UNIVERSITY OF SWAZILAND
Faculty of Health Sciences
Department of Environmental Health Science

B.Sc. DEGREE IN: ENVIRONMENTAL MANAGEMENT AND WATER RESOURCES

MAIN EXAMINATION PAPER 2018

TITLE OF PAPER	:	HYDRAULICS
COURSE CODE	:	EHS 320
DURATION	:	2 HOURS
MARKS	:	100
INSTRUCTIONS	:	READ THE QUESTIONS & INSTRUCTIONS CAREFULLY
	:	ANSWER **ANY FOUR** QUESTIONS
	:	EACH QUESTION **CARRIES 25** MARKS.
	:	WRITE NEATLY & CLEARLY
	:	NO PAPER SHOULD BE BROUGHT INTO THE EXAMINATION ROOM.
	:	BEGIN EACH QUESTION ON A SEPARATE SHEET OF PAPER.

DO NOT OPEN THIS QUESTION PAPER UNTIL PERMISSION IS GRANTED BY THE INVIGILATOR.

QUESTION ONE (25 Marks)

A tank shown in Figure Q1-1 contains water up to a height of 0.5 m above the base. An immiscible liquid of specific gravity 0.8 is filled on top of the water up to 1 m height. Calculate:

i) The total pressure on one side wall of the tank. .....[13 marks]

ii) The position of the center of pressure for one side wall of the tank which is 2 meters wide. .....[12 marks]

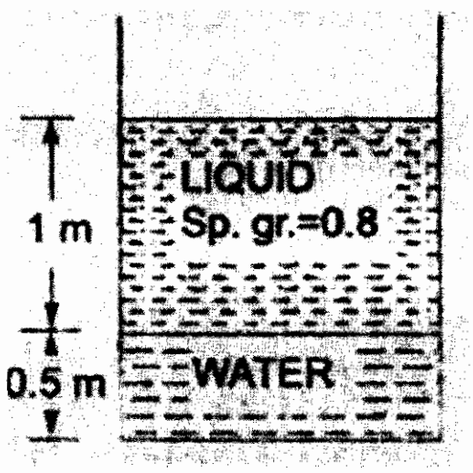

Figure Q1-1

QUESTION TWO (25 Marks)

Water is pumped from a sump (see Fig. Q2-1 below) to a higher elevation by installing a hydraulic pump with the data:

Discharge of water = 6.9 m^3/min

Diameter of suction pipe = 150 mm

Diameter of delivery pipe = 100 mm

Energy supplied by the pump = 25 kW

2A. Determine the pressure in KN/m^2 at points A and B neglecting all losses.

.....[13 marks]

2B. If the actual pressure at B is 25 KN/m^2 determine the total energy loss in KW between the sump and the point B.

.....[12 marks]

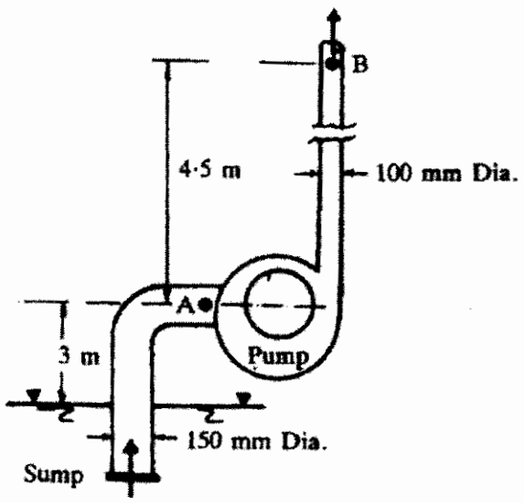

Figure Q2-1

QUESTION THREE (25 Marks)

For the pipe loop shown in Fig. Q3-1 below, determine the flows in each of the pipes using the Hardy-Cross method. Use the head loss formula $H_L = Kq^2$ where the K values are indicated in the figure for each pipe. Start with flow magnitudes and directions indicated for each pipe in the figure.

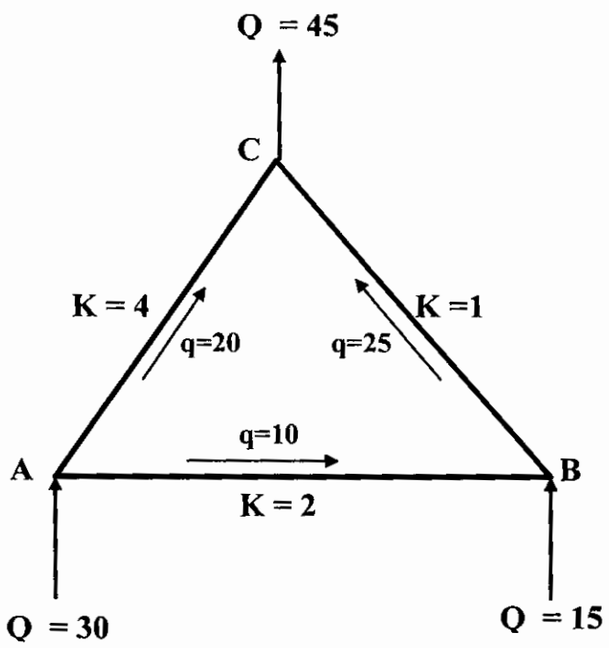

Figure Q3-1

QUESTION FOUR (25 Marks)

Calculate the discharge through the composite flood way channel shown in Figure Q4-1 below. The Manning's coefficient for each section of the composite channel are shown in the figure (n= 0.025 for the left portion and n = 0.040 for the right portion). Take the slope along the channel as 0.0010 and the depth of flow y shown in the figure as y = 2.438 m. The side slopes are 1:1 on both the left and right sides of the channel.

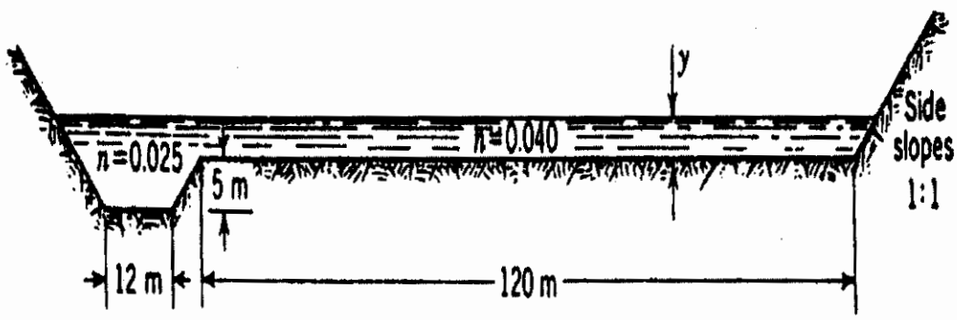

Figure Q4-1

QUESTION FIVE (25 Marks)

A surface pump shown in Figure Q5-1 below abstracts water from a river whose water level fluctuates over the year. The suction pipe has a diameter of 100 mm. The maximum level difference between the pump and the lowest water level in the river is 3 meters as shown in the figure. Using the additional information provided below, calculate the maximum discharge (in liters per second) the pump can draw from the river before it starts to develop cavitation problem.

- Atmospheric pressure = 100 KPa
- Vapour pressure of water = 2.342 kPa
- Head loss along the suction pipe = $\frac{4.16V^2}{2g}$; where V is the velocity of water in the suction pipe

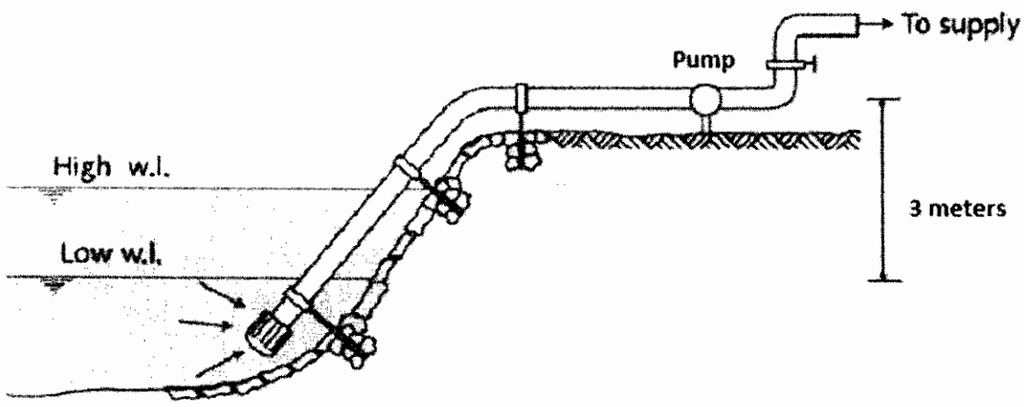

Figure Q5-1