GATE
CE - 2020

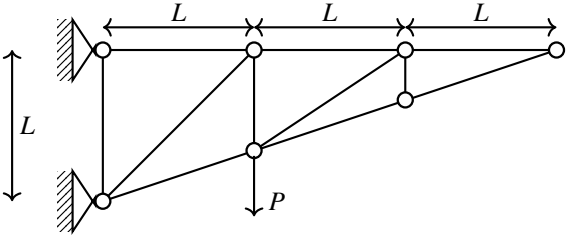
EE24BTECH11061 - Rohith Sai

Single Correct 1 Mark each

1) The area of an ellipse represented by an equation $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is

a) $\frac{\pi ab}{4}$
b) $\frac{\pi ab}{2}$
c) πab
d) $\frac{4\pi ab}{3}$

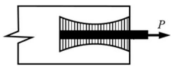
2) Consider the planar truss shown in the figure *(not drawn to scale)*

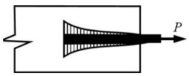


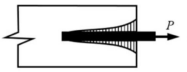
Neglecting self-weight of the members, the number of zero-force members in the truss under the action of the load P, is

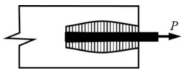
a) 6
b) 7
c) 8
d) 9

3) A reinforcing steel bar, partially embedded in concrete, is subjected to a tensile force P, The figure that approximately represents the distribution of the magnitude of bond stress (represented as hatched region), along the embedded length of the bar, is

a)


b)


c)


d)


4) In a two-dimensional stress analysis, the state of stress at a point P is

$$(\sigma) = \begin{pmatrix} \sigma_{xx} & \tau_{xy} \\ \tau_{xy} & \sigma_{yy} \end{pmatrix}$$

The necessary and sufficient condition for existence of the state of pure shear at the point P, is

a) $\sigma_{xx}\sigma_{yy} - \tau_{xy}^2 = 0$
b) $\tau_{xy} = 0$
c) $\sigma_{xx} + \sigma_{yy} = 0$
d) $\left(\sigma_{xx} - \sigma_{yy}\right)^2 + 4\tau_{xy}^2 = 0$

5) During the process of hydration of cement, due to increase in Dicalcium Silicate (C_2S) content in cement clinker, the heat of hydration

a) increases
b) decrease
c) initially decreases and then increase
d) does not change

6) The Los Angeles test for stone aggregates is used to examine

a) abrasion resistance
b) crushing strength
c) soundness
d) specific gravity

7) Which one of the following statements is **NOT** correct?

a) A clay deposit with a liquidity index greater than unity is in a state of plastic consistency.
b) The cohesion of normally consolidated clay is zero when triaxial test is conducted under consolidated undrained condition.
c) The ultimate bearing capacity of a strip foundation supported on the surface of sandy soil increases in direct proportion to the width of footing.
d) In case of a point load, Boussinesq's equation predicts higher value of vertical stress at a point directly beneath the load as compared to Westergaard's equation.

8) In a soil investigation work at a site, Standard Penetration Test (SPT) was conducted at every 1.5 m interval up to 30 m depth. At 3 m depth, the observed number of hammer blows for three successive 150 m penetrations were 8, 6 and 9, respectively. The SPT N-value at 3 m depth, is

a) 23
b) 17
c) 15
d) 14

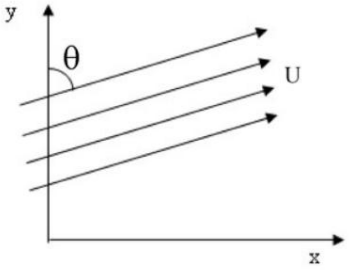
9) Velocity of flow is proportional to the first power of hydraulic gradient in Darcy's law. This law is applicable to

a) laminar flow in porous media
b) transitional flow in porous media
c) turbulent flow in porous media
d) laminar as well as turbulent flow in porous media

10) A body flowing in a liquid is in a stable state of equilibrium is its

a) metacentre lies above its centre of gravity
b) metacentre lies below its centre of gravity
c) metacentre coincides with its centre of gravity
d) centre of gravity is below its centre of buoyancy

11) Uniform flow with velocity U makes an angle θ with the y-axis, as shown in the figure



The velocity potential (ϕ), is

a) $\pm U\,(x\sin\theta + y\cos\theta)$
b) $\pm U\,(y\sin\theta - x\cos\theta)$
c) $\pm U\,(x\sin\theta - y\cos\theta)$
d) $\pm U\,(y\sin\theta + x\cos\theta)$

12) The data for an agricultural field for a specific month are given below:

Pan Evaporation = 100 mm
Effective Rainfall = 20 mm (after deducting losses due to runoff and deep percolation)
Crop Coefficient = 0.4
Irrigation Efficiency = 0.5

The amount of irrigation water (in mm) to be applied to the field in that month, is

a) 0
b) 20
c) 40
d) 80

13) During chlorination process, aqueous (aq) chlorine reacts rapidly with water to form Cl^-, HOCl, and H^+ as shown below

$$Cl_2\,(aq) + H_2O \rightleftharpoons HOCl + Cl^- + H^+$$

The most active disinfectant in the chlorination process from amongst the following, is

a) H^+
b) HOCl
c) Cl^-
d) H_2O