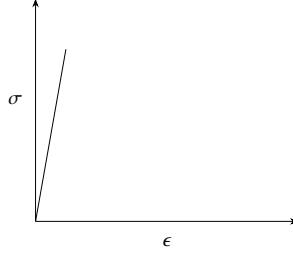
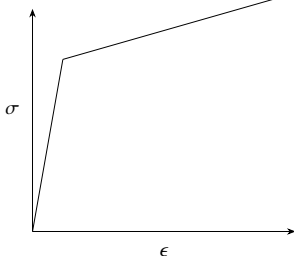
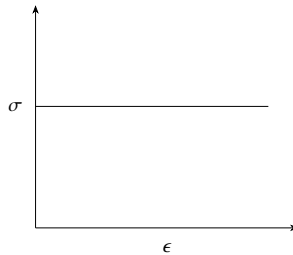
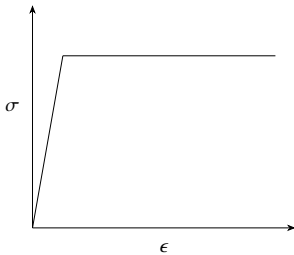


- 1) Consider a steel (Young's modulus $E = 200 \text{ GPa}$) column hinged on both sides. Its height is 1.0 m and cross-section is $10 \text{ mm} \times 20 \text{ mm}$. The lowest Euler critical buckling load (in N) is
- 2) A swimmer can swim 10 km in 2 hours when swimming along the flow of a river. While swimming against the flow, she takes 5 hours for the same distance. Her speed in still water (in km/h) is
- 3) Which one of the following is the most conservative fatigue failure criterion?

a) Soderberg b) Modified Goodman c) ASME Elliptic d) Gerber

- 4) Which one of the following types of stress-strain relationship best describes the behaviour of brittle materials, such as ceramics and thermosetting plastics, (σ = stress and ϵ = strain)?



- 5) Match the following products with preferred manufacturing processes:

Product		Process	
P.	Rails	1.	Blow molding
Q.	Engine crankshaft	2.	Extrusion
R.	Aluminium channels	3.	Forging
S.	PET water bottles	4.	Rolling

- a) P-4, Q-3, R-1, S-2 b) P-4, Q-3, R-2, S-1 c) P-2, Q-4, R-3, S-1 d) P-3, Q-4, R-2, S-1

6) Holes of diameter $25.0^{+0.040}_{-0.020}$ mm are assembled interchangeably with the pins of diameter $25.0^{+0.005}_{-0.008}$ mm. The minimum clearance in the assembly will be

- a) 0.048 mm b) 0.015 mm c) 0.005 mm d) 0.008 mm

7) Under certain cutting conditions, doubling the cutting speed reduces the tool life to $\left(\frac{1}{16}\right)^{th}$ of the original. Taylor's tool life index (n) for this tool-workpiece combination will be

8) In a linear arc welding process, the heat input per unit length is inversely proportional to

- a) welding current
b) welding voltage
c) welding speed
d) duty cycle of the power source

9) The function of interpolator in a CNC machine controller is to

- a) control spindle speed
- b) coordinate feed rates of axes
- c) control tool rapid approach speed
- d) perform Miscellaneous (M) functions (tool change, coolant control etc.)

10) Consider a spatial curve in three-dimensional space given in parametric form by

$$x(t) = \cos t, y(t) = \sin t, z(t) = \frac{2}{\pi}t, 0 \leq t \leq \frac{\pi}{2}$$

The length of the curve is

11) Consider an ant crawling along the curve $(x-2)^2 + y^2 = 4$, where x and y are in meters. The ant starts at the point $(4,0)$ and moves counter-clockwise with a speed of 1.57 meters per second. The time taken by the ant to reach the point $(2,2)$ is (in seconds)

12) Find the solution of $\frac{d^2y}{dx^2} = y$ which passes through the origin and the point $(\ln 2, \frac{3}{4})$

- a) $y = \frac{1}{2}e^x - e^{-x}$ b) $y = \frac{1}{2}(e^x + e^{-x})$ c) $y = \frac{1}{2}(e^x - e^{-x})$ d) $y = \frac{1}{2}e^x + e^{-x}$

13) The probability of obtaining at least two "SIX" in throwing a fair dice 4 times is

- a) $\frac{425}{432}$ b) $\frac{19}{144}$ c) $\frac{13}{144}$ d) $\frac{125}{432}$