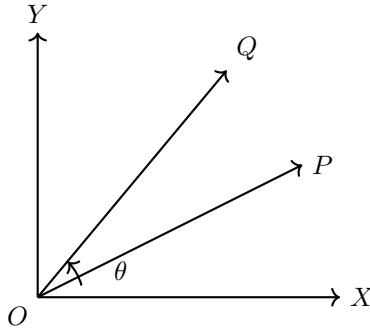


2019-ME-14-26

EE24BTECH11034 - K Teja Vardhan

October 31, 2024

1. Which one of the following welding methods provides the highest heat flux $\left(\frac{W}{mm}^2\right)$?
 - (a) Oxy-acetylene gas welding
 - (b) Tungsten inert gas welding
 - (c) Plasma arc welding
 - (d) Laser beam welding
2. The length, width, and thickness of a steel sample are 400 mm, 40 mm, and 20 mm, respectively. Its thickness needs to be uniformly reduced by 2 mm in a single pass by using horizontal slab milling. The milling cutter (diameter: 100 mm, width: 50 mm) has 20 teeth and rotates at 1200 rpm. The feed per tooth is 0.05 mm. The feed direction is along the length of the sample. If the over-travel distance is the same as the approach distance, the approach distance and time taken to complete the required machining task are:
 - (a) 14 mm, 18.4 s
 - (b) 21 mm, 28.9 s
 - (c) 21 mm, 39.4 s
 - (d) 14 mm, 21.4 s
3. The position vector \overrightarrow{OP} of point $P(20, 10)$ is rotated anti-clockwise in the $X - Y$ plane by an angle $\theta = 30^\circ$ such that point P occupies position Q , as shown in the figure. The coordinates (x, y) of Q are



- (a) (13.40, 22.32)
- (b) (22.32, 8.26)
- (c) (12.32, 18.66)
- (d) (18.66, 12.32)

4. The table presents the demand of a product. By simple three-months moving average method, the demand-forecast of the product for the month of September is

Month	Demand
January	450
February	440
March	460
April	510
May	520
June	495
July	475
August	560

- (a) 490
 - (b) 510
 - (c) 530
 - (d) 536.67
5. Evaluation of $\int_2^4 x^3 dx$ using a 2-equal-segment trapezoidal rule gives a value of .
6. A cylindrical rod of diameter 10 mm and length 1.0 m is fixed at one end. The other end is twisted by an angle of 10° by applying a torque. If the maximum shear strain in the rod is $p \times 10^{-3}$, then p is equal to .

7. A solid cube of side 1 m is kept at a room temperature of 32°C . The coefficient of linear thermal expansion of the cube material is 1×10^{-5} and the bulk modulus is 200 GPa. If the cube is constrained all around and heated uniformly to 42°C , then the magnitude of volumetric stress induced due to heating is
8. During a high cycle fatigue test, a metallic specimen is subjected to cyclic loading with a mean stress of +140 MPa, and a minimum stress of -70 MPa. The R -ratio for this cyclic loading is
9. Water flows through a pipe with a velocity given by $\vec{V} = \left(\frac{4}{t} + x + y\right) \hat{j}$ *fracms*, where \hat{j} is the unit vector in the y direction, $t (> 0)$ is in seconds, and x and y are in meters. The magnitude of total acceleration at the point $(x, y) = (1, 1)$ at $t = 2$ s is $\frac{m}{s^2}$.
10. Air of mass 1 kg, initially at 300 K and 10 bar, is allowed to expand isothermally till it reaches a pressure of 1 bar. Assuming air as an ideal gas with gas constant of $0.287 \frac{\text{kJ}}{\text{kg.K}}$, the change in entropy of air is
11. Consider the stress-strain curve for an ideal elastic-plastic strain hardening metal as shown in the figure. The metal was loaded in uniaxial tension starting from O . Upon loading, the stress-strain curve passes through initial yield point at P , and then strain hardens to point Q , where the loading was stopped. From point Q , the specimen was unloaded to point R , where the stress is zero. If the same specimen is reloaded in tension from point R , the value of stress at which the material yields again is MPa.

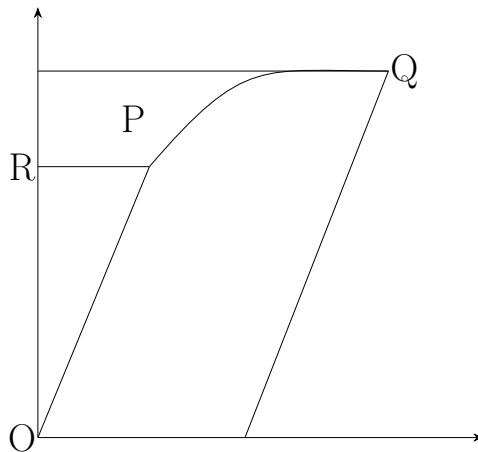


Figure 1: Stress-Strain Curve

12. The set of equations $x + y + z = 1$
 $ax - ay + 3z = 5$
 $5x - 3y + az = 6$ has infinite solutions, if $a =$

(a) -3

(b) 3

(c) 4

(d) -4