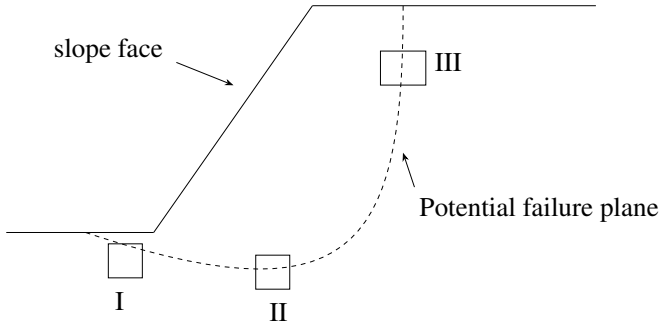
gate 7

EE24Btech11041 - Mohit

1) A singly reinforced concrete beam of balanced section is made of M20 grade concrete and Fe415 grade steel bars. The magnitudes of the maximum compressive strain in concrete and the tensile strain in the bars at ultimate state under flexure, as per IS 456 : 2000 are _____, respectively. (round off to four decimal places) (CE 2023)
   a) 0.0035 and 0.0038
   b) 0.0020 and 0.0018
   c) 0.0035 and 0.0041
   d) 0.0020 and 0.0031
2) In cement concrete mix design, with the increase in water-cement ratio, which one of the following statements is TRUE? (CE 2023)
   a) Compressive strength decreases but workability increases
   b) Compressive strength increases but workability decreases
   c) Both compressive strength and workability decrease
   d) Both compressive strength and workability increase
3) The specific gravity of a soil is 2.60. The soil is at 50% degree of saturation with a water content of 15%. The void ratio of the soil is _____. (CE 2023)
   a) 0.35
   b) 0.78
   c) 0.87
   d) 1.28
4) A group of 9 friction piles are arranged in a square grid maintaining equal spacing in all directions. Each pile is of diameter 300mm and length 7m. Assume that the soil is cohesionless with effective friction angle $\phi' = 32^\circ$. What is the center-to- center spacing of the piles (in m) for the pile group efficiency of 60%? (CE 2023)
   a) 0.582
   b) 0.486
   c) 0.391
   d) 0.677
5) A possible slope failure is shown in the figure. Three soil samples are taken from different locations (1, II and III) of the potential failure plane. Which is the most appropriate shear strength test for each of the sample to identify the failure mechanism? Identify the correct combination from the following options:
   P: Triaxial compression test
   Q: Triaxial extension test
   R: Direct shear or shear box test
   S: Vane shear test



(CE 2023)

a) I-Q, II-R, III-P
b) I-R, II-P, III-Q
c) I-S, II-Q, III-R
d) I-P, II-R, III-Q

6) When a supercritical stream enters a mild-sloped (M) channel section, the type of flow profile would become _____. (CE 2023)

a) M_1
b) M_2
c) M_3
d) M_1 and M_2

7) Which one of the following statements is TRUE for Greenhouse Gas (GHG) in the atmosphere? (CE 2023)

a) GHG absorbs the incoming short wavelength solar radiation to the earth surface, and allows the long wavelength radiation coming from the earth surface to pass through
b) GHG allows the incoming long wavelength solar radiation to pass through to the earth surface, and absorbs the short wavelength radiation coming from the earth surface
c) GHG allows the incoming long wavelength solar radiation to pass through to the earth surface, and allows the short wavelength radiation coming from the earth surface to pass through
d) GHG allows the incoming short wavelength solar radiation to pass through to the earth surface, and absorbs the long wavelength radiation coming from the earth surface

8) G_1 and G_2 are the slopes of the approach and departure grades of a vertical curve, respectively.

Given $|G_1| < |G_2|$ and $|G_1| \neq |G_2| \neq 0$
Statement 1: $+G_1$ followed by $+G_2$ results in a sag vertical curve.
Statement 2: $-G_1$ followed by $-G_2$ results in a sag vertical curve.
Statement 1: $+G_1$ followed by $-G_2$ results in a crest vertical curve.

Which option amongst the following is true? (CE 2023)

a) Statement 1 and Statement 3 are correct; Statement 2 is wrong
b) Statement 1 and Statement 2 are correct; Statement 3 is wrong
c) Statement 1 is correct; Statement 2 and Statement 3 are wrong
d) Statement 2 is correct; Statement 1 and Statement 3 are wrong

9) The direct and reversed zenith angles observed by a theodolite are $56°00'00''$ and $303°00'00''$, respectively. What is the vertical collimation correction? (CE 2023)

a) $+1°00'00''$
b) $-1°00'00''$
c) $-0°30'00''$
d) $+0°30'00''$

10) A student is scanning his 10 inch $\times$ 10 inch certificate at 600 dots per inch (dpi) to convert it to raster. What is the percentage reduction in number of pixels if the same certificate is scanned at 300 dpi? (CE 2023)

a) 62
b) 88
c) 75
d) 50

11) If $\mathbf{M}$ is an arbitrary real $n \times n$ matrix, then which of the following matrices will have non-negative eigenvalues? (CE 2023)

a) $\mathbf{M}^2$
b) $\mathbf{M}\mathbf{M}^T$
c) $\mathbf{M}^T\mathbf{M}$
d) $\left(\mathbf{M}^T\right)^2$

12) The following function is defined over the interval $[-L, L]$:

$$f(x) = px^4 + qx^5. \tag{1}$$

If it is expressed as a Fourier series,

$$f(x) = a_0 + \sum_{n=1}^{\infty} \left\{ a_n \sin\left(\frac{n\pi x}{L}\right) + b_n \cos\left(\frac{n\pi x}{L}\right) \right\}, \tag{2}$$

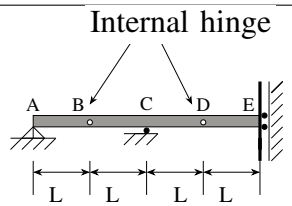
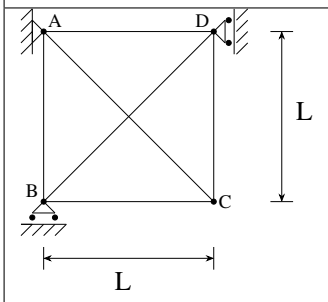
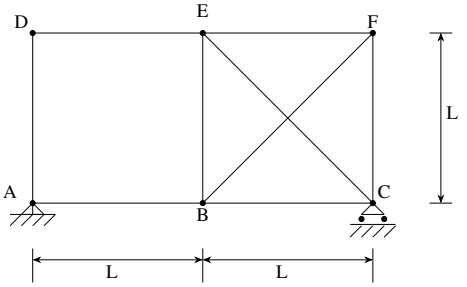
which options amongst the following are true? (CE 2023)

a) $a_n, n = 1, 2, \ldots, \infty$ depend on p
b) $a_n, n = 1, 2, \ldots, \infty$ depend on q
c) $b_n, n = 1, 2, \ldots, \infty$ depend on p
d) $b_n, n = 1, 2, \ldots, \infty$ depend on q

13) Consider the following three structures:

(CE 2023)

a) Structure I is unstable
b) Structure II is unstable
c) Structure III is unstable
d) All three structures are stable

	Structure I: Beam with hinge support at A, roller at C, guided roller at E, and internal hinges at B and D
	Structure II: Pin-jointed truss, with hinge support at A, and rollers at B and D
	Structure III: Pin- jointed truss, with hinge support at A and roller at C