 kN/m^3, N_q = 15 and N_γ = 20. Effective cohesion c' is zero for both soils. Unit weight of water is 10 kN/m^3. Neglect shape factor and depth factor.

Average elastic modlulus E and Poisson's ratio μ of dense sand is 60×10^3 kN/m^2 and 0.3 respectively.

13) Using factor of safety = 3, the net safe bearing capacity $\left(\text{in kN/m}^2\right)$ of the foundation is:



a) 610
b) 320
c) 983
d) 693