Menoufiya University

Faculty of Engineering Shebin El-Kom

Civil Engineering Department

Diploma Exam 16 / 01 / 2017

Open channel flow (CVE558)

Time allowed 3 hrs

Max. Degree : 100

Answer the following questions . Any missing data can be reasonably assumed . Illustrates you answer with neat sketches . answers should be organized , concise and readable.

Question (1) .....(20 MARKS)

A- Find the best hydraulic section for each of the following sections

- Trapezoidal ..... (5 marks)
- Triangular ..... (5 marks)

B- An earth channel is lined with concrete (n = 0.017) , has side slopes 1 : 1.5 and is tangent to a = 3.0 ft radius of the bottom , and is laid on a slope of 0.004 . Find the depth of uniform flow for discharge Of 250 c.f.s..... (10 marks)

Question (2) .....(20 MARKS)

A- Show that the maximum velocity in a circular open channel of certain diameter . Also show th the maximum discharge occurs when the water depth is 0.95 the diameter ..... (8 marks)

B- For uniform laminar flow in wide open channels that :

1- The velocity distribution at a vertical section is parabolic ..... (4 marks)

2- The average velocity : $V = \frac{g.s}{3v} . y_o^2$ ..... (4 marks)

3- The unit discharge : $q = \frac{g.s}{3v} . y_o^3$ ..... (4 marks)

and then evaluate the values of the velocity coefficient α and the momentum coefficient β.

Question (3) ..... (20 MARKS)

A- If the velocity distribution for turbulent flow over rough open channel surfaces is represented by :

$u = 5.75\ u_* \text{Log}\frac{30y}{k}$

It is required to :

1- Prove that $E = \frac{14.2}{c} = 0.883\sqrt{f} = 9.5\frac{9.5\,n}{R^{1/6}}$ ..... (4 marks

2- Derive an expression for the mean velocity at a vertical section (V_m) and give the he above the bed of which it occurs ..... (4 marks

3- Compare the expression you get in (b) with the mean of the velocities at 0.2 and 0.8 of th water depth ..... (4 marks

4- Show that $E = \frac{U_{max}}{V_m - 1}$ ..... (4 marks

B- Estimate the maximum shear stress on the both the sides and the bottom of a trapezoidal ope channel if: b=4y = 5 m , n = 0.015 , Z=1.5 , S_o = 10 cm/km , d_{so} = 2.50 m, γ_s=2.65t/m^3 angle repose Θ = 38° , show how to check the stability of the hydraulic section , calculate the shea velocity. ..... (4 marks

Question (4) .....(20 MARKS)

A- Show that the discharge of abroad crested weir may be expressed as :

$Q = 1.705\ C_d . b\ (E - h)^{1.5}$ m^3/sec in which :

E = specific energy just upstream weir and

h = height of weir ..... (4 marks

B- A uniform flow of 20 m^3/sec occurs in a rectangular channel of 5 m width and 2.5 m water depth . the channel bed is gradually contracted to a width of 3 m , find :

1- The difference in water levels just before and at the constriction .....**(4 marks)**
2- The width of contraction to produce critical depth on it , and the drop in water levels **(4marks)**
3- Draw a relationship between y_1 , y_2 versus b_2 .....**(4 marks)**
4- The dirrerence in water levels if the width is contracted to 2 m .....**(4 marks)**

Question (4) .....(20 MARKS)

A- Derive the G.V.F. equation in terms of each of the following parameters :
1- The section factor (z) .....**(3 marks)**
2- The conueyance factor (k) .....**(3 marks)**

B- A discharge of 250 m^3/sec . flows over the spillway of a dam and then flows over a level R.C. floor of width 50 m . The velocity of water at the bottom of the spillway is 14.0 m/sec and the water depth below the apron is 3.0 m . Estimate :
1- How long should the apron be built ? .....**(12 marks)**
2- The energy lost from the foot of the spillway to the downstream side of the jump.
(take n=0.016) .....**(2 marks)**

This exam measures the following ILOs											
Question Number	Q2 -A			Q1 - B	Q2- B	Q3- A	Q1 - A	Q3 - B	Q4- A	Q5 -A	Q5 -B
Skills	a 2			b 5	b 6	b 12	C 9	C 11	C 4	C1	C6
	Knowledge & Understanding Skills			Intellectual Skills			Professional Skills				