Problems of Seive Analysis or particaal size distribution

Problem 1) The following gives the results of sieve analysis for two soil sample A and B . determine the effective size , coefficient of uniformity and classify the soil by unified method ?

Sieve (mm)	% Finer	
	Soil A	Soil B
63	100	-
20	64	100
6.3	39	94
2	24	69
0.6	12	32
0.212	0.5	13
0.063	1	2

Answer :

Important Note : For uniformly graded soil : Coefficient of uniformity = $C_u = 1$ or nearly 2

For well graded soil :

Coefficient of uniformity = $C_u = 2$ to 15 and Coefficient of curvature = $C_c = 1$ to 3
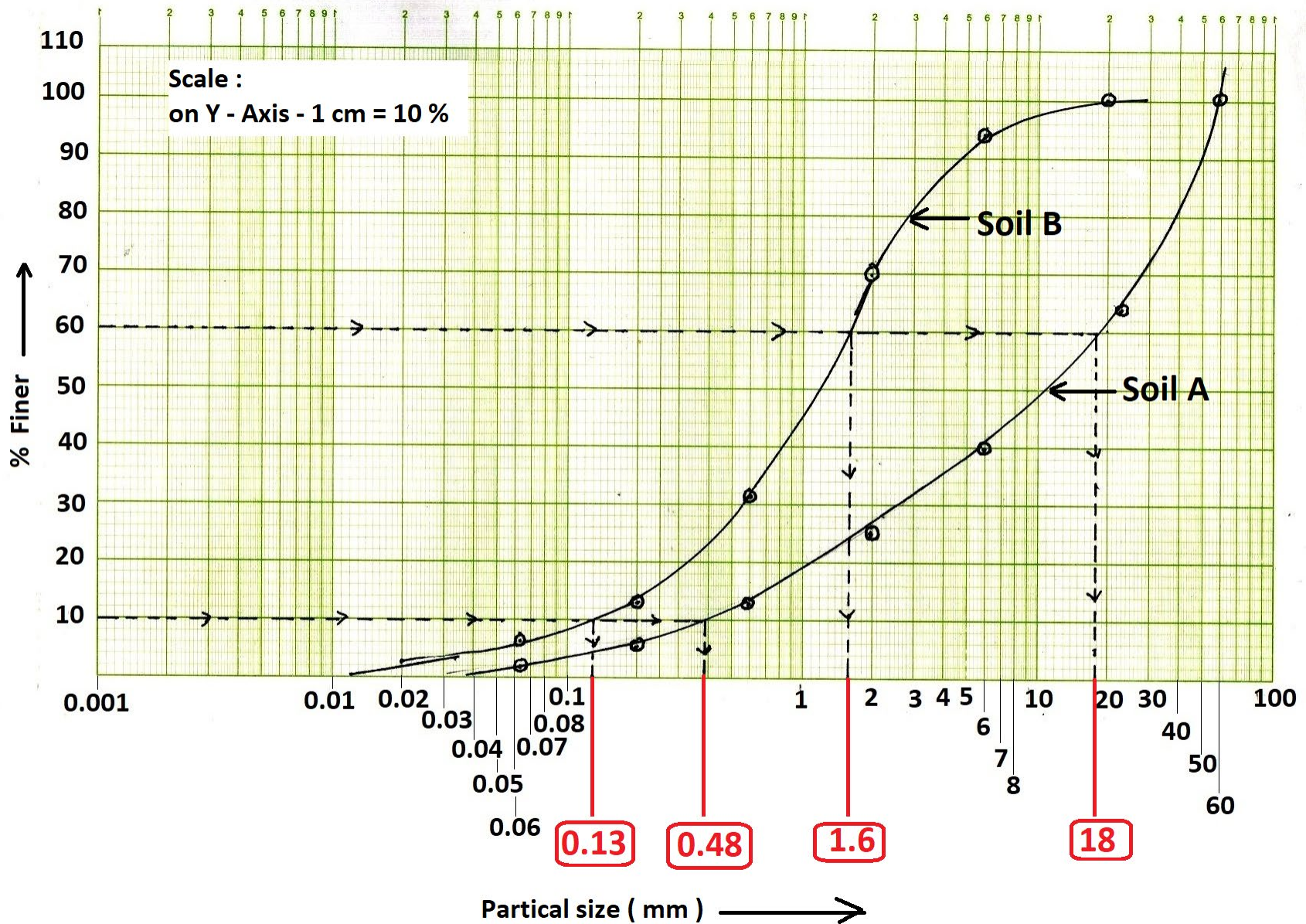
Draw semi log graph as sieve size on X axis and % finer on Y axis.

for soil A : D_{10} = 0.48 mm and D_{60} = 18 mm

Coefficient of uniformity = $C_u = {D_{60}}/{D_{10}} = {18}/{0.48}$ = 37.5 hence the soil is poorly graded.

for soil B : D_{10} = 0.13 mm and D_{60} = 1.6 mm

Coefficient of uniformity = $C_u = {D_{60}}/{D_{10}} = {1.6}/{0.13}$ = 12.30 hence, the soil is well graded.

Scale :
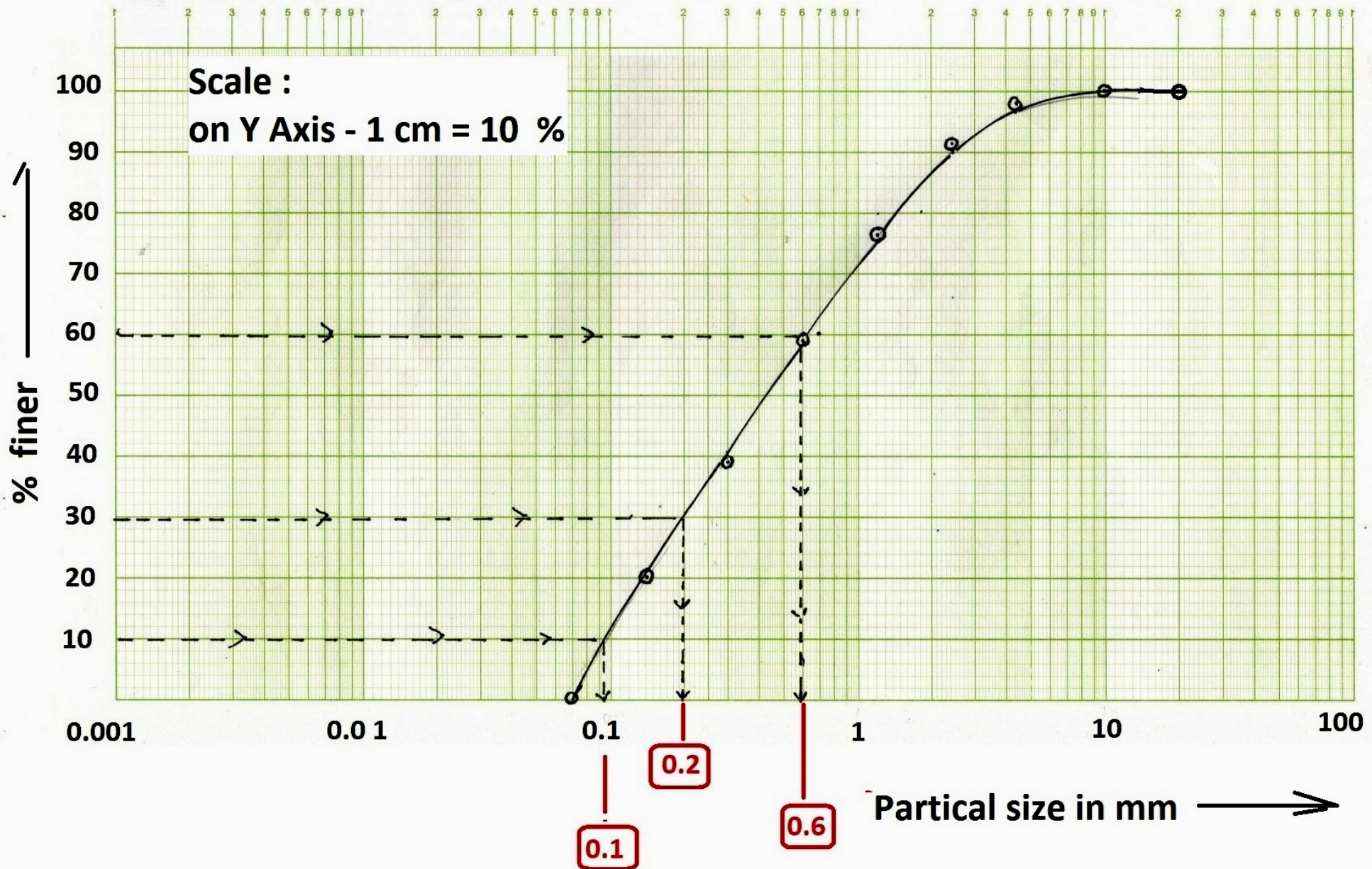on Y - Axis - 1 cm = 10 %

% Finer

Soil B

Soil A

Partical size (mm)

0.13   0.48   1.6   18

3

Problem 2) the result of sieve analysis on dry soil sample weighing 1000 gm are given below.

IS Seive (mm)	Mass of soil retained (gm)
20	0
10	0
4.75	92
2.40	247
1.2	369.5
600 μ	181
300 μ	94
150 μ	9.5
75 μ	1.5

Plot particle size distribution curve and determine coefficient of curvature and coefficient of uniformity . also identify type of soil ?

Answer :

1	2	3	4	5	
IS Seive (mm)	Mass of soil retained (gm)	Cumulative mass retained(gm)	Cumulative % soil retained (gm) $= {Column\ 3}/{5000}$ x 100	% Finer	
				Only 1st value :	100 – Column no. 4
20	0	0	0	100 - 0 = 100	
10	0	0	0	100 - 0 = 100	
4.75	92	92	1.84	100 – 1.84 = 98.16	
2.40	247	92 + 247 = 339	6.78	98.16 – 6.78 = 91.38	
1.2	369.5	339 +369.5= 708.5	14.17	91.38 – 14.17 = 77.21	
0.6	181	708.5+181 = 889.5	17.79	77.21 – 17.79 = 59.42	
0.3	94	889.5+94= 983.5	19.67	59.42 – 19.67 = 39.75	
0.15	9.5	983.5 + 9.5 = 993	19.86	39.75 – 19.86 = 19.89	
0.075	1.5	993 + 1.5 = 994.5	19.90	19.89 – 19.90 = 0	
		$\sum 5000$	$\sum 100$		

Scale :
on Y Axis - 1 cm = 10 %

% finer

100
90
80
70
60
50
40
30
20
10

0.001   0.0 1   0.1   1   10   100

Partical size in mm

0.1
0.2
0.6

From graph ; we get $D_{10} = 0.1$; $D_{30} = 0.2$ and $D_{60} = 0.6$

Hence , Coefficient of uniformity = $C_u = \dfrac{D_{60}}{D_{10}} = {0.6}/{0.1} = 6$

Coefficient of Curvature = $C_c = \dfrac{D_{30}}{D_{60} \; x \; D_{10}} = {0.2}/{(0.6 \; x \; 0.1)} = 3.34$

Since Coefficient of uniformity = $C_u = 6$ which lies in between the values 2 to 15,

Hence, The soil is well graded soil .

Problem 3) the result of sieve analysis on dry soil sample weighing 1000 gm are given below.

IS Seive (mm)	Mass of soil retained (gm)
20	33
10	49
4.75	85
2	140
1	160
0.6	142
0.425	118
0.300	80
0.212	56
0.150	35
0.075	23

Plot particle size distribution curve and determine coefficient of curvature and coefficient of uniformity . also identify type of soil ?

| 1	2	3	4	5	
IS Seive (mm)	Mass of soil retained (gm)	Cumulative mass retained(gm)	Cumulative % soil retained (gm) $= Column\ 3/5889$ x 100	% Finer	
				Only 1st value : 100 – Column no. 4	
20	33	33	0.56	100 – 0.56 = 99.44	
10	49	82	1.39	99.44 – 1.39 = 98.05	
4.75	85	167	2.83	98.05 – 2.83 = 95.22	
2	140	307	5.21	95.22 – 5.21= 90	
1	160	467	7.93	90 – 7.93 = 82.08	
0.6	142	609	10.34	82.08 – 10.34 = 71.74	
0.425	118	727	12.34	71.74 – 12.34 = 59.4	
0.300	80	809	13.7	59.4 – 13.7 = 45.7	
0.212	56	865	14.68	45.7 – 14.68 = 31	
0.150	35	900	15.28	31 – 15.28 = 15.74	
0.075	23	923	15.67	0	
		$\sum 5889$	$\sum 100$		

From graph ; we get $D_{10} = 0.11$; $D_{30} = 0.2$ and $D_{60} = 0.4$

Hence , Coefficient of uniformity = $C_u = \dfrac{D_{60}}{D_{10}} = 0.4/0.11$ = 3.63

Coefficient of Curvature = $C_c = \dfrac{D_{30}}{D_{60}\ x\ D_{10}} = 0.2/(0.4\ x\ 0.11\ )$ = 4.54

Since Coefficient of uniformity = C_u= 3.63 which lies in between the values 2 to 15,
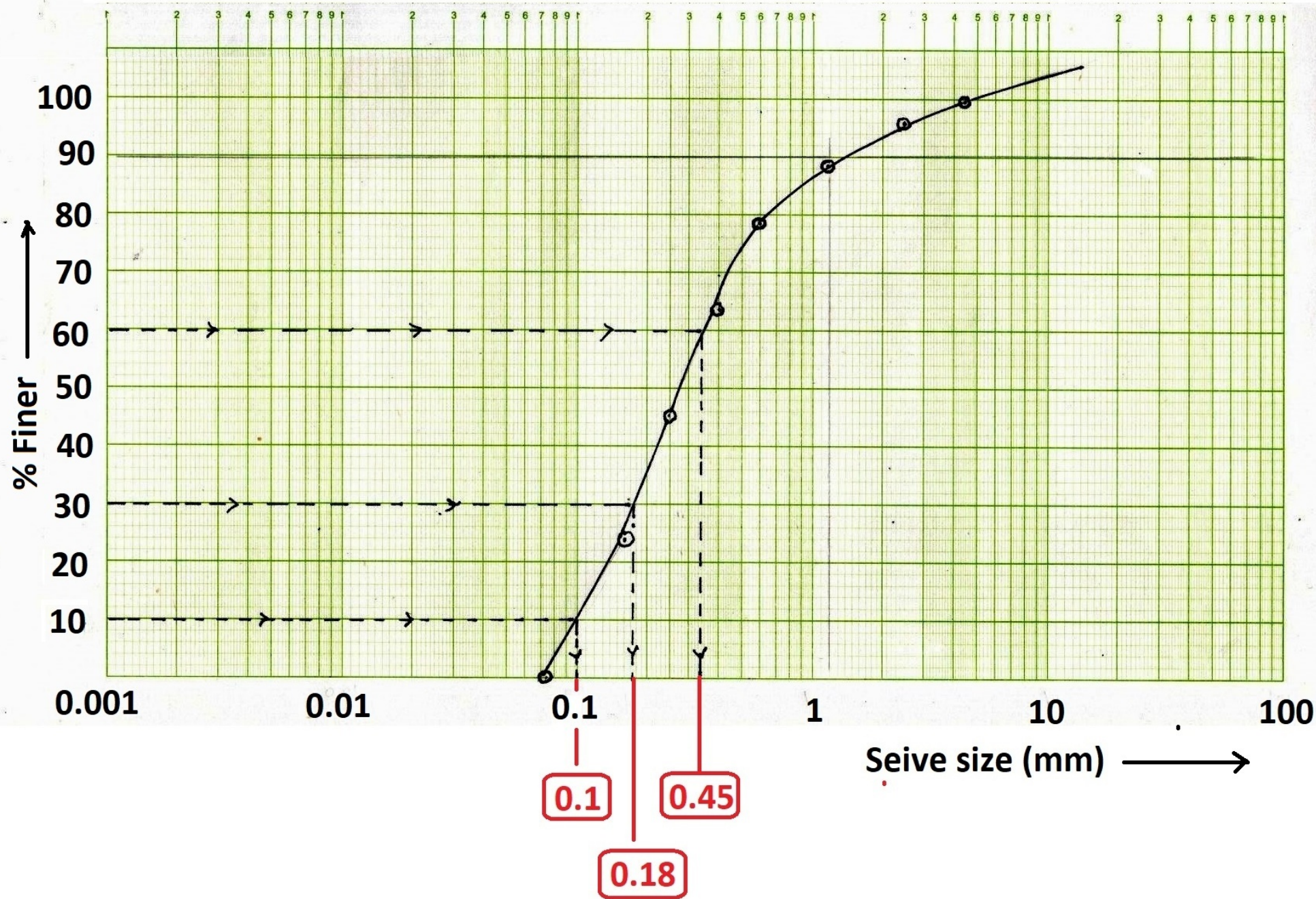
Hence, The soil is well graded soil .

Scale :
on Y Axis - 1 cm = 10 %

% Finer

Sieve Size (mm)

0.11
0.2
0.4
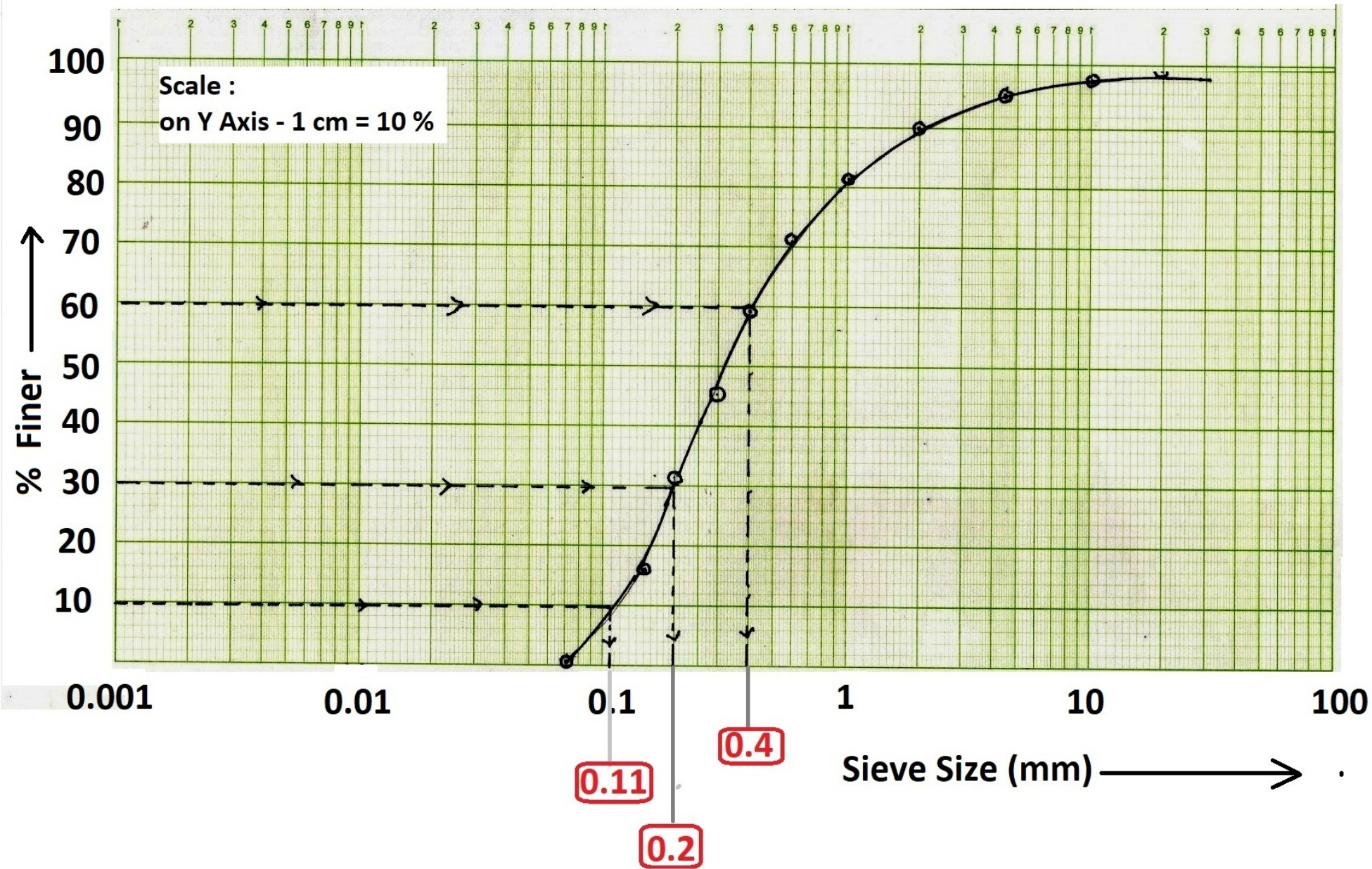
Problem 4) result of sieve analysis on the dry soil weighing 500 gms is as follow :

IS Seive (mm)	Mass of soil retained (gm)
4.75	9.36
2.4	53.75
1.2	78.10
600 μ	83.22
425 μ	85.80
300 μ	76.82
150 μ	67.02
75 μ	33.83

Plot the particle size distribution curve and determine Cc and Cu . Identify the soil ?

Answer :

1	2	3	4	5
			Cumulative % soil retained	% Finer
IS Seive (mm)	Mass of soil retained (gm)	Cumulative mass retained(gm)	(gm) $= Column\ 3/_{2077.36}$ × 100	Only 1st value : 100 – Column no. 4
4.75	9.36	9.36	0.450	99.55
2.4	53.75	63.11	3.038	96.512
1.2	78.10	141.21	6.79	89.72
0.6	83.22	224.43	10.80	78.922
0.425	85.80	310.23	14.94	63.98
0.300	76.82	387.05	18.63	45.35
0.150	67.02	454.07	21.85	23.502
0.075	33.83	488	23.49	0
		$\sum 2077.36$	$\sum 100$	

From graph ; we get $D_{10} = 0.1$; $D_{30} = 0.18$ and $D_{60} = 0.45$

Hence , Coefficient of uniformity = $C_u = \dfrac{D_{60}}{D_{10}} = {}^{0.45}\!/_{0.1} = 4.5$

Coefficient of Curvature = $C_c = \dfrac{D_{30}}{D_{60} \ x \ D_{10}} = {}^{0.18}\!/_{(\ 0.45 \ x \ 0.1 \ )} = 4$

Since Coefficient of uniformity = C_u = 4.5 which lies in between the values 2 to 15,

Hence, The soil is well graded soil .