Assignment on Gradually Varied flow

1. Prove that the gradually varied flow equation for a wide rectangular channel may be written as

$$\frac{dy}{dx} = S_O \frac{1-\left(\frac{y_n}{y}\right)^{10/3}}{1-\left(\frac{y_c}{y}\right)^3}$$

When Manning's equation is used and it is as below, if Chezy's equation is used for the friction losses

$$\frac{dy}{dx} = S_O \frac{1-\left(\frac{y_n}{y}\right)^3}{1-\left(\frac{y_c}{y}\right)^3}$$

2. Lakes A and B are connected by a 10-m wide rectangular channel, as shown in Figure below. If n for the flow surfaces is 0.013, sketch the water-surface profile in the channel if the water level in Lake B is at

i. El. 155.0
ii. El. 161.0
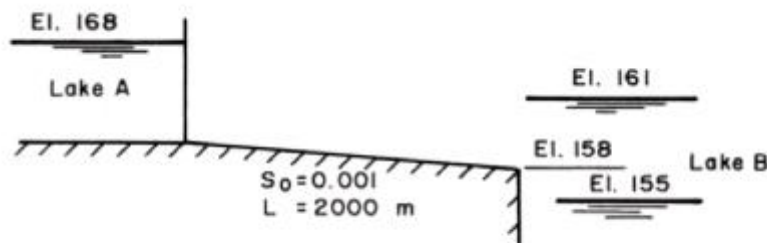
3. If a sluice gate is used to control flow from a lake, should a gate be located near or at a long distance from the lake outlet. Why? If the gate is located at a long distance from the lake outlet, is there a situation in which the outflow from the lake does not depend upon the gate opening. Sketch all possible flow situations assuming the channel-bottom slope to be
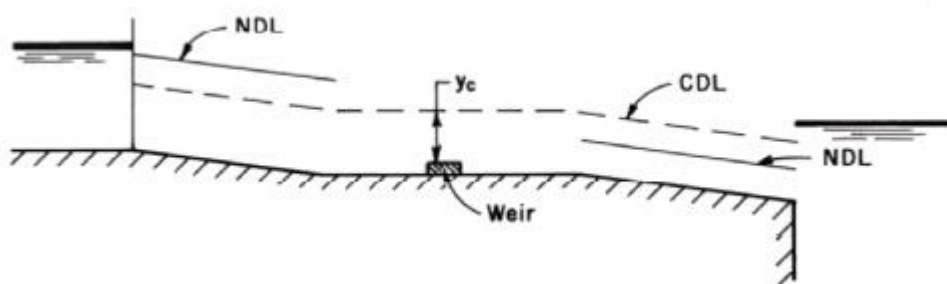   a. mild;
   b. steep.

4. Sketch the water-surface profiles in the channel system as shown below. In this figure, NDL and CDL denote normal- and critical-depth lines, respectively.
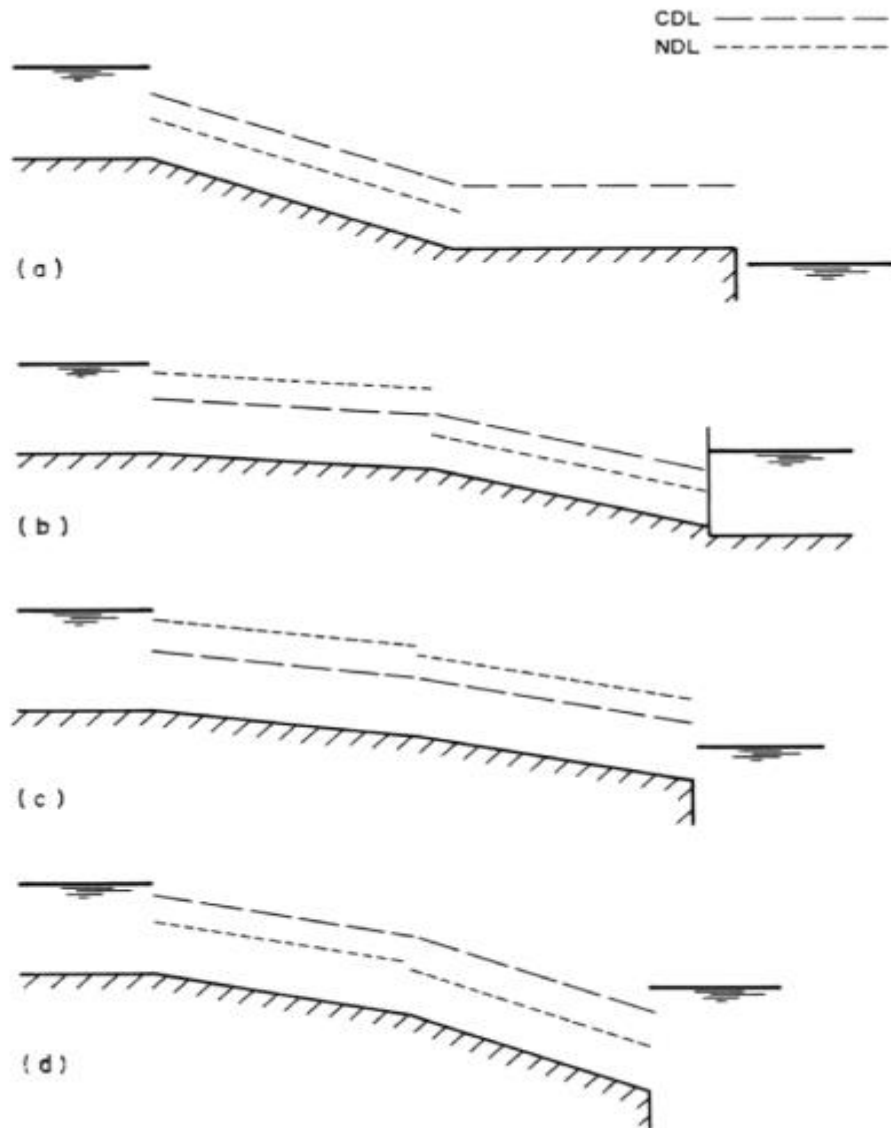
5. Name the water-surface profiles shown in figure below .


(a)
(b)
(c)
(d)
(e)
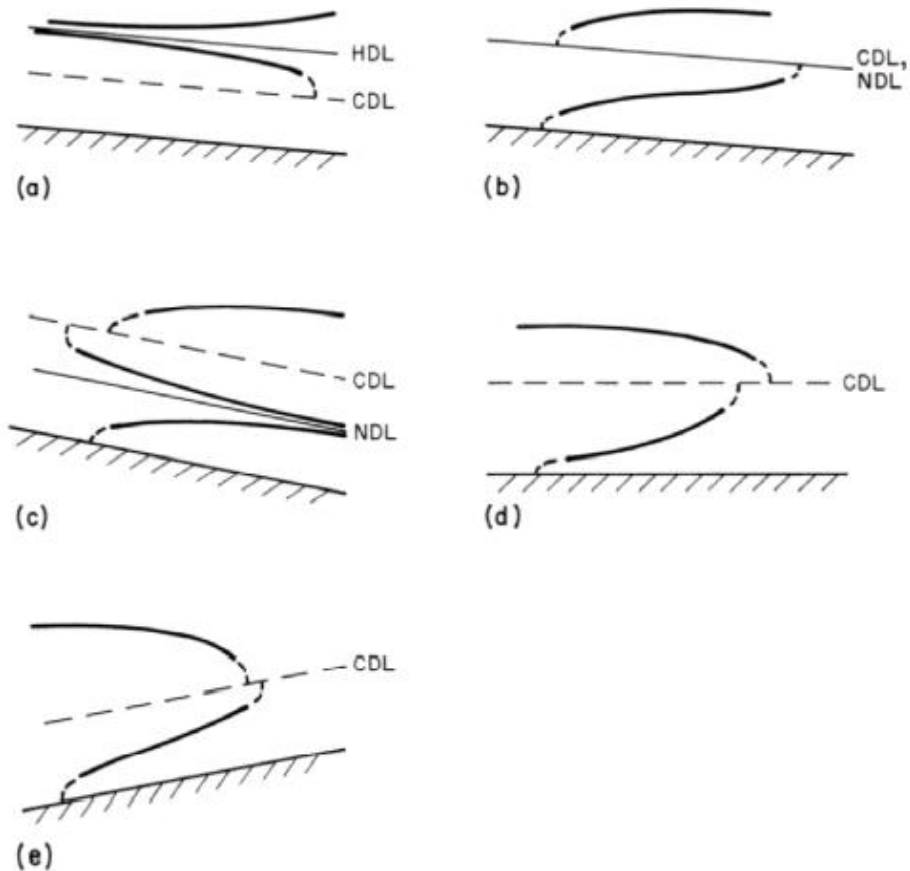
6. Sketch the water surface profiles in the channels shown in Figure below

7. The bottom slope of a long trapezoidal channel (bottom width = 15 ft, side slopes = 1:1) is suddenly changed from 0.0005 to 0.05. The flow in the channel is 800 ft3/sec and the Manning n is 0.028. Compute the critical and normal flow depths in each channel reach and sketch the water surface profile.

8. Sketch and label the types of water surface profiles in the channel as given below
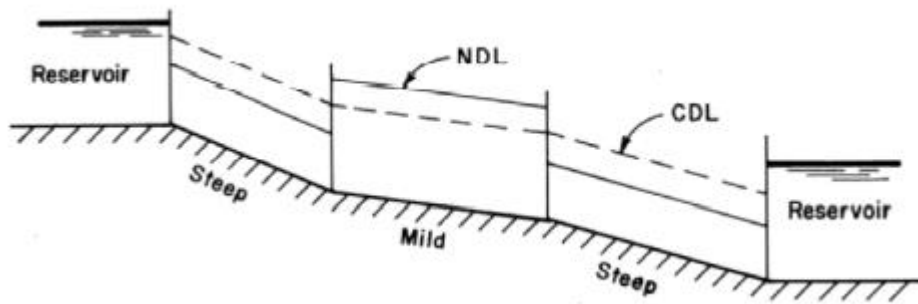
9. Sketch and label the type of water surface profiles in the channel shown below.
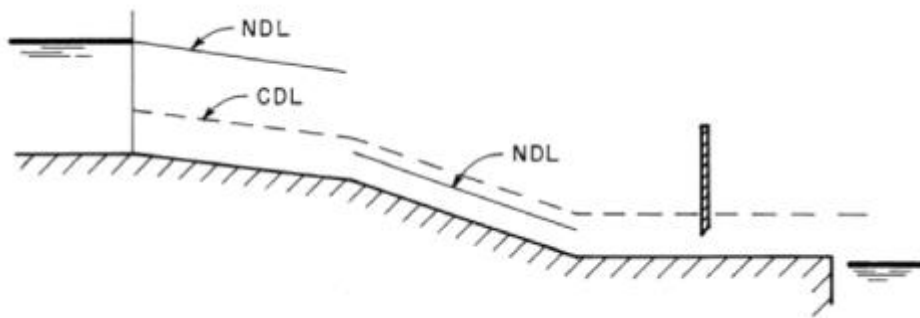
10. A chute spillway is blasted through rock and is not lined. The bottom drops 1.5 ft in 20 feet. Determine the flow depth and the rate of discharge in the chute if the reservoir water level is 10 ft above the channel bottom at the entrance.