Q. Draw the reinforcement details of a simply supported singly reinforced rectangular beam having the following specifications. Prepare the schedule of the reinforcement and estimate the quantity of the steel. Draw the longitudinal section, Cross section at middle and cross section at end.

Specifications:

Clear span of the beam = 4300 mm

Thickness of wall or bearing on either side = 230 mm

Width of the beam (b) = 230 mm

Total depth of the beam = (D) = 400 mm

Materials:

Concrete = M20

Steel = Fe415

Reinforcement:

Bottom main bar = 20 mm of 4 no's – out of which 2 bars are cranked at 45° at a distance of l/4 from the face of the support

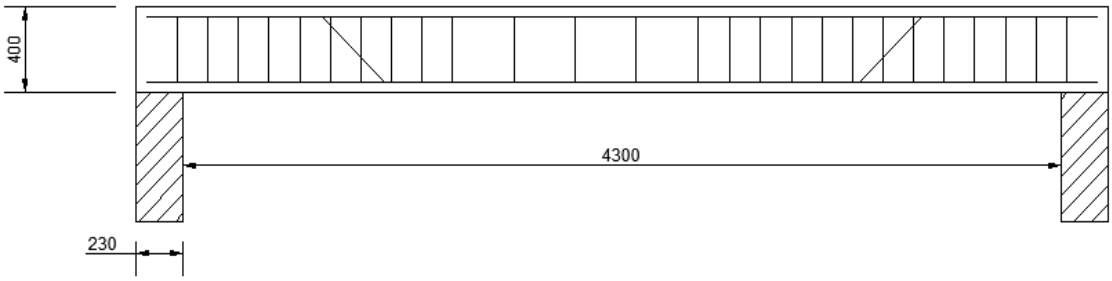
Hanger bars = 12 mm of 2 no's

Stirrups = 8 mm two legged stirrups, 150 mm c/c at a distance of

1500 mm from either side and 300 mm c/c at middle

Covers:

Top, bottom and side covers = 25mm



Sol:

Reinforcement calculation:

1. Length of main bar (*l)* = clear span + bearings – 2(side covers)

   = 4300 + 230 + 230 – 2(25)

   = 4710 mm

2. Length of cranked bar = length of main bar + 2(0.42d)

   = 4710 + 2(0.42 x d)

   Since, d = overall depth – (top and bottom covers + bottom dia. of the bar)

   = 400 – (2 x 25 + 20)

   d = 330 mm

   = 4710 + 2(0.42 x 330)

   = 4987.2 ~ 4990 mm

3. Length of hanger bar = length of main bar

   = 4710 mm

4. Stirrups = 2(a + b) + 2(12d)

   a = 230 – 2(25)

   = 180 mm

   b = 400 – 2(25)

   = 350 mm

   = 2(180 + 350) + 2(12 x 8) {where, " d " is dia of the bar}

   = 1252 mm

   No. of stirrups required at one side = length / spacing

   = 1500 / 150

   = 10 No's

   No. of stirrups required for another side = length / spacing

   = 1500 / 150

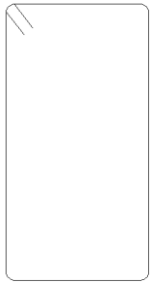
   = 10 No's

   No. of stirrups at middle = length / spacing

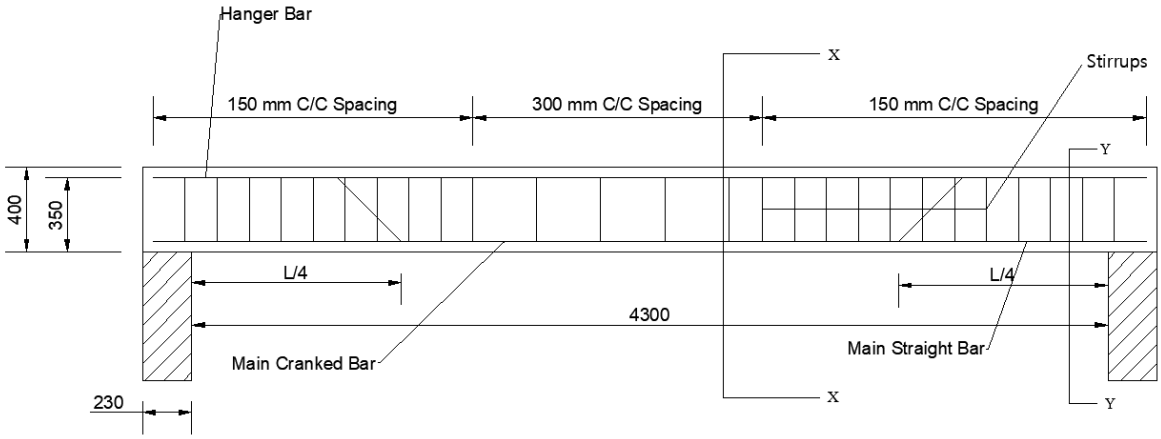
   = [4710 – (1500 + 1500) / 300] + 1

   = 6.7 ~ 7 no's

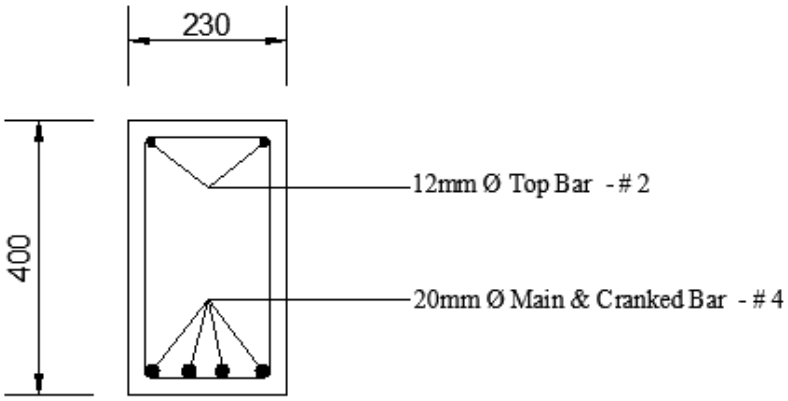
Bar Bending Schedule:

S. no	Name of the bar	Shape of the bar	Dia. of the bar (mm)	No. s	Length (m)	Total length (m)	Weight (kg/m)	Total weight (kg)
1.	Main Straight bar		20	2	4.710	9.420	2.47	23.27
2.	Main Cranked bar		20	2	4.990	9.980	2.47	24.65
3.	Hanger bar		12	2	4.710	9.420	0.89	23.27
4.	Stirrups		8	27	1.252	33.804	0.39	13.18

Longitudinal Section:



Cross section at middle:



Cross section at end: