2009-CE-1-12

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I. Q.1-Q.20 CARRY ONE MARK EACH.

1) A square matrix $\mathbf{B}$ is skew-symmetric if (2009-CE)

a) $\mathbf{B}^\top = -\mathbf{B}$ b) $\mathbf{B}^\top = \mathbf{B}$ c) $\mathbf{B}^{-1} = \mathbf{B}$ d) $\mathbf{B}^{-1} = \mathbf{B}^T$

2) For a scalar function $f(x, y, z) = x^2 + 3y^2 + 3z^2$, the gradient at the point P(1, 2, -1) is (2009-CE)

a) $2\vec{i} + 6\vec{j} + 4\vec{k}$ b) $2\vec{i} + 6\vec{j} - 4\vec{k}$ c) $2\vec{i} + 12\vec{j} + 4\vec{k}$ d) $\sqrt{56}$

3) The analytic function $f(z) = \frac{z-1}{z^2+1}$ has singularities at (2009-CE)

a) 1 and -1 b) 1 and i c) 1 and $-i$ d) i and $-i$

4) A thin walled cylindrical pressure vessel having a radius of 0.5 m and wall thickness of 25 mm is subjected to an internal pressure of 700 kPa. The hoop stress developed is (2009-CE)

a) 14 MPa b) 1.4 MPa c) 0.14 MPa d) 0.014 MPa

5) The modulus of rupture of concrete in terms of its characteristic cube compressive strength (f_{ck}) in MPa according to IS 456:2000 is (2009-CE)

a) $5000 f_{ck}$ b) $0.7 f_{ck}$ c) $5000\sqrt{f_{ck}}$ d) $0.7\sqrt{f_{ck}}$

6) In the theory of plastic bending of beams, the ratio of plastic moment to yield moment is called (2009-CE)

a) shape factor
b) plastic section modulus
c) modulus of resilience
d) rigidity modulus

7) For limit state of collapse, the partial saftey factors recommended by IS 456:2000 for estimating design strength of concrete and reinforcing steel are respectively (2009-CE)

a) 1.15 and 1.5 b) 1.0 and 1.0 c) 1.5 and 1.15 d) 1.5 and 1.0

8) The point within the cross sectional plane of a beam through which the resultant of the external loading on the beam has to pass through to ensure pure bending without twisting of the cross-section of beam is called (2009-CE)

a) moment centre b) centroid c) shear centre d) elastic centre

9) The square root of the ratio of moment of inertia of the cross section to its cross sectional area is called (2009-CE)

a) second moment of area
b) slenderness ratio
c) section modulus
d) radius of gyration

10) Deposit with flocculated structure is formed when (2009-CE)

a) clay particles settle on sea bed
b) clay particles settle on fresh water lake bed
c) sand particles settle on river bed
d) sand particles settle on sea bed

11) Dilatancy correction is required when a strata is (2009-CE)

a) cohesive and saturated and also has N value of STP > 15
b) saturated slit/fine sand and N value of SPT < 10 after the overburden correction
c) saturated slit/fine sand and N value of SPT > 15 after the overburden correction
d) coarse sand under dry condition and N value of SPT < 10 after the overburden correction

12) A precast concrete pile is driven with a 50 kN hammer falling through a height of 1.0 m with an efficiency of 0.6. The set value observed is 4 mm per blow and the combined temporary compression of the pile, cushion and the ground is 6mm. As per Modified Hiley Formula, the ultimate resistance of the pile is (2009-CE)

a) 3000 kN
b) 4285.7 kN
c) 8333 kN
d) 11905 kN