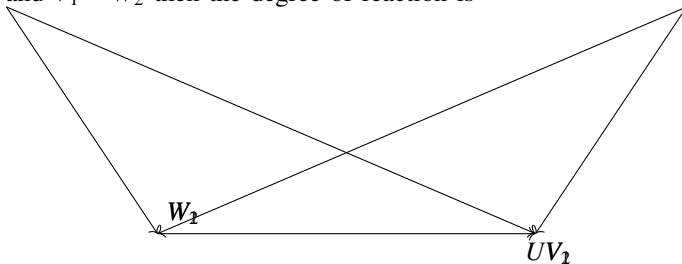


- 1)  $\lim_{x \rightarrow 0} \left( \frac{1 - \cos x}{x^2} \right)$  is
  - a)  $\frac{1}{4}$
  - b)  $\frac{1}{2}$
  - c) 1
  - d) 2
- 2) A CNC vertical milling machine has to cut a straight slot of 10mm width and 2mm depth by a cutter of 10mm diameter between points (0,0) and (100,100) on the XY plane (*dimensions in mm*). The feed rate used for milling is 50  $\frac{\text{mm}}{\text{min}}$ . Milling time for the slot (*in seconds*) is
  - a) 120
  - b) 170
  - c) 180
  - d) 240
- 3) A solid cylinder of diameter 100mm and height 50mm is forged between two frictionless flat dies to a height 25mm. The percentage change in diameter is
  - a) 0
  - b) 2.07
  - c) 20.7
  - d) 41.4
- 4) The velocity triangles at inlet and exit of the rotor of a turbomachine are shown  $V$  denotes blade velocity. subscripts 1 and 2 refer to inlet and outlet respectively.  $V_2 = W_1$  and  $V_1 = W_2$  then the degree of reaction is



- a) 0
  - b) 1
  - c) 0.5
  - d) 0.25
- 5) Which one of the following configuration has the highest fin effectiveness?

- a) Thin, closely spaced fins  
 b) Thin, widely spaced fins  
 c) Thick, widely spaced fins  
 d) thick, closely spaced fins
- 6) An ideal gas of mass  $m$  and temperature  $T_1$  undergoes a reversible isothermal process from an initial pressure  $P_1$  to final pressure  $P_2$ . The heat loss during the process is  $Q$ . The entropy change  $\Delta S$  of the gas is
- a)  $mR \ln \frac{P_2}{P_1}$   
 b)  $mR \ln \frac{P_1}{P_2}$   
 c)  $mR \ln \frac{P_2}{P_1} - \frac{Q}{T_1}$   
 d) 0
- 7) In the mechanism given below, if the angular velocity of the eccentric circular disc is  $1 \frac{\text{rad}}{\text{s}}$ , the angular velocity  $\frac{\text{rad}}{\text{s}}$  of the follower link for the instant shown in the

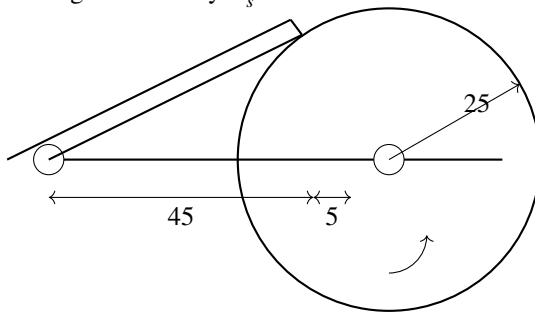


figure is

- a) 0.05  
 b) 0.1  
 c) 5.0  
 d) 10.0
- 8) A circular solid disc of uniform thickness  $20\text{mm}$  radius  $200\text{mm}$  and mass  $20\text{kg}$ , is used as a flywheel. If it rotates at  $600\text{rpm}$ , the kinetic energy of the flywheel, in joules is
- a) 395  
 b) 790  
 c) 1580  
 d) 3160
- 9) A cantilever beam of length  $L$  is subjected to moment  $M$  at the free end. The moment of inertia of the beam cross section about the neutral axis  $I$  and the Young's modulus is  $E$ . The magnitude of the maximum deflection is
- a)  $\frac{ML^2}{2EI}$   
 b)  $\frac{ML^2}{EI}$   
 c)  $\frac{2ML^2}{EI}$   
 d)  $\frac{4ML^2}{EI}$
- 10) For a long slender column of uniform cross section, the ratio of critical buckling load for the case with both ends clamped to the case with both ends hinged is

- a) 1
- b) 2
- c) 4
- d) 8

11) At  $x = 0$ , the function  $f(x) = x^3 + 1$  has

- a) a maximum value
- b) a minimum value
- c) a singularity
- d) a point of inflection

12) For the spherical  $x^2 + y^2 + z^2 = 1$ , the unit outward normal vector at the point

$$\left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 0\right)$$

- a)  $\frac{1}{\sqrt{2}}\mathbf{i} + \frac{1}{\sqrt{2}}\mathbf{j}$
- b)  $\frac{1}{\sqrt{2}}\mathbf{i} - \frac{1}{\sqrt{2}}\mathbf{j}$
- c)  $\mathbf{k}$
- d)  $\frac{1}{\sqrt{3}}\mathbf{i} + \frac{1}{\sqrt{3}}\mathbf{j} + \frac{1}{\sqrt{3}}\mathbf{z}$

CARRY TWO MARKS EACH

13) The homogeneous state of stress for metal part undergoing plastic deformation is

$$T = \begin{pmatrix} 10 & 5 & 0 \\ 5 & 20 & 0 \\ 0 & 0 & -10 \end{pmatrix},$$

where the stress component values are in  $MPa$ . Using Von Mises yield criterion, the value of estimated shear yield stress, in  $MPa$

- a) 9.50
- b) 16.07
- c) 28.52
- d) 49.41