ELIZADE UNIVERSITY

FACULTY: ENGINEERING

DEPARTMENT: CIVIL ENGINEERING

SECOND SEMESTER EXAMINATION (JULY 2017)

2016/2017 ACADEMIC SESSION

Course Title: Hydraulics

Course Code: CVE 302

HOD'S SIGNATURE

Instructions:

1) **Attempt Four Questions**
2) **Time Allowed: 2.5 hours**
3) **SEVERE PENALTIES APPLY FOR MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORIZED MATERIALS DURING EXAM**

QUESTION 3 (15 Marks)

a) State the basic equations of the used in open channel flow. **2 marks**

b) A concrete trapezoidal channel has a bottom width of 4 m and 45-degree side slopes. If the channel is on a 1-percent slope and is flowing at a depth of 1 m throughout its length, how much flow is being carried (use Manning's equation)? How much flow would the same channel carry if it were a rectangular channel 4 m wide? Assume a Manning's n of 0.013 for concrete. **13 marks**

QUESTION 4 (15 Marks)

a) Explain with a neat sketch the term Laminar Flow and Turbulent Flow. **5 marks**

b) A rectangular concrete channel is 3 m wide and 2 m high. The water in the channel is 1.5 m deep and is flowing at a rate of 30 m^3/s. Determine the flow area, wetted perimeter, and hydraulic radius. Is the flow laminar or turbulent? Take: kinematic viscosity for water at 20°C as 1.00×10^{-6} m^2/s. **10 marks**

QUESTION 5 (15 Marks)

a) State various factors which affect the thickness of the boundary layer. **5 marks**

b) A thin rectangular plate 15 cm wide and 1 cm long is immersed in glycerine with density of 1260 kg/m^3 and dynamic viscosity of 8.044×10^{-1} $N-s/m^2$ and is towed in the direction of its length at a constant velocity of 1m/s. Determine:

i. The coefficient of drag

ii. The boundary thickness at the trailing edge

iii. The shearing stress at the trailing edge **10 marks**

QUESTION 6 (15 Marks)

a) Define the following terms:

i. uniform flow. **2 marks**

ii. Gradually-varied flow. **2 marks**

b) State the assumption for a steady uniform flow to occur in an open channel. **4 marks**

c) Find the loss of head due to friction in a pipe carrying water. The pipe is 300 m long and 15 cm in diameter. The discharge through the pipe is $0.04m^3$. Take f = 0.04. **7 marks**

FACULTY OF ENGINEERING

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Course Title: Hydraulics **Course Code: CVE302**

Session: 2016/17 **Semester: Second** **Level: 300**

Instructions: Attempt Four Questions **Time: 2 hrs 30 mins**

QUESTION 1 (15 Marks)

a) Define Hydraulics.**2 marks**

b) With a suitable schematic diagram, derive a *Newton's equation of viscosity for a* viscous fluid between a moving and a stationary flat surface. **7 marks**

c) The diameters of cylindrical pistons *A* and *B* are 3 cm and 20 cm, respectively. The faces of the pistons are at the same elevation, and the intervening passages are filled with an incompressible hydraulic oil. A force *P* of 100 N is applied at the end of the lever, as shown in Figure Q1. What weight *W* can the hydraulic jack support?

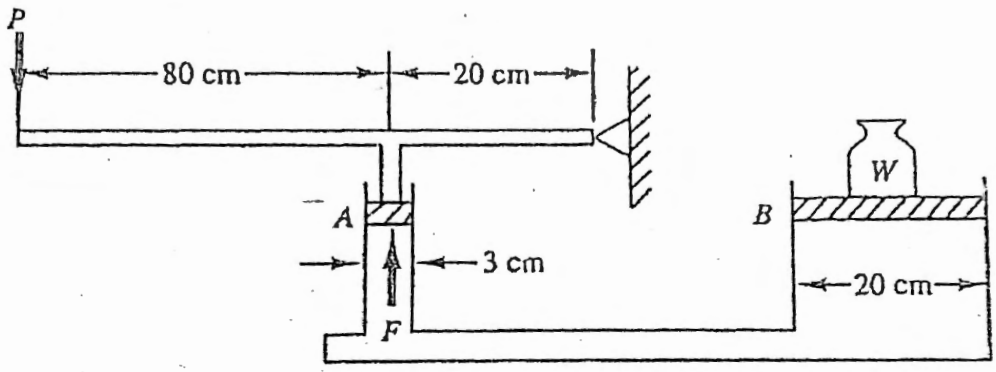

Figure Q1: Hydraulic jack **6 marks**

QUESTION 2 (15 Marks)

a) Explain the following term:

i. Energy Grade. **2 marks**

ii. State the primary and secondary causes of energy loss in a pipe. **3 marks**

b) A 1,200-mm diameter transmission pipe carries 126 l/s from an elevated storage tank with a water surface elevation of 540 m. Two kilometers from the tank, at an elevation of 434 m, a pressure meter reads 586 kPa. If there are no pumps between the tank and the meter location, what is the rate of head loss in the pipe? (Note: 1 kPa = 1,000 N/m^2.) **10 marks**