# ASSIGNMENT 3

## EE24BTECH11011 - PRANAY

27) In an experiment, positive and negative values are equally likely to occur. The probability of obtaining at most one negative value in five trials is

    a) $\frac{1}{32}$
        b) $\frac{2}{32}$
        c) $\frac{3}{32}$
        d) $\frac{6}{32}$

28) The eigenvalues of the matrix $\begin{pmatrix} 9 & 5 \\ 5 & 8 \end{pmatrix}$ are

    a) $-2.42$ and $6.86$
    b) $3.48$ and $13.53$
    c) $4.70$ and $6.86$
    d) $6.86$ and $9.50$

29) For the parallelogram $OPQR$ shown in the sketch, $\mathbf{OP} = a\hat{i} + b\hat{j}$ and $\mathbf{OR} = c\hat{i} + d\hat{j}$ . The area of the parallelogram is
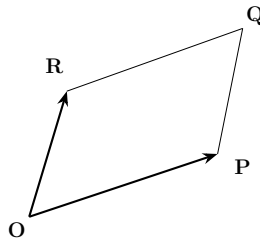


    a) $ad - bc$
                        c) $ad + bc$

    b) $ac + bd$
                        d) $ab - cd$

30) The solution of the ordinary differential equation $\frac{dy}{dx} + 2y = 0$ for the boundary condition , $y = 5$ at $x = 1$ is

    a) $y = e^{-2x}$
        b) $y = 2e^{-2x}$
        c) $y = 10.95e^{-2x}$
        d) $y = 36.95e^{-2x}$

31) A simply supported beam is subjected to a uniformly distributed load of intensity $w$ per unit length, on half of the span from one end. The length of the span and the flexural stiffness are denoted as $l$ and $EI$, respectively. The deflection at mid-span of the beam is

    a) $\frac{5}{6144}\frac{wl^4}{EI}$
        b) $\frac{5}{768}\frac{wl^4}{EI}$
        c) $\frac{5}{384}\frac{wl^4}{EI}$
        d) $\frac{5}{192}\frac{wl^4}{EI}$

32) The sketch shows a column with a pin at the base and rollers at the top. It is subjected to an axial force $P$ and a moment $M$ at mid-height .The reaction(s) at $R$ is/are
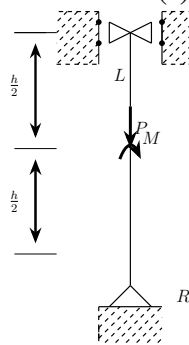
a) vertical force equal to $P$
b) vertical force equal to $\frac{P}{2}$
c) vertical force equal to $P$ and a horizontal force equal to $\frac{M}{h}$
d) vertical force equal to $\frac{P}{2}$ and a horizontal force equal to $\frac{M}{h}$

33) A concrete beam prestressed with a parabolic tendon is shown in the sketch. The eccentricity of the tendon is measured from the centroid of the cross-section. The applied prestressing force at service is 1620 kN. The uniformly distributed load of 45 kN/m includes the self-weight.



**7300**

sectional elevation

**500**

**750**

Cross-section
(tendon not shown)
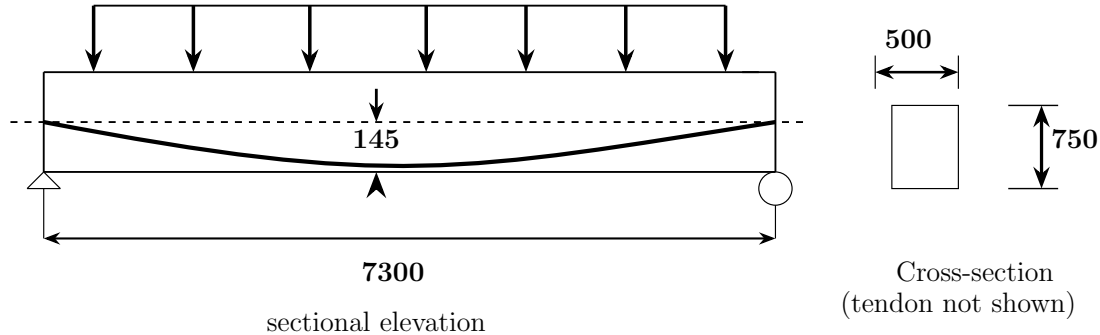
*All dimensions are in mm*

The stress $\left(\frac{N}{mm^2}\right)$ in the bottom fibre at mid-span is
a) tensile 2.90
b) compressive 2.90
c) tensile 4.32
d) compressive 4.32

34) A symmetric frame $PQR$ consists of two inclined members $PQ$ and $QR$, connected at $Q$ with a rigid joint, and hinged at $P$ and $R$. The horizontal length $PR$ is $l$. If a weight $W$ is suspended at $Q$, the bending moment at $Q$ is

a) $\frac{Wl}{2}$          b) $\frac{Wl}{4}$          c) $\frac{Wl}{8}$          d) zero

35) Two plates are connected by fillet welds of size 10 mm and subjected to tension, as shown in the sketch. The thickness of each plate is 12 mm. The yield stress and the ultimate tensile stress of steel are 250 MPa and 410 MPa, respectively. The welding is done in the workshop ($\gamma_{mv} = 1.25$). As per the Limit State Method of IS 800: 2007, the minimum length (rounded off to the nearest higher multiple of 5 mm) of each weld to transmit a force $P$ equal to 270 kN is
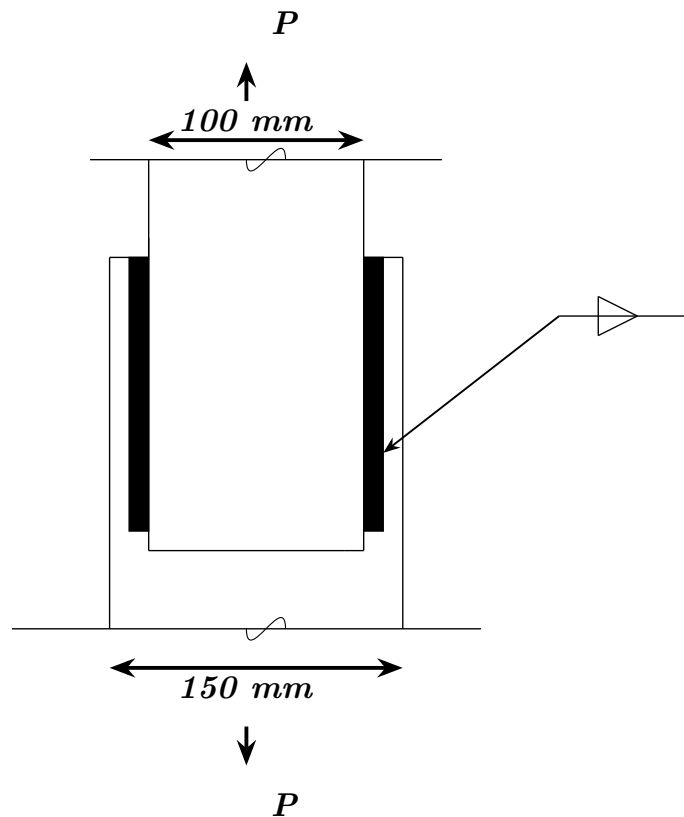
a) 100 mm        b) 105 mm        c) 110 mm        d) 115 mm

36) Two soil specimens with identical geometric dimensions were subjected to falling head permeability tests in the laboratory under identical conditions. The fall of water head was measured after an identical time interval. The ratio of initial to final water heads for the test involving the first specimen was 1.25. If the coefficient of permeability of the second specimen is 5-times that of the first, the ratio of initial to final water heads in the test involving the second specimen is

a) 3.05        b) 3.80        c) 4.00        d) 6.25

37) A layer of normally consolidated, saturated silty clay of 1 m thickness is subjected to one dimensional consolidation under a pressure increment of 20 kPa. The properties of the soil are: specific gravity = 2.7, natural moisture content= 45%, compression index = 0.45, and recompression index = 0.05. The initial average effective stress within the layer is 100 kPa. Assuming Terzaghis theory to be applicable, the primary consolidation settlement (rounded off to the nearest mm) is
a) 2 mm
b) 9 mm
c) 14 mm
d) 16 mm

38) Steady state seepage is taking place through a soil element at $Q$,2 m below the ground surface immediately downstream of the toe of an earthen dam as shown in the sketch. The water level in a piezometer installed at $P$, 500 mm above $Q$, is at the ground surface. The water level in a piezometer installed at $R$, 500 mm below $Q$, is 100 mm above the ground surface. The bulk saturated unit weight of the soil is $18 kN/m^3$ and the unit weight of water is $9.81 kN/m^3$. The vertical effective stress (in kPa) at $Q$ is
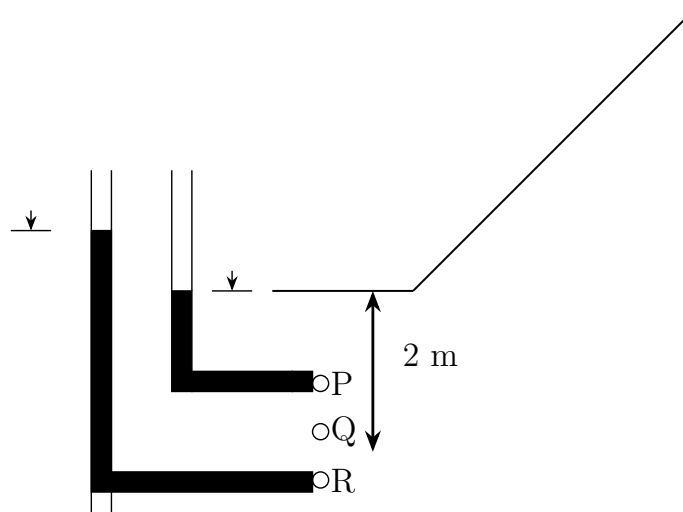
a) 14.42      b) 15.89      c) 16.38      d) 18.34

39) The top width and the depth of flow in a triangular channel were measured as 4 m and 1 m, respectively. The measured velocities on the centre line at the water surface, 0.2 m and 0.8 m below the surface are 0.7 m/s, 0.6 m/s and 0.4 m/s, respectively. Using two-point method of velocity measurement, the discharge $\left(\text{ in } m^3/s\right)$ in the channel is

a) 1.4      b) 1.2      c) 1.0      d) 0.8