BASIC CIVIL ENGINEERING EXERCISES

CE 103 Basic Surveying

Assignment (92)

Q1297

Explain

(a) Linear measurement

(b) Angular measurement

Q1298

Which survey scales are used for which purposes?

Q1299

List the equipments used in surveying.

Q1300

Describe the followings

(a) Tape

(b) Surveying signs

(c) The way to lay down the chain

Q1301

Describe the method to perform the surveying on hilly ground.

Q1302

Explain

(a) The method to insert the arcs

(b) Polar co-ordinates/ Radiation

(c) Site surveying and levelling

Q1303

Write the notes for

(a) Prism

(b) Cross staff

Q1304

How will you measure the slope angle.

Q1305

How will you form the chain angle.

CE 105 Hydraulics

Assignment (93)

Q1306

1. A plate separated by 0.5 mm from a fixed plate moves at 0.5 m/s under a shear stress of 4.0 N/m^2. Determine the viscosity of the fluid between the plates.

(Answer: 0.004 Ns/m^2)

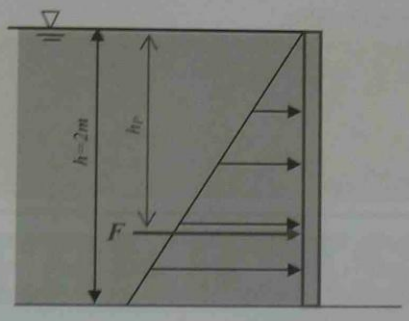
2. A Newtonian fluid fills the gap between a shaft and a concentric sleeve. When a force of 788N is applied to the sleeve parallel to the shaft, the sleeve attains a speed of 2m/s. If a 1400 N force is applied, what speed will the sleeve attain? The temperature of the sleeve remains constant.

(Answer: 3.55 m/s)

3. Water is moving through a pipe. The velocity profile at some section is shown below and is given mathematically as $u = \frac{\beta}{4\mu}\left(\frac{d^2}{4} - r^2\right)$, where u = velocity of water at any position r, β = a constant, μ = viscosity of water, d = pipe diameter, and r = radial distance from centreline. What is the shear stress at the wall of the pipe due to water? What is the shear stress at a position r = d/4? If the given profile persists a distance L along the pipe, what drag is induced on the pipe by the water in the direction of flow over this distance?

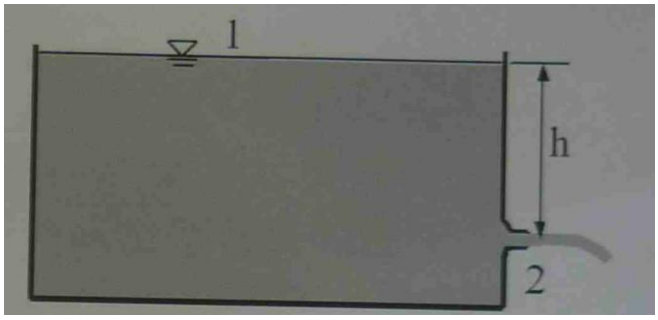
Q1307

1. A rectangular plate gate is placed in a water channel (density of water: 1000kg/m^3). Its width is 0.8m and the water depth is 2m. Estimate the pressure force and its centre of pressure



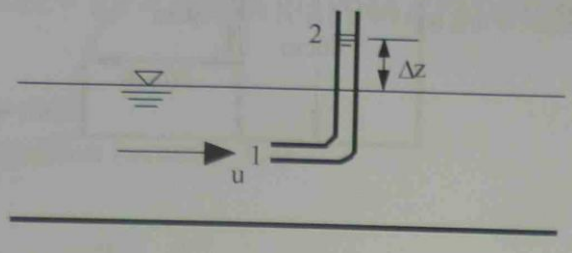
Q1308

A large tank with a well-rounded, small opening as an outlet. What is the velocity of a jet issuing from the tank (neglect the kinetic energy at section 1)?



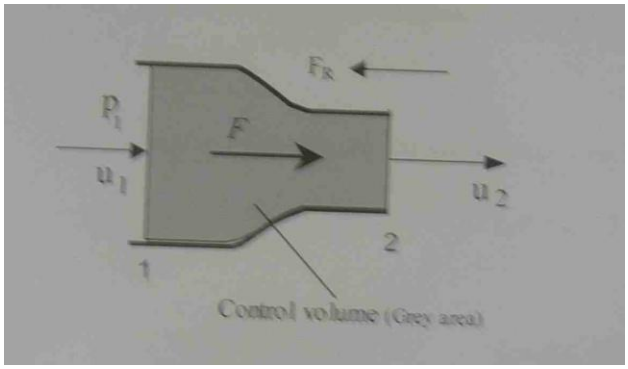
Q1309

1. The device Pitot tube shown below is used to determine the velocity of liquid at point 1. It is a tube with its lower end directed upstream and its other leg vertical and open to the atmosphere. The impact of the liquid against Opening 1 forces liquid to rise in the vertical leg to the height Δz above the free surface. Determine the velocity at 1.



Q1310

Calculate the force F_R required to hold a nozzle to the firehose for a discharge of 5 litre/second if the nozzle has an inlet diameter of 75 mm and an outlet diameter of 25 mm.



Q1311

1. A small ingot and platform rest on a steady water jet. If the total weight supported is 825N, what is the jet velocity? Neglect energy losses.

Q1312

Oil flows through a 25 mm diameter pipe with a mean velocity of 0.3 m/s. Given that $\mu=4.8\times10^{-2}$ kg/ms and $\rho=800 kg/m^3$, calculate (a) the pressure drop in a 45 m length and the maximum velocity, and (b) the velocity 5mm from the pipe wall.

Q1313

1. In the laminar flow of a fluid in a circular pipe, the velocity profile is exactly a true parabola. The discharge is then represented by the volume of a paraboloid. Prove that for this case the ratio of the mean velocity to the maximum velocity is 0.5. (Note: $u = u_{max}\left[1-(r/R)^2\right]$)

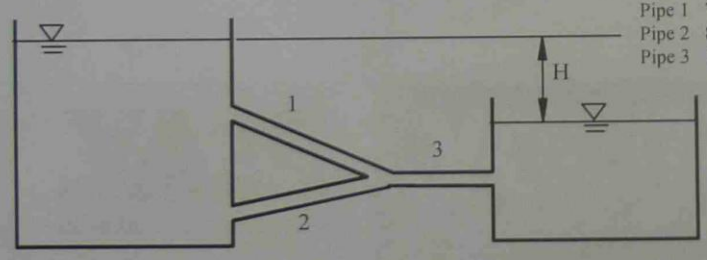
2. An oil ($\rho=868.5\ kg/m^3$ and $\mu=0.0814$ kg/ms) is to flow through a 300m level concrete pipe. What size pipe will carry $0.0142 m^3/s$ with a pressure drop due to friction of 23.94kPa?

(Answer: 155 mm)

3. Water flows at a rate of $0.04 m^3/s$ in a 0.12-m-diameter horizontal pipe that contains a sudden contraction to a 0.06-m-diameter pipe (K_L=0.40). Determine the pressure drop across the contraction section. How much of this pressure difference is due to energy losses and how much is due to kinetic energy change?

(Answer: 133.9 kPa , 40.0 kPa, 93.9kPa)

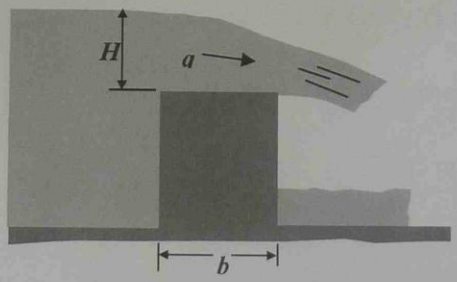
4. If $H = 11m$, find the discharge through pipes 1, 2, and 3 (Neglect local losses).



Q1314

1. Water flows over a dam as illustrated below. Assume the flow rate q (per unit length along the dam, hence with unit of m^2/s) depends on the head H, width b, acceleration of gravity g, fluid density ρ, and fluid viscosity μ. Develop a suitable set of dimensionless parameters for this problem using b, g, and ρ as repeating variables.

(Answer: $\frac{q}{b^{3/2}g^{1/2}} = \phi\left(\frac{H}{b}, \frac{\mu}{b^{3/2}g^{1/2}\rho}\right)$*)*

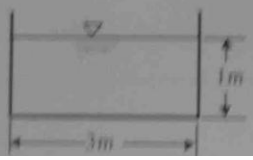


2. A 1:50 model of a boat has a wave resistance of 0.02N when operating in water at 1.0m/s. Find the corresponding prototype wave resistance. Find also the horsepower requirement for the prototype. What velocity does this test represent in the prototype? (use Froude criterion, 1Kilowatt = 1.34 Horsepower)

Q1315

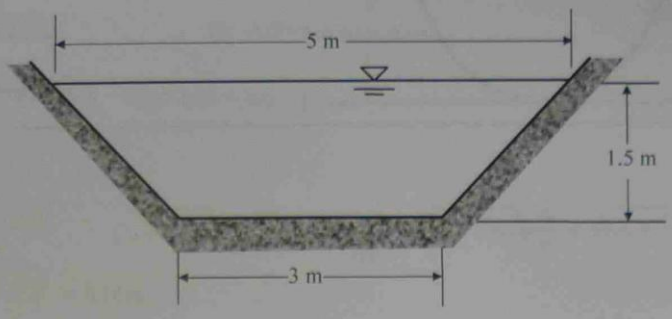
7.3 Calculation of Hydraulic Radius and Hydraulic Mean Depth

Example 1: Rectangular channel



Q1316

1. Compute the hydraulic radius and hydraulic mean depth for a trapezoidal channel.



Q1317

Example:
If the daily water consumption in Bristol is 300 liters/person, how many people would be provided with water by 1 m^3/s flow?

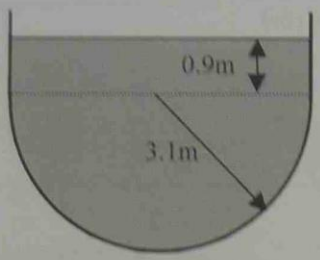
Q1318

Example:
The normal depth of flow in a trapezoidal concrete lined channel is 2 m. The channel has a base width of 5 m and side slope of 1 (vertical):2 (Horizontal). Manning's n is 0.015 and the bed slope S_O is 0.001. Determine the discharge Q and the mean velocity V.

Q1319

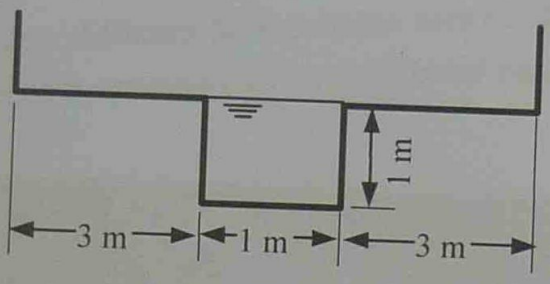
1. Water is in steady uniform flow through a finished-concrete channel (Manning's n=0.012) as shown below. If the bed slope is So= 0.0016, what is the discharge?

(Answer: 102 m^3/s)



Q1320

Example 1:



Case a: So=0.001, n=0.02, estimate the discharge in the channel

Solution

Q1321

During a large flood, the water level in the channel is given in the following figure. Manning's n is 0.015 for the main channel and 0.035 for the flood banks. The bed slope S_o is 0.001. Estimate the discharge for a maximum flood depth of 4 m.

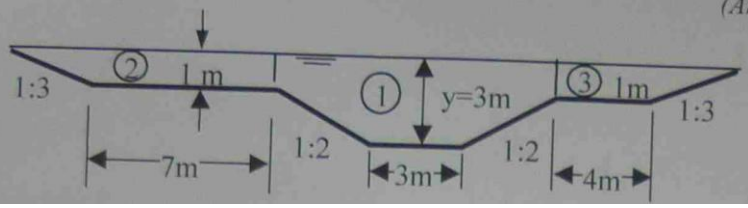
Q1322

2. A rectangular, concrete lined channel (Manning's n = 0.015) is to be constructed to carry flood water. The slope of the channel bed slope is 1 in 500. The design discharge is $10 m^3/s$. (a) Calculate the proportions of the rectangular channel that will minimize excavation and result in the optimum hydraulic section. (b) If the cross sectional area of flow is kept the same as in part (a) but for safety reasons the depth of flow in the channel is limited to 1.00m, what will be the discharge now?

Q1323

1. Compute the discharge in a compound channel. The estimated Manning's *ns* are 0.015 for the main channel and 0.035 for the over-bank sections . The bed slope of the channel S_o is 0.001.

(Answer: 97.09 m^3/s)



Q1324

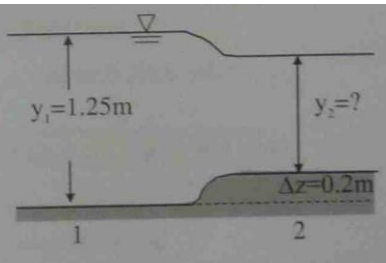
For a trapezoidal channel with a base width b=6.0 m, side slope x=2 (i.e., 1 vertical : 2 horizontal) and Manning's n=0.02, calculate the critical depth, critical velocity and critical slope if its discharge $Q=17 m^3/s$.

Q1325

Write energy equation.

Q1326

A steady uniform flow in a rectangular channel of width 5m is interrupted by the presence of a hump of 0.2m in the channel. The upstream depth is 1.25 m and the discharge is 10 m^3/s, find the depth of flow at position 2 (taking $\alpha=1$ and assume no energy loss).



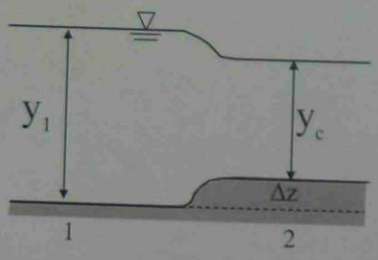
Q1327

Define specific energy.

Q1328

1. Water is flowing at a normal depth in a 3m wide rectangular channel with a bed slope of 1:500. If Manning's n=0.025 and the discharge is $5m^3/s$. Calculate the height of a hump which would produce the critical flow without causing backwater upstream (i.e., raising the upstream water level).

(Answer: 0.31 m)



Q1329

1. Water is flowing at a rate of $10m^3/s$ through a rectangular channel 4 m wide, at a depth of 0.5 m. A weir downstream causes the water to backup the channel and a hydraulic jump occurs. Find the sequent depth and the loss of energy at the jump.

Q1330

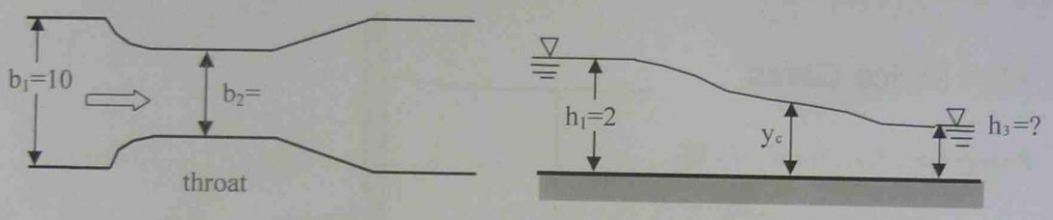
Example Venturi Flume

An open channel is 2 m wide and of rectangular cross section. A venturi flume having a throat width of 1.0m is installed at one point. Estimate the discharge:

a) if the upstream depth is 1.2 m and a critical flow occurs in the flume
b) if the upstream depth is 1.2 m and the depth in the throat is 1.05 m
(Take Cv=1 and Cd=0.95)

Q1331

2. Determine the width b_2 of the throat for a Venturi flume so that it will just produce critical flow, given $Q=40m^3/s$, $b_1=10m$ and $h_1=2m$. Also calculate the possible downstream supercritical flow depth h_3 (Neglect energy losses).



Q1332

Write the water balance equation for catchment.

CE 106 Hydrology

Assignment (94)

Q1333

What is hydrological cycle?

Q1334

Sketch catchment water balance diagram.

Q1335

The volume of atmospheric water is 12,900 km^3. The evapotranspiration from land is 72,000km^3/year and that from ocean is 505,000km^3/year. Estimate the residence time of water molecules in the atmosphere (in days).

Q1336

A reservoir has the following inflows and outflows (in cubic meters) for the first three months of the year. If the storage at the beginning of January is 60m^3, determine the storage at the end of March.

Month	Jan	Feb	Mar
Inflow	4	6	9
Outflow	8	11	5

Q1337

The total amount of water in the atmosphere is 12.9×10^3 km^3. Estimate the depth of precipitation if the atmosphere water is completely transformed to precipitation (treat the earth as a sphere with a mean radius of 6,371km and the sphere surface area equation is $4\pi R^2$).

Q1338

About 577,000 km^3 of water fall as precipitation each year on the earth, calculate the average annual depth of precipitation on the earth surface (in millimetres).

Q1339

The volume of ocean water is 1338×10^6 km^3. The runoff from rivers is 44.7×10^3 km^3/year and the runoff from groundwater is 2.2×10^3 km^3/year. The precipitation on the ocean is 1270 mm /year (The ocean area is 361.3×10^6 km^2). Estimate the residence time of water molecules in the ocean (in years).

Q1340

The average annual precipitation in England and Wales is 926.9mm. A person consumes 150 litres of water every day (include agriculture, industry, trade, ..). With a population of 53,390,300 in England and Wales and an area of 58,368 square miles, what percentage of the precipitation is used by humans?

Q1341

In a given year, a catchment with an area of 2500km^2 received 130 cm of precipitation. The average flow rate measured in the river draining the catchment was 30m^3/s.

1) How much runoff reached the river for the year (in m^3)?
2) Estimate the amount of water lost due to the combined effects of evapotranspiration and infiltration to groundwater (in m^3)?
3) How much precipitation is converted into river runoff (in percentage)?

Q1342

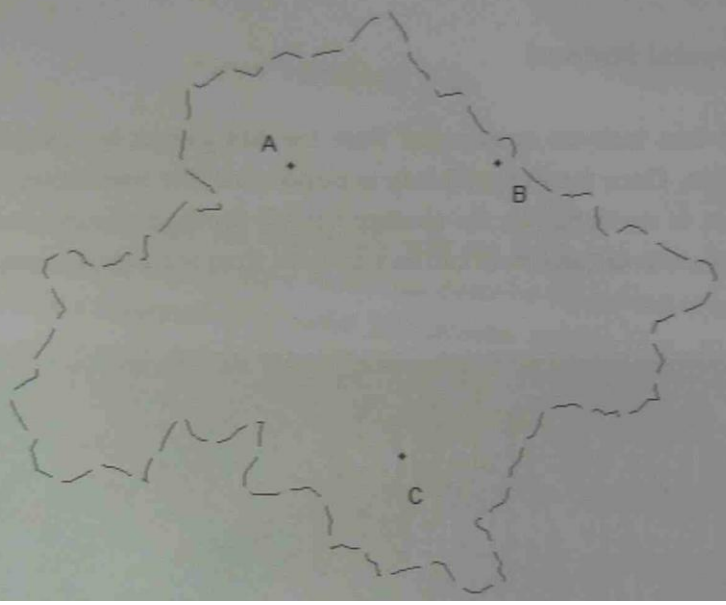
A storm with 100mm depth fell over an area of 100 km^2 within 2 hours. Estimate the energy and power release from this storm (in Joule and MW).

Q1343

What are the types of participation?

Q1344

Draw Thiessen polygons on the catchment shown in Figure 6. If the rainfall depths recorded by Gauge A, B and C are 10mm, 8mm and 9mm and the corresponding polygon areas are 5.1km^2, 3.2km^2 and 5.3km^2, estimate the catchment average rainfall depth.



Q1345

What is the terminal velocity for a light rain with a drop size of 0.6 mm at sea level (Cd= 1.07, $\rho_a = 1.2kg/m^3$, $\rho_w = 1000kg/m^3$)? If the air density drops by 50% at 5km in the sky, will the same rain drop falls faster or slower? Calculate its velocity at this height (assume little change with g ρ_w and Cd). If a weather radar beam detects such a rain drop at 5km from the ground at sea level, calculate the approximate travel time for it to hit the ground (use the average of the two velocities and assume no updraft/downdraft with the air).

Q1346

Over a period of 30 years from 1971-2000, records of daily rainfall data have been collected. One site X was inspected in 1985 and a large Willow tree was found to be over-shadowing the gauge. This was cut down in the same year. The data from the gauge was found to be of great potential value in a subsequent reservoir study and a means for inspecting and adjusting the data was sought.

Use the double mass analysis technique to carry out the following operations using the data in the table:

a) determine the approximate date of the first significant evidence for over-shadowing of Gauge X;
b) does the felling of the tree appear to have solved the gauging problem?
c) evaluate a correction ratios that can be used to adjust incorrect values. (Hint: use graph paper or excel to solve the question)

Q1347

Estimate the evaporation rate (in mm/day) from an open water surface based on the energy balance method. The net radiation is 1000 W/m^2 and air temperature is 20^0C. Assume no sensible heat or ground heat flux. The water density is $1000kg/m^3$.

Q1348

What are the potential evapotranspiration and reference evapotranspiration? Describe their relationship with the actual evapotranspiration.

Q1349

The initial infiltration capacity f_0 of a catchment is estimated as 4.5mm/hr, the time constant as 0.35/hour, and the capacity f_c as 0.4 mm/hour. Use Horton's equation to find a) the value f_t at t=10 min, 30 min, 1 hr, 2hr and 6 hr; b) the total volume of infiltration over the 6 -hr period. Assume continuously ponded conditions.

Q1350

A catchment of are 0.25 km^2 is subjected to a storm with the following profile:

Time (hr)	1	2	3	4	5	6
Rain (mm)	7	18	25	12	10	3

If the volume of storm runoff is $8250m^3$, estimate the index (neglect the effect of ET)

Q1351

With the measurements in the following table, calculate the soil moisture flux q (cm/day) between depth 0.5m and 0.8m in each week. Hydraulic conductivity $K = 240(-\Psi)^{-2.3}$ (K in cm/day and Ψ in cm). Use the average suction head to derive hydraulic conductivity. For $1km^2$ area, how much water has passed the layer between 0.5m and 0.8m in these two weeks (in m^3)?

Week	Total head at 0.5m (cm)	Total head at 0.8m (cm)
1	-70	-105
2	-80	-120

Q1352

Describe the followings

(a) Artesian aquifer well

(b) Water wall

(c) Bore hole

(d) Piezometric surface

(e) Base flow

(f) Ground water re-charge

(g) Fossil water

Q1353

What are the characteristics of confined & unconfined ground water?

Q1354

Water in an aquifer moves with a flux of 30cm/day. The average soil particle size is 1.5 mm. Find the Reynolds number and check whether Darcy's law is applicable (water density is 1000kg/m^3 and water viscosity is 1.137x10^{-3} Ns/m^2).

Q1355

Write the equation for

(a) Unconfined flow to a well

(b) Confined flow to a well

Q1356

Write the equation to express unsteady flow.

Q1357

b) A well of 0.3m radius in a confined aquifer was pumped at a steady rate of 30litre/s from a fully penetrating well. When the well level remained constant at 85.5m above datum, the observation well (borehole) constructed at a distance of 10m recorded a water level of 86.5m. The aquifer thickness is estimated at 20m.

1) What are the hydraulic conductivity and transmissivity of the aquifer around the well (in m/day and m^2/day)?

(Answers: 72.3 m/day, 1452 m^2/day)

Q1358

What are the essential differences between unconfined and confined groundwater flow?

Q1359 + Q1360

1. Use diagrams to show how to separate flow events and then divide the event flow hydrograph into direct runoff and base flow.
2. What are the assumptions in unit hydrograph model?
3. A river catchment has a 2 hour unit hydrograph with the ordinates 0, 3, 11, 35, 55, 66, 63, 40, 22, 9 and 2 m^3/s. Assume that the base flow at time t=0 hours is 50 m^3/s and linearly increases to 74 m^3/s at t=24 hours.

   a) Compute the hydrograph resulting from two successive 2 hour periods of effective rain of 2.0cm and 3.0 cm respectively.

   (Answers: 50, 58, 85, 159, 273, 357, 386, 333, 230, 152, 101, 78, 74 m^3/s)

   b) To prevent downstream flooding, the maximum flow to be released from the catchment is set at 273 m^3/s. Calculate the space needed to store the excess water in this event (in m^3).

   (Answer: around 1.85 million m^3)

4. Derive 2 hour 1cm Unit hydrograph from the following S-curve.

Time (hour)	0	1	2	3	4	5	6	7	8…
S(t) (m^3/s)	0	16	226	301	341	361	371	376	376

(Answers: 0, 8, 113, 142.5, 57.5, 30, 15, 7.5, 2.5, 0 m^3/s)

Q1361

Define flow routing.

Q1362

Estimate the downstream hydrograph using the Muskingum method with K=3hr and X=0.3. The time interval is 3 hours. The upstream hydrograph is as follows

Time (hr)	0	3	6	9	12	15	18
I (m^3/s)	1	3	9	15	13	10	6

Q1363

The Muskingum method of flood routing has been chosen to forecast the movement of a flood wave from a point 30 km upstream of a centre of population. Engineers have previously estimated the Muskingum K and X parameters for this reach to be 10 hours and 0.15 respectively.

If the upstream flood was measured every 6 hours starting at 0900 hours and the flows were recorded as 25, 35, 50, 80, 140, 130, 90, 80, 50, 30 and 25 m^3/s for the first 60 hours and 25 m^3/s thereafter then estimate the peak flow at the town and the time at which the peak flow will occur.

Q1364

Explain soil moisture sensor.

Q1365

In a Bristol river, an annual peak flow in excess of 10 m³/s has a return period of 100 years. If the annual peak flows are independent between the years, estimate the probability of such a peak flow will occur in 2 consecutive years.

Q1366

On average, how many times will a 10-year flood occur in a 40 year period? What is the probability that exactly this number of 10-year floods will occur in a 40 year period?

Q1367

1. On average, how many times will a 10-year flood occur in a 40 year period? What is the probability that three 10-year floods will occur in a 40 year period? What is the probability that such a flood will not occur at all in a 40 year period? What is the probability that such a flood will occur at least once in a 40 year period? (Hint: use the Binomial distribution)

   (Answers: 4, 0.2003, 0.0148, 0.9852)

2. If the annual maximum flows for a catchment in England between 1987 and 1996 were 25.1, 41.5, 29.9, 21.2, 35.5, 23.8, 25.5, 28.0, 33.0 and 31.5 cumecs, estimate the 20, 50 and 100 year return period flows assuming that they were distributed in accordance with a log normal distribution (i.e., use a Log probability paper).

   (Download a sheet of Log 2 cycle probability paper at
   http://sorrel.humboldt.edu/~geology/courses/geology531/graph_paper_index.html)

   (Answers: 45, 50, 53 m^3/s)

Q1368

2. A water supply reservoir with a useful storage capacity of $4.9 \times 108 m^3$ was formed by constructing a concrete dam across a river valley. It was designed to meet a demand of 13.6 cumecs and was completed and empty at the end of 1944. The average annual inflows for the ensuing 20 year period were 22, 24, 6, 9, 32, 40, 11, 10, 12, 24, 28, 6, 7, 9, 21, 16, 24, 27, 19 and 34 cumecs respectively. Use the water balance method to solve the following questions.
   a) When was the reservoir full for the first time?
   b) Estimate the number of months that the reservoir spilled over this 20 year period?
   c) Did the reservoir run dry during this period? If so, when and for how long?
   d) If the inflow data had been available prior to the original reservoir design what capacity would you have recommended?
   e) Given the existing storage determine the largest demand that could be sustained over the available historical record?

   (Answers: a) September 1946; b) 76.3 months; c) April 1958, 8.6 months; d) $5.9 \times 10^8 m^3$; e) $12.5 m^3/s$)

Q1369

Sketch the zones of storage in a water reservoir

Q1370

Describe the basic hydrological design procedure.

CE 107 Sanitation & Water Supply

Assignment (95)

Q1372

What are the solutions to water crisis?

Q1373

Explain

(a) Water borne diseases

(b) Water washed diseases

Q1374

Describe

(a) Arborloo

(b) Single pit ventilated improved pit latrine

(c) Single pit pour flush toilet

(d) Ethekwini Latrine

Q1375

Explain biogas toilet.

Q1376

Sketch simplified sewerage system.

Q1377

What are the types of water resources used in rural areas?

Q1378

Explain

(a) Surface water

(b) Ground water

(c) Rain water collection

Q1379

What are the process of inducing behaviour change and promoting hygiene?

Q1380

Write the equations for

(a) Effective pit volume

(b) Ethekwini Latrines

(c) Single pit pour flush latrines

Q1382

Express the formula to calculate sewer gradient

Q1383

Calculate sewer diameter

Q1384

Suppose I min = 0.005, qi= 0.0025 $m^{3/}$ min calculate sewer diameter and number of people served

Q1385

Describe hydrogen sulphide control

Q1386

What are the basis of hydraulic design

Q1387

Describe storm water flow

Q1388

Based on the knowledge gained in the unit, provide the project work plan to design a sewerage and water supply system for a village of 300 population.

CE 110 Building Construction

Assignment (96)

Write the project performance plan and procedure to construct the small building

Your project plan should contain the following outlines with appropriate diagrams and work plans.

- Foundation
- Wood selection
- Nail junction joiner selection
- Heavy timber frame construction.
- Roof construction
- Exterior finish
- Interior finish
- Stair
- Brick masonary
- Masonary load bearing wall construction
- Brick laying

Assignment (97)

Write the project performance plan and procedure to construct the small building

Your project plan should contain the following outlines with appropriate diagrams and work plans.

- Steel frame construction
- Light gauge steel frame construction
- Concrete construction
- Site cast concrete framing system
- Pre cast concrete framing system
- Roofing
- Glazing
- Windows & doors construction

- Cladding
- Cladding with masonary , concrete
- Cladding with metal & glass.
- Interior finishes
- Interior wall partition’
- Finish ceilings & floors