

CE 2013 Q40-52

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) = $1000 kg/m^3$, dynamic 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, $20^\circ C$ BOD on Monday. Since the 5th day fell on Saturday, the final DO readings were taken on next Monday. On calculation, BOD (i.e. 7 day, $20^\circ C$) was found to be 150 mg/L. What would be the 5-day, $20^\circ C$ BOD (in mg/L)? Assume value of BOD rate constant (k) at standard temperature of $20^\circ C$ 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, $^\circ C$
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 specimen 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	$126^\circ 45'$	$308^\circ 00'$
BC	$49^\circ 15'$	$227^\circ 30'$
CD	$340^\circ 30'$	$161^\circ 45'$
DE	$258^\circ 30'$	$78^\circ 30'$
EA	$212^\circ 30'$	$31^\circ 45'$

the corrected fore bearing of line BC will be

- a) $48^\circ 15'$
- b) $50^\circ 15'$

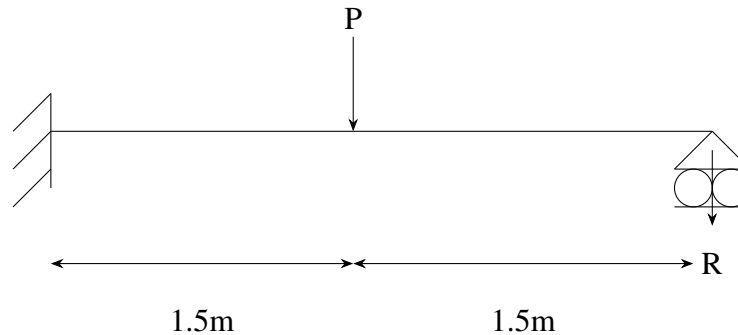
c) $49^{\circ}45'$

d) $48^{\circ}45'$

- 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 staff is $6^{\circ}10'$. 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 \geq SSD.
- b) comfort condition with allowable rate 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; and beam angle = 1° .

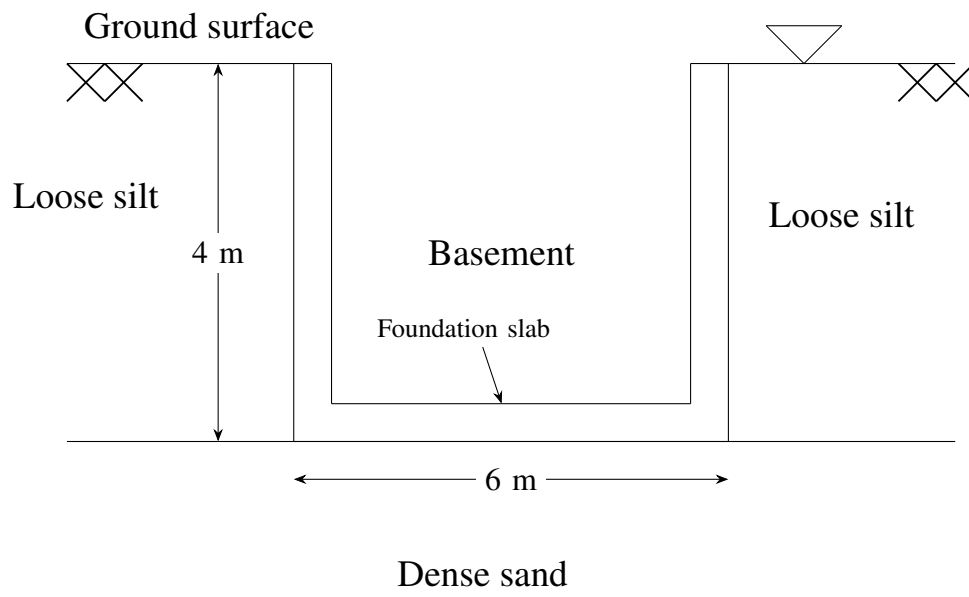
- 11) What is the length of valley curve (in m) based on the head light sight distance condition? _____
- 12) What is the length of valley curve (in m) based on the comfort condition? _____

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 $N_{\gamma} = 45$. For loose silt, saturated unit weight = 18 kN/m^3 , $N_q = 15$ and $N_{\gamma} = 20$. 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 modulus E and Poisson's ratio μ of dense sand is $60 \times 10^3 \text{ kN/m}^2$ and 0.3 respectively.

- 13) Using factor of safety = 3, the net safe bearing capacity (in kN/m^2) of the foundation is:



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