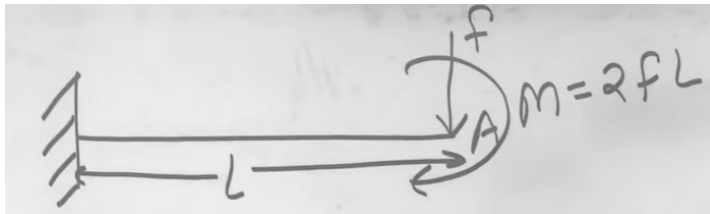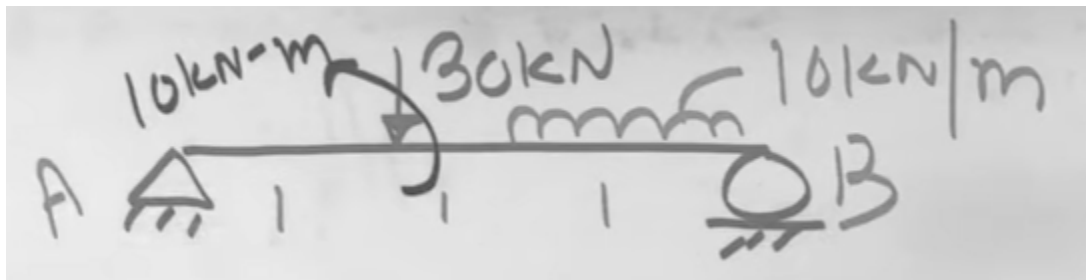# GATE 2023 Engineering Sciences Question Paper
# (Memory-Based)

**Question. Find the deflection at Point A.**
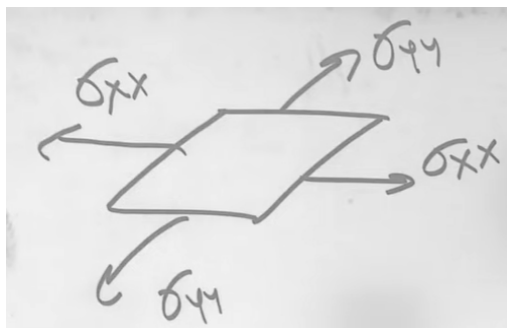


**Answer.** $-4FL^3/3EI$

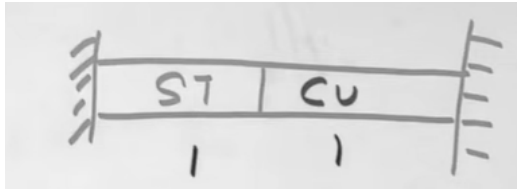**Question. Calculate the Shear Force at mid point.**



**Answer.** 1.875

**Question. A thin steel plate is loaded in XY plane M = 0.3, E = 200 GPA, $\sigma$xx = 120 MPa. What is the value of $\sigma$yy? Given: $\epsilon$ = -3 x 10$^{-4}$**



**Answer.** 80 MPa

**Question. What will be the magnitude of axial stress developed in the**



$$\alpha_{ST} = 12 \times 10^{-6}$$
$$\alpha_{CU} = 18 \times 10^{-6}$$
$$E_{ST} = 200 \, GPa$$
$$E_{CU} = 100 \, GPa$$
$$\Delta T\uparrow = 100°C$$

**Answer.** 200 MPa

**Question. The state of stress at a critical location in a structure is $\sigma xx$ = 420 MPa, $\sigma yy$ = 100 MPa. $\sigma zz$ = $\tau xy$ = $\tau yx$ = 0. Syt = 400 MPa**

**Question. A thin walled, closed cylinder vessel of inside diameter d and wall thickness t contains fluid under pressure p. Figure shows part of cylindrical vessel. End caps are not shown. Consider elements shown with sides parallel and perpendicular to axis of cylinder. $\sigma 1$ and $\sigma 2$ are**
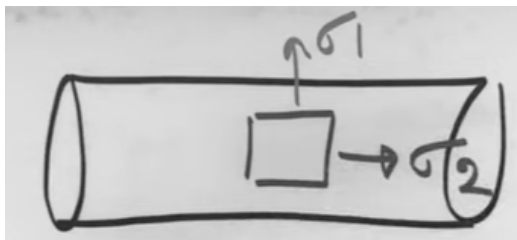


**Answer.** $\sigma 1$ = PD/2t, $\sigma 2$ = PD/2t

**Question. Which among the given curves in the graph figure represents shear thinning fluid**
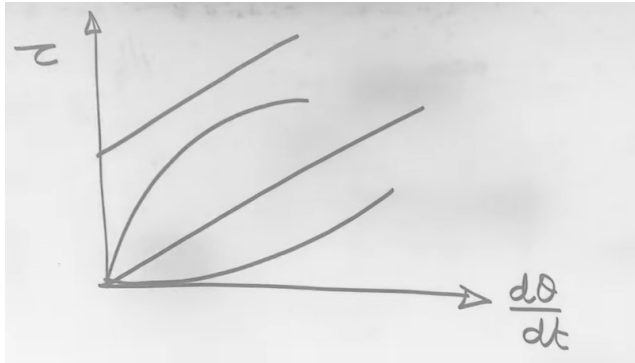


**Answer. The curve which shows a decrease in the slope- Pseudoplastic**

**Question. A body is completely submerged in fluid**
**Given: Centre of buoyancy= Centre of gravity = . In which condition will the body be stable, unstable or neutral equilibrium.**

**Answer.** Neutral Equilibrium when Ycb = Ycg, Stable Equilibrium when Ycg > Ycb

**Question. Which of the following options are correct regarding fluid kinematics**

1. The conservation of mass for an unsteady flow $\vec{\nabla} \cdot \vec{\vartheta} = 0$
2. Circulation is defined as the line integral of waticity around closed curve
   $$\Gamma = \oint \vec{v} \, ds$$
3. For some fluid shear stress can be in non-linear function of the shear stress and the strain rate
4. The integration of Euler equation along a streamline under steady state condition leads to the bernoulli's equation

A. 1, 2, 3 are correct
B. 1, 2 are correct
C. 1, 2, are correct
D. 3, 4 are correct

**Answer.** D

**Question. A water jet (p = 1000) is approaching a vertical plate, having an orifice at centre as shown. While a part of the jet passes through orifice, the remainder flows along the plate. Neglect friction and assume both the inlet and exits jet to have circular cross section. If V = 5 m/sec, D = 100 mm, d = 25 mm, magnitude of horizontal force required to hold the plate in its position is**
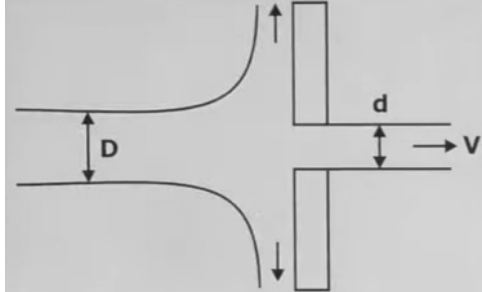


**Answer.** 184.07 N

**Question. Axial velocity profile u(r) for an axisymmetric flow through a circular tube of radius R is given as**
$$u(r)/U = (1 - r/R)^{1/n}$$
**where U is centreline velocity. If V refers to area averaged velocity (vol. flow rate per unit area) then the ratio of V/U for n = 1 is**

**Answer.** ⅓

**Question. In steady 2D incompressible flow, u and v are x and y components of flow velocity and r is density. Among the following pair of relations, which one satisfies definition of stream function (f)**

A.
$$\rho u = -\frac{\partial \psi}{\partial y} \text{ and } \rho v = \frac{\partial \psi}{\partial x}$$

B.
$$u = \frac{\partial \psi}{\partial y} \text{ and } v = -\frac{\partial \psi}{\partial x}$$

C.
$$\rho u = \frac{\partial \psi}{\partial y} \text{ and } \rho v = -\frac{\partial \psi}{\partial x}$$

D.
$$u = -\frac{\partial \psi}{\partial x} \text{ and } v = -\frac{\partial \psi}{\partial y}$$

**Answer.** A, B, C are correct

**Question. The momentum thickness expressed as**

A. $\int_0^\infty \dfrac{u}{u_\infty} dy$

B. $\int_0^\infty \left(1 - \dfrac{u}{u_\infty}\right) dy$

C. $\int_0^\infty \left(1 - \dfrac{u^2}{u_\infty^2}\right) dy$

D. $\int_0^\infty \dfrac{u}{u_\infty}\left(1 - \dfrac{u}{u_\infty}\right) dy$

**Answer. D**