GATE Questions 8

EE24BTECH11012 - Bhavanisankar G S

1) Details pertaining to an orthogonal metal cutting process are given below :
Chip thickness ratio 0.4
Undeformed thickness 0.6 mm
Rake angle +10 °
Cutting speed 2.5 m/s
Mean thickness of primary shear zone 25 μ
The shear strai rate in s^{-1} during the process is

a) 0.1781×10^5 b) 0.7754×10^5 c) 1.0104×10^5 d) 4.397×10^5

2) In a single pass drilling operation, a through hole of 15 mm diameter is to be drilled in a steel plate of 50 mm thickness. Drill spindle speed is 500 rpm, feed is 0.2 mm/rev and drill point angle is 112° Assuming 2 mm clearance at approach and exit, the total drill time (*inseconds*) is

a) 35.1 b) 32.4 c) 31.2 d) 30.1

3) Consider two infinitely long thin concentric tubes of circular cross-section as shown in the figure. Id D_1 and D_2 are the diameters of the inner and outer tubes respectively, then the view factor F_{22} is given by

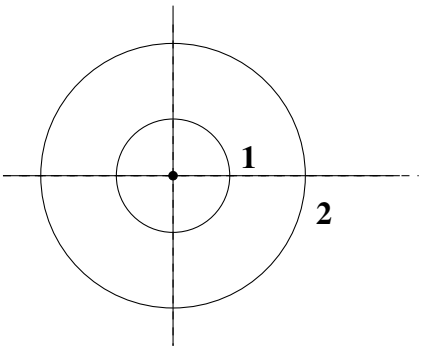

Fig. 3.

a) $\frac{D_2}{D_1} - 1$ b) 0 c) $\frac{D_2}{D_1}$ d) $1 - \frac{D_1}{D_2}$

4) An incompressible fluid flows over a flat plate with zero pressure gradient. The boundary layer thickness is 1 mm at a location where the Reynolds number is 1000. If the velocity of the fluid alone is increased by a factor of 4, then the boundary layer thickness at the same location in mm will be

a) 4 b) 2 c) 0.5 d) 0.25

5) A room contains 35 kg of dry air and 0.5 kg of water vapour. The total pressure and temperature of air in the room are 100 kPa and 25 ° C respectively. Given that the saturation pressure for water at 25 °*C* is 3.17 kPa, the relative humidity of the air in the room is

a) 67 % b) 55 % c) 83 % d) 71 %

6) A fillet welded joint is subjected to transverse loading F as shown in the figure. Both legs of the fillets are of 10 mm size and the weld length is 30 mm. If the allowable shear stress of the weld is 94 MPa, considering the minimum throat area of the weld, the maximum allowable transverse load in kN is

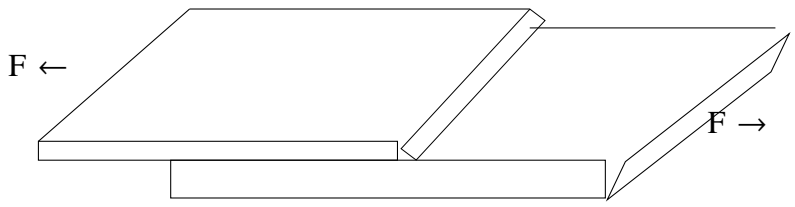

Fig. 6.

a) 14.44 b) 17.92 c) 19.93 d) 22.16

7) A concentrated mass m is attached at the centre of a rod of length 2L as shown in the figure. The rod is kept in a horizontal equilibrium position by a spring of stiffness k. For very small amplitudes of vibration, neglecting the weights of the rod and spring, the undamped natural frequency of the system is

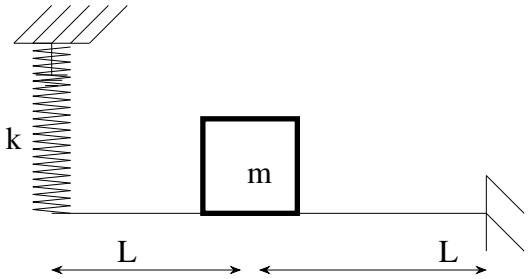

Fig. 7.

a) $\sqrt{\frac{k}{m}}$ b) $\sqrt{\frac{2k}{m}}$ c) $\sqrt{\frac{k}{2m}}$ d) $\sqrt{\frac{4k}{m}}$

8) The state of stress at a point under plane stress condition is

$$\sigma_{xx} = 40MPa; \sigma_{yy} = 100MPa; \tau_{xy} = 40MPa$$

The radius of the Mohr's circle representing the given state of stress in MPa is

a) 40 b) 50 c) 60 d) 100

9) The inverse Laplace transform of the function $F(x) = \frac{1}{s(s+1)}$ is given by

a) $f(t) = \sin t$
b) $f(t) = e^{-t} \sin t$
c) $f(t) = e^{-t}$
d) $f(t) = 1 - e^{-t}$

10) For the matrix $A = \begin{pmatrix} 5 & 3 \\ 1 & 3 \end{pmatrix}$, ONE of the normalized eigen vectors is given as

a) $\begin{pmatrix} \frac{1}{2} \\ \frac{\sqrt{3}}{2} \end{pmatrix}$
b) $\begin{pmatrix} \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{pmatrix}$
c) $\begin{pmatrix} \frac{3}{\sqrt{10}} \\ \frac{\sqrt{-1}}{\sqrt{10}} \end{pmatrix}$
d) $\begin{pmatrix} \frac{1}{\sqrt{5}} \\ \frac{\sqrt{2}}{\sqrt{5}} \end{pmatrix}$

11) Calculate the punch size im mm for a circular blanking operation for which details are given below
Size of the blank 25 mm
Thickness of the sheet 2 mm
Radial clearance between punch and die 0.06 mm
Die allowance 0.05 mm

a) 24.83 b) 24.89 c) 25.01 d) 25.17

12) In a single pass rolling process using 410 mm diameter steel rollers, a strip of width 140 mm and thickness 8 mm undergoes 10 % reduction of thicnkness. The angle of bite in radians is

a) 0.006 b) 0.031 c) 0.062 d) 0.600

13) In a DC are welding operation, the voltage-arc length characteristic was obtained as $V_{arc} = 20 + 5l$ where the arc length l was varied between 5 mm and 7 mm. Here V_{arc} denotes the arc voltage in Volts. The arc current was varied feom 400 A to 500 A. Assuming linear power source characteristic, the open circuit voltage and the short circuit current for the welding opeartion are

a) 45 V, 450 A
b) 75 V, 750 A
c) 95 V, 950 A
d) 150 V, 1500 A