

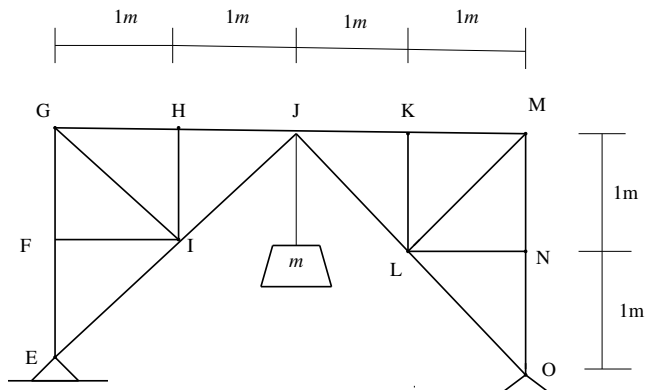
2017-XE-53-65

EE24BTECH11010 - BALAJI B

- 1) Copper is an *FCC* metal with lattice parameter of 3.62 \AA . Hall effect measurement shows electron mobility to be $3.2 \times 10^{-3} m^2 V^{-1} s^{-1}$. Electrical resistivity of copper is $1.7 \times 10^{-8} \Omega m$. The average number of free electrons per atom in copper is _____ (Charge of an electron: $1.6 \times 10^{-19} \text{ C}$) (2017-XE)
- 2) In an ionic solid the cation and the anion have ionic radii as 0.8 \AA and 1.6 \AA 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 _____

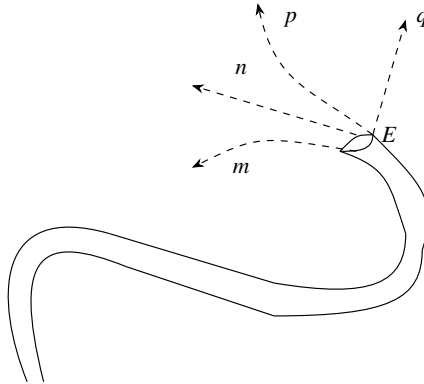
Assume acceleration due to gravity $g = 10m/s^2$

(2017-XE)

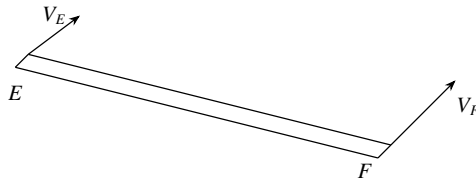


- 5) A ball moves along a planar frictionless slot as shown. Which one of the paths shown closely matches the path by the ball after it exits the slot at E (2017-XE)

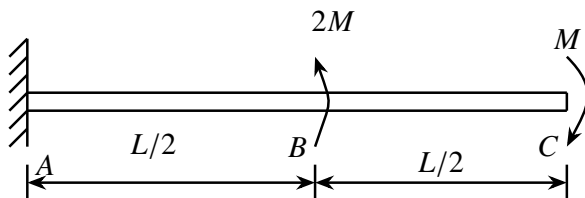
- a) path m b) path n c) path p d) path q



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

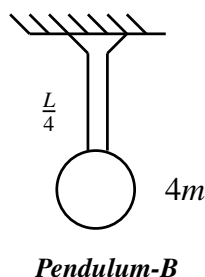
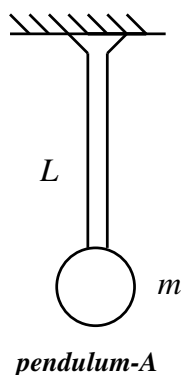


- a) Both V_E and V_F are perpendicular to EF .
 b) Magnitude of V_E is equal to the magnitude of V_F and the angular velocity of EF is zero.
 c) The velocity V_E is not perpendicular to EF and the angular velocity of EF is nonzero.
 d) Magnitude of V_E is not equal to the magnitude of V_F and the angular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

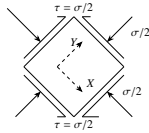
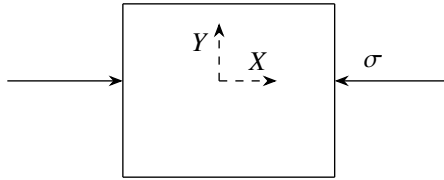


- a) 1 : 2 b) 1 : 1 c) $\sqrt{2} : 1$ d) 2 : 1

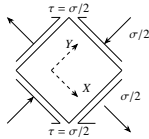
- 9) A closed thin-walled cylindrical steel pressure vessel of wall thickness $t = 1$ mm is subjected to internal pressure. The maximum value of pressure p (in kPa) that the wall can withstand based on the maximum shear stress failure theory is given by (Yield strength of steel is 200MPa and mean radius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

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

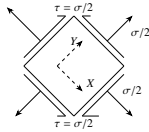
- 10) The state of stress at a point in a body is represented using components of stresses along X and Y directions as shown. Which one of the following represents the state of the stress along X' and Y' axes? (X' - axis at 45° clockwise with respect to X - axis) (2017-XE)



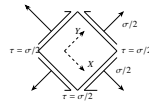
a)



b)



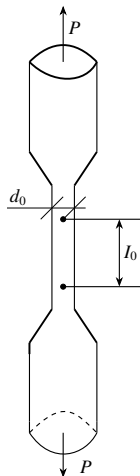
c)



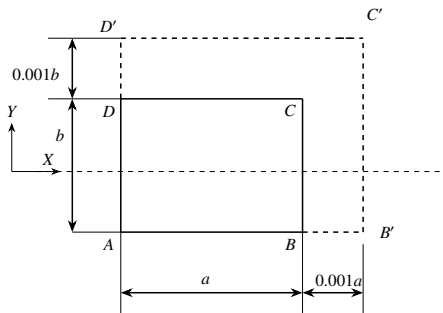
d)

- 11) An aluminum specimen with an initial gauge diameter $d_0 = 10\text{mm}$ and a gauge length $l_0 = 10\text{mm}$ is subjected to tension test. A tensile force $P = 50\text{kN}$ 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 $G = 25\text{GPa}$. 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 $\varepsilon_2 = 0.001$ c) $\varepsilon_1 = 0.001$ and $\varepsilon_2 = -0.001$
 b) $\varepsilon_1 = -0.001$ 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) $\frac{\pi^2 b^2}{3T_c L^2}$