2015-EE-40-52

EE24BTECH11010 - BALAJI B

1) Copper is an *FCC* metal with lattice parameter of 3.62 Å. Hall effect measurement shows electron mobility to be 3.2×10^{-3} $m^2V^{-1}s^{-1}$. Electrical resistivity of copper is 1.7×10^{-8} Ωm. The average number of free electrons per atom in copper is _____(Charge of an electron: 1.6×10^{-19} C) (2017-XE)

2) In an ionic solid the cation and the anion have ionic radii as 0.8 Å and 1.6 Å respectively. The maximum coordination number of the cation in the structure will be (2017-XE)

a) 3 b) 4 c) 6 d) 8

3) Which of the following statement(s) is / are true regarding susceptibility of a material

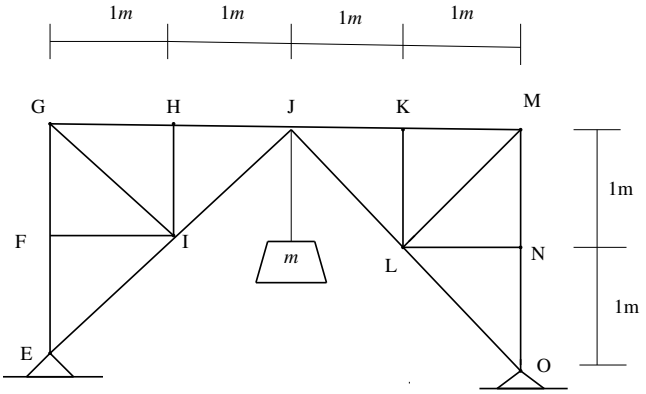
(i) Magnetic susceptibility is positive for a diamagnetic material
(ii) Magnetic susceptibility is negative for a diamagnetic material
(iii) Magnetic susceptibility is negative for an ferromagnetic material
(iv) Magnetic susceptibility is positive for a paramagnetic material

(2017-XE)

a) (ii) and (iv) b) (i) and (iii) c) (ii) and (iii) d) (i) and (iv)

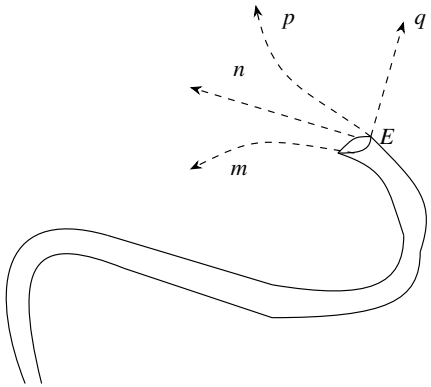
4) In the truss shown, a mass **m = 10kg** is hung from the node **J**. The magnetic of net force(in **Newtons**) transferred by the truss **EFGHIJ** onto the truss **JKLMNO** at the node **J** is _____

Assume acceleration due to gravity **g = 10m/s^2** (2017-XE)

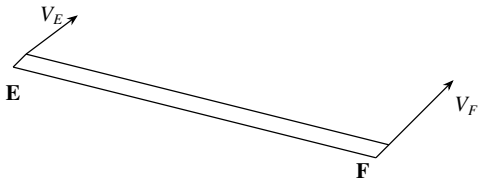


5) A ball moves along a plannar frictionless slot as shown. Which one of the paths shown closely matches the path by the ball after it exits the slot at **E** (2017-XE)

a) path m b) path n c) path p d) path q

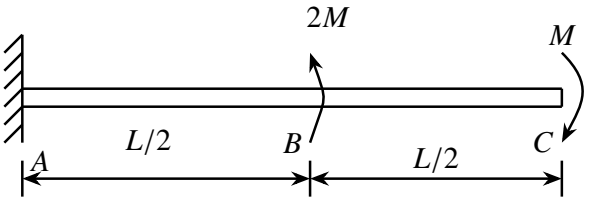


6) A rod **EF** moving in a plane has velocity $\mathbf{V}_E$ at **E** and $\mathbf{V_F}$ that are parallel to each other. Which of the following **CANNOT** be true? (2017-XE)



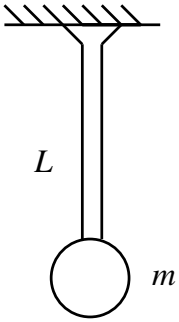
a) Both V_E and V_F are perpendicular to EF.
b) Magnitude of V_E is equal to the magnitude of V_F and the angular velocity of EF is zero.
c) The velocity V_E is not perpendicular to EF and the angular velocity of EF is nonzero.
d) Magnitude of V_E is not equal to the magnitude of V_F and the angular velocity of EF is nonzero.

7) The beam shown below carries two external moments. A counterclockwise moment of magnitude $2M$ acts at point B and a clockwise moment of magnitude M acts at the free end, C. The beam is fixed at A. The shear force at a section close to the fixed end is equal to (2017-XE)

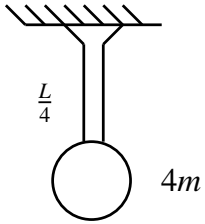


a) $\frac{2M}{L}$ b) $\frac{M}{L}$ c) 0 d) $-\frac{M}{L}$

8) Two pendulums are shown below. ***Pendulum-A*** carries a bob of mass m, hung using a hinged massless rigid rod of length L whereas ***Pendulum-B*** carries a bob of mass $4m$ and length $L/4$. The ratio of the natural frequencies of ***Pendulum-A*** and ***Pendulum-B*** is given by (2017-XE)



pendulum-A



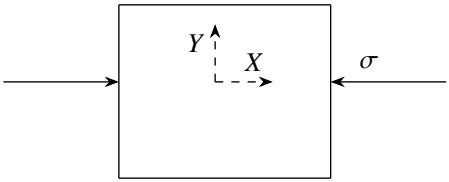
Pendulum-B

a) 1 : 2 b) 1 : 1 c) $\sqrt{2}$: 1 d) 2 : 1

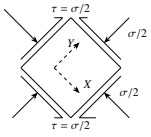
9) A closed thin-walled cylindrical steel pressure vessel of wall thickness t = 1 mm is subjected to internal pressure. The maximum value of pressure p (in kPa) that the wall can withstand based on the maximum shear stress failure theory is given by (Yield strength of steel is 200 MPa and mean radius of the cylinder r = 1 m). (2017-XE)

a) 100 b) 200 c) 300 d) 400

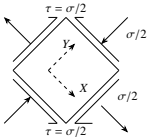
10) The state of stress at a point in a body is represented using components of stresses along X and Y directions as shown. Which one of the following represents the state of the stress along X' and Y' axes?(X'- axis at 45° clockwise with respect to X- axis) (2017-XE)



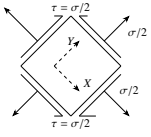
a)



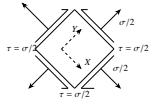
b)



c)

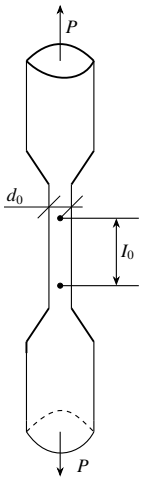


d)

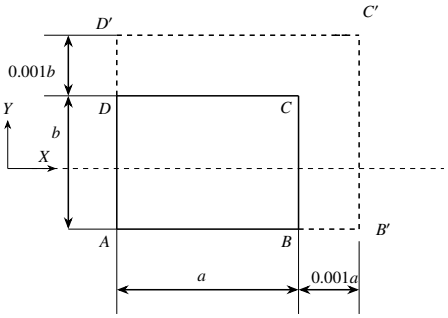


11) An aluminum specimen with an initial gauge diameter $d_0 = 10mm$ and a gauge length $l_0 = 10mm$ is subjected to tension test. A tensile force $P = 50kN$ is applied at the ends of the specimen as shown resulting in an elongation of $1mm$ in the gauge length. The Poisson's ratio (γ) of the specimen is _____

Shear modulus of the material $G = 25GPa$. Consider engineering stress-strain conditions. (2017-XE)



12) A rectangular sheet $ABCD$ of dimensions a and b along X and Y directions, respectively, is stretched to a rectangle $AB'C'D'$, as shown. The maximum principal strain (ε_1) and minimum principal strain (ε_2) due to the stretch are given by (2017-XE)



a) $\varepsilon_1 = 0.001$ and $\varepsilon_2 = 0.001$
b) $\varepsilon_1 = -0.001$ and $\varepsilon_2 = 0.001$
c) $\varepsilon_1 = 0.001$ and $\varepsilon_2 = -0.001$
d) $\varepsilon_1 = -0.001$ and $\varepsilon_2 = -0.001$

13) A solid bar of uniform square cross-section of side b and length L is rigidly fixed to the supports at the two ends. When the temperature in the rod is increased uniformly by T, the bar undergoes elastic buckling. Assume Young's modulus E and coefficient of thermal expansion α to be independent of temperature. The coefficient of thermal expansion α is given by (2017-XE)

a) $\frac{3\pi^2 b^2}{T_c L^2}$
b) $\frac{\pi^2 b^2}{T_c L^2}$
c) $\frac{\pi^2 b^2}{2T_c L^2}$
d) $\frac{\pi^2 b^2}{3T_c L^2}$