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- 1) A square matrix \mathbf{B} is skew-symmetric if
 - a) $\mathbf{B}^T = -\mathbf{B}$
 - b) $\mathbf{B}^T = \mathbf{B}$
 - 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
 - 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 a
 - 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
 - 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
 - a) $5000f_{ck}$
 - b) $0.7f_{ck}$
 - 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
 - a) shape factor
 - b) plastic section modulus
 - c) modulus of resilience
 - d) rigidity modulus
- 7) For limit state of collapse, the partial safety factors recommended by IS 456:2000 for estimating design strength of concrete and reinforcing steel are respectively
 - 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

- 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
- a) second moment of area
 - b) slenderness ratio
 - c) section modulus
 - d) radius of gyration
- 10) Deposit with flocculated structure is formed when
- 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
- 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
- a) 3000 kN
 - b) 4285.7 kN
 - c) 8333 kN
 - d) 11905 kN