Higher National Diploma in Construction Technology
NVQ Level 06 – Semester I

Hydraulics II & Hydrology	F45C001M15	Three Hours

Answer any five (05) questions only

Q1:

a) State at least four types of fluid flows. (04 Marks)

b) Briefly describe any two types of fluid flows mentioned in Q1.a. (04 Marks)

c) What do you understand by '**Major energy loss and minor energy loss in pipe flow'**? (02 marks)

d) The rate of flow of a water stream through a horizontal pipe is 0.25 m^3/sec. Let assume the diameter of the pipe which is 200 mm is suddenly enlarged to 400 mm at some point. If the pressure intensity in the smaller diameter pipe is 11.772 N/cm^2, determine;
  i). Loss of head due to sudden enlargement, (04 Marks)
  ii). Pressure intensity in the larger pipe, (03 Marks)
  iii). Power lost due to enlargement. (03 Marks)

Q2:

a) Briefly explain the following terms;
  i). Specific energy in open channel flow,
  ii). Critical depth and critical flow,
  iii). Subcritical flow and Supercritical flow. (06 Marks)

b) An 8m wide & 1.2m depth channel discharges 15 m^3/sec of water quantity. calculate;
  i). Specific energy of the flowing water,
  ii). Critical depth, critical velocity and minimum specific energy,
  iii). Froude number and state whether flow is subcritical or supercritical.
  (06 Marks)

c) Briefly explain the term "Hydraulic jump" in an open channel. (02 Marks)

d) If a 3.6m wide rectangular channel discharging 9.0 m³/sec of water quantity with a 6m/sec of constant velocity, provide answers for the questions given below;

    i).   Is there a condition for a hydraulic jump to occur?
          If so, calculate the height, length and strength of the possible jump.   (03 Marks)
    ii).   What is the loss of energy per kg of water? (in 'm')   (03 Marks)

Q3:

a) Briefly explain the mechanism of a 'Centrifugal Pump' with the help of suitable diagram.
    (04 Marks)

b) A pipeline 60 cm diameter bifurcates into two branches at a Y-junction as 40 cm and 30 cm in diameters. If the rate of flow in the main pipe is 1.5 m³/sec and the mean velocity of flow in 30 cm diameter pipe is 7.5 m/sec, determine the rate of flow in the 40 cm diameter pipe.
    (06 Marks)

c) Explain the term "Water Hammer" in pipe flow using a suitable sketch.   (04 Marks)

d) A water stream is flowing through a 2500m length and 500 mm diameter pipe with a velocity of 1.5 m/sec. There is a valve fixed at the end of pipe to control the water out flow and if the valve is closed for 25 seconds, find the "Rise in pressure" in it. Take the value of C as 1460 m/sec.   (06 Marks)

Q4):

a) Name two types of current meters used for flow measurements in streams.   (02 Marks)

b) Explain, what is meant by stream gauging?
Briefly explain the area-velocity method that is used for stream gauging.   (06 Marks)

c) The data of a stream gauging operation at a gauging site are given below. The rating equation of the current meter is $v = 0.51 N_s + 0.03$ m/sec where N_s = revolution per second. Calculate the discharge in the stream.   (12 Marks)

Distance from left water edge (m)	0	1.0	3.0	5.0	7.0	9.0	11.0	12.0
Depth (m)	0	1.1	2.0	2.5	2.0	1.7	1.0	0
Revolution of a current meter kept at 0.6 m depth	0	39	58	112	90	45	30	0
Duration of observation (s)	0	100	100	150	150	100	100	0

Q5):

a) Name two methods used to compute "Average annual rainfall", other than the Thiessen's Polygon method. (02 Marks)

b) Write the step-by-step procedure for Thiessen's Polygon method that is used to calculate the "Average annual rainfall". (08 Marks)

c) There were five raingauges uniformly spread in a small watershed. The depth of rainfall observed at these raingauges and the area of Thiessen's polygons for the corresponding raingauges are as follows.

Rainfall gauge no.	1	2	3	4	5
Rainfall depth (mm)	47.3	46.4	43.8	52.3	48.5
Area of Thiessen's polygon (1000 m^2)	95	102	98.67	80.52	85.38

Determine the average depth of precipitation. (10 Marks)

Q6):

a) Briefly explain the challenges for sustainable water resources in Sri Lanka. (04 Marks)

b) State that the meaning of 'hydrograph'. (02 Marks)

c) Define the meaning of 'unit hydrograph' also. (02 Marks)

d) Briefly describe the application of the 'unit hydrograph'. (04 Marks)

e) What are the limitations of the 'unit hydrograph'? (04 Marks)

f) What do you mean by the 'flood routing'? (04 Marks)