# 2018-GATE-CE-40-52

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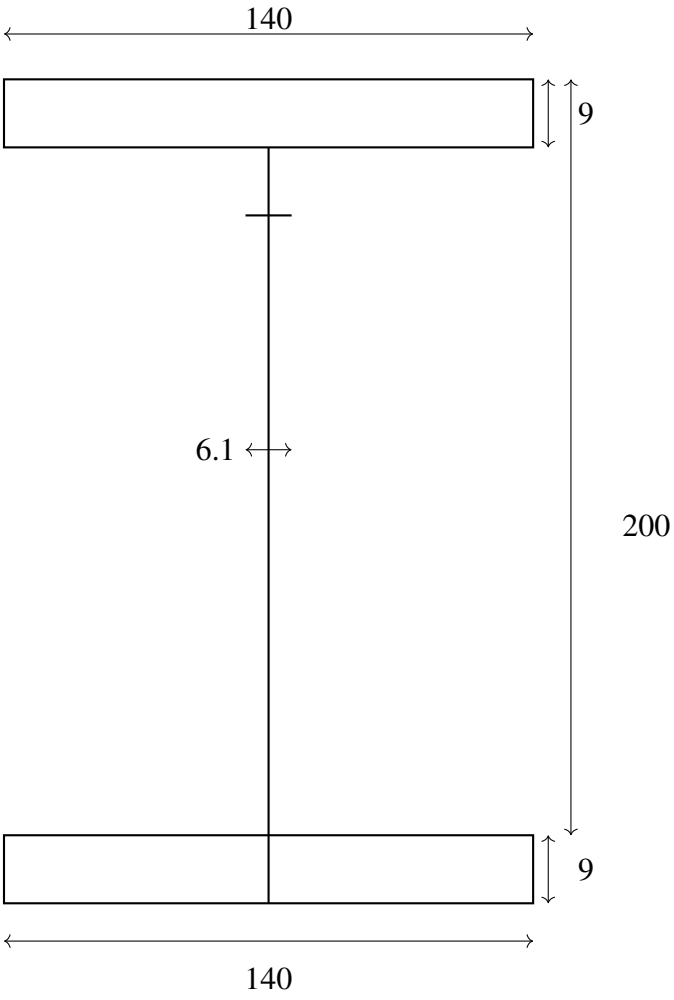
1) An RCC short column (*withlateralties*) of rectangular cross section of $250mm * 300mm$ is reinforced with four numbers of $16mm$ diameter longitudinal bars. The grades of steel and concrete are $Fe415$ and $M20$,respectively. Neglect eccentricity effect. Considering limit state of collapse i compression ($IS\,456 : 2000$),the axial load carrying capacity of the column ($inkN, uptoonedecimalplace$),is

2) An RCC beam of rectangular cross section has factored shear of $200kN$ at its critical section. Its width $b$ is $250mm$ and effective depth $d$ is $350mm$.Assume design shear strength $\tau_c$ of concrete as $0.62N/mm^2$ and maximum allowable shear stress $\tau_{c,max}$ in concrete as $2.8N/mm^2$.If two legged $10mm$ diameter vertical stirrup of $Fe250$ grade steel are used, then the required spacing ($incm, uptoonedecimalplace$) as per limit state method will be

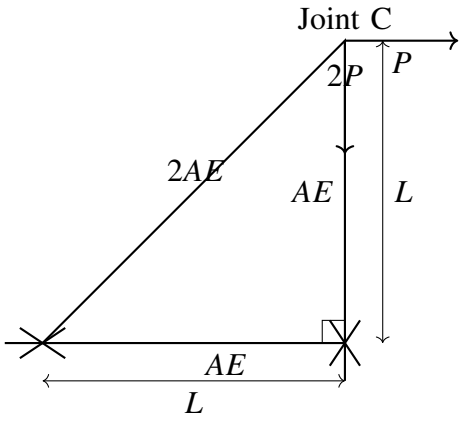
3) the dimensions of a symmetrical welded I-section are shown in the figure.

   The plasti section modulus about the weaker axis ($incm^3 uptoonedecimalplace$) is




(All dimensions are in mm)

4) consider the deformable pin-joined truss with loading,geometry and section properties as shown in figure.



Given that $E = 2 * 10^{11} N/m^2, A = 10mm^2, L = 1m$ and $p = 1kN$.The horizontal displacement of joint C $(inmm, uptoonedecimalplace)$ is

5) The water level in the the adjacent river is at an elevation of $+20.0m$.Unit weight is $10kN/m^3$.The factor of safety $(uptotwodecimalplaces)$ against sand boiling for the proposed excavation is

6) A conventional drained triaxial compression test was conducted on a normally consolidates clay sample under an effective pressure of $200kPa$.the deviator stress at failure was found to be $400kPa$. An identical specimen of the same clay sample is isotropically consolidated to a confining pressure of $200kPa$ and subjected to standard undrained triaxial compression test. If the deviator stress at failure is $150kPa$, the pore pressure developed $(inkPa, uptoonedecimalplace)$ is.

7) The void ratio of a soil is 0.55 at an effective normal stress of $140kPa$.The compression index of the soil is 0.25.In order to reduce the void ratio to 0.4, an increase in the magnitude of effective normal stress $(inkPa, uptoonedecimalplace)$ should be.

8) A rigid smooth retaining wall of height $7m$ with vertical backface retains saturated day as backfil. the saturated unit weight and undrained cohesion of the backfill are $17.2kN/m^3$ and $20kPa$, respectively.The difference in the active lateral forces on the wall $(inkNpermeterlenghtofwall, uptorwodecimalplace)$,before and after the occurrence of tension crack is.

9) Rainfall depth over a watershed is monitored through six number of well distributed rain gauges. Gauges date are given below

| **Rain Gauge Number** | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **Rainfall Depth (mm)** | 470 | 465 | 435 | 525 | 480 | 510 |
| **Area of Thiessen Polygon** ($\times 10^4$ **m**$^2$) | 95 | 100 | 98 | 80 | 85 | 92 |

The Thiessen mean value $(inmm, uotoonedecimalplace)$ of the rainfall is

10) The infiltration rate $f$ in a basin under ponding condition is given by $f = 30 + 10e^{-2t}$, where, $f$ is in mm/h and $t$ is time in hour. The depth of infiltration $(inmm, uptoonedecimalplace)$ during the last 20 minute of a storm of 30 minute duration is

11) In a laboratory, a flow experiment is performed over a hydraulic structure.The measured value of discharge and velocity are $0.05m^3/s$, and $0.25m/s$, respectively.If the full scale structure $(30timesbigger)$ is subjected to a discharge of $270m^3/s$ then the time scale $(modetofullscale)$ value $(uptotwodecimalplaces)$ is

12) A water sample analysis data is given below

The carbonate hardness

| **Ion** | **Concentration, mg/L** | **Atomic Weight** |
|---|---|---|
| $Ca^{2+}$ | 60 | 40 |
| $Mg^{2+}$ | 30 | 24.31 |
| $HCO_3^-$ | 400 | 61 |

$(expressedasmg/LofCaCO_3, uptoonedecimalplace)$ for the water sample is

13) ultimate BOD $(L_0)$ of a wastewater sample is estimated as 87% of COD. The COD of this wastewater is $300mg/L$. considering first order BOD reaction rate constant $k\,(inmg/L, uptoonedecimalplace)$ after three days of incubation at 27% for this wastewater will be.