

# **Computer Programming in Civil Engineering**

## **Assignment: Applications of Python in the field of Open Channel Flow**

Date:

1. A rectangular channel of width 2 m and carry a discharge of 4.8 m<sup>3</sup>/s with a depth of 1.6 m. At a certain section a small hump of size 0.1 m is proposed to build.

a. Calculate the likely change in the water surface elevation.

b. In the above question if the hump of height made equal to 0.5 m. find out the upstream and downstream depth of flow.

C. Also calculate the maximum value of AZ i.e., maximum rise in bed level possible without changing the upstream condition.

2. A rectangular channel 3.5 m wide and conveys a discharge of 15 m<sup>3</sup>/s at a depth of 2 m. It is proposed to reduce the width of channel at a hydraulic structure location. Assuming the transition to be horizontal and flow to be frictionless. Determine the water surface elevation at upstream and downstream of this constriction when the contracted width becomes 2.5 m.

3. Design a most efficient trapezoidal channel for conveying discharge of 100 m<sup>3</sup>/s, given that rugosity coefficient is 0.015 and channel bed slope 1:2500. Assume the freeboard of 10% of depth of flow. Also compute the Froude number.

# **Computer Programming in Civil Engineering**

## **Assignment: Applications of Python in the field of Hydrology**

Date:

1. The infiltration capacity of soil in a small watershed is found to be 6cm/hr before rainfall event. It was found to be 1.2 cm/hr at the end of 8 hours storm. If the decay coefficient is 0.888 /hour, Find the total infiltration during these 8 hours by using Horton's equation.

2. For a drainage basin of 640 km, isohels based on a storm event yield the following data: calculate the mean precipitation.

<b>Isohyets interval (cm)</b>	<b>Inter- Isohytal Area (km')</b>
14-12	90
12-10	140
10-8	125
8-6	140
6-4	85
4-2	40
2-0	20

3. The recorded annual rainfall from 5 rain gauge stations in a catchment and the corresponding Theissen polygon area as follows:

<b>Polygon Area (m^2)</b>	<b>P (cm)</b>
25	125
30	175
30	225
10	275
5	375

If the scale of the map is 1:50000 estimate the volume and the mean depth o Rainfall.

# **Computer Programming in Civil Engineering**

## **Assignment: Applications of Python in the field of Transportation Engineering**

Date:

1. Calculate the length of transition curve on a plain terrain using the following data.

Design speed = 65 kmph, Radius of curvature- 220 m. Allowable rate of introduction of superelevation (pavement rotated about its centreline= 1 in 150, Pavement width including extra widening 7.5 m

2. Calculate 10 years EWL and traffic index value using following data.

<b>ELW Constant</b>	<b>AADT</b>
330	3750
1070	470
2460	320
4620	120

Assume 60% increase in traffic in next 10 years. Calculate the thickness of the pavement required if R = 48 and C= 16.

3. CBR test was conducted for soil subgrade and following results were found. Compacted soil CBR = 6%, Poorly graded Gravels CBR = 12%, Well graded Gravel CBR = 60%, Bituminous surface of thickness 4cm. Assume wheel load as 4085 kg and tyre pressure as 7 kg/cm.

<b>Load (kg)</b>	<b>Penetration (mm)</b>	<b>Standard Load(kg)</b>	<b>CBR (%)</b>
60	2.5	1370	4.38
82	5.0	2055	3.99

# **Computer Programming in Civil Engineering**

## **Assignment: Applications of Python in the field of Concrete Technology**

Date:

Design concrete mix as per IS 10262

Grade of designation: M40, Type of Cement: OPC 43, Maximum size of aggregates: 20 mm, Minimum cement content: 320 kg/m<sup>3</sup>, Maximum cement content: 450 kg/m<sup>3</sup>, Maximum water cement ratio: 0.45, Workability: 100 mm (slump). Exposure condition: Severe, Method of placing of concrete: Pumping, Aggregate type: Crushed angular type aggregates, Chemical admixture type: Super- plasticizer, Specific Gravity of cement: 3.15, Specific gravity of fine aggregates: 2.74; confirming the grading as per Zone-I, and that of Course aggregates: 2.74, Moisture absorption by aggregates: Nil,

## **Computer Programming in Civil Engineering**

Assignment: Applications of Python in the field of Reinforced Cement Concrete

Date:

1. Find the ultimate moment carrying capacity of singly reinforced beam section 230 mm x 400 mm (effective) reinforced with 2#16 and 2#20 on tension side. Materials M20, fe415
2. Design one way simply supported slab of 3 m effective span having support width of 230 mm. Given that LL is 4 kN/m and floor finish being 1.8 kN/m. Materials M20, fe415.

# **Computer Programming in Civil Engineering**

## **Assignment: Applications of Python in the field of Soil Mechanics**

Date:

1. A Concentrated load of 2500 kN is applied at the ground surface. Determine the vertical stress at a point up to 6 m depth and at a horizontal distance of 5 m from the axis of load. Plot graph by using Excel. Use Boussinesq's Theory.

# **Computer Programming in Civil Engineering**

## **Assignment: Applications of Python in the field of Foundation Engineering**

Date:

1. A 3m square footing is located in a dense sand at a depth of 2 m. Determine the ultimate bearing capacity for the following water table positions.

- a. At ground surface
- b. At footing level
- c. 1 m below the footing

Calculate the bearing capacity by approximate formulas and my conventional method. Take bulk density of soil is  $18 \text{ kN/m}^3$ , Saturated soil density is  $20 \text{ kN/m}^3$ , unit weight of water is  $10 \text{ kN/m}^3$  for angle of internal friction of  $35^\circ$ ,  $N_c$  is 33,  $N_q$  is 34.

2. A 450 mm square section of concrete pile 15 m long is driven in a deep deposits of uniform clay. The laboratory UCS test on undisturbed sample indicates an average value of UCS as  $75 \text{ kN/m}^2$ . Calculate the ultimate load capacity of soil.  $\alpha=0.8$ .

# **Computer Programming in Civil Engineering**

## **Assignment: Applications of Python in the field of Water Supply Engineering**

Date: 2.9-22

a. Calculate the total alkalinity of water

1. A 200 ml sample of water having initial pH of 10 requires 30 ml of 0.02N H<sub>2</sub>SO<sub>4</sub> to titrate a sample to pH of 4.5 and 11 ml of 0.02N H<sub>2</sub>SO<sub>4</sub> to titrate the sample to pH of 8.3

b. Find the concentrations of alkaline species in mg/l as CaCO<sub>3</sub>,



## **Computer Programming in Civil Engineering**

### **Assignment: Applications of Python in the field of Waste Water Engineering**

Date:

1. Determine the BOD at 7"-day 25°C if BOD at 3rd day 20°C is found out to be 50 mg/l. Take Decay coefficient as 0.23.
2. The sludge from the aeration tank of ASP has solid content by weight of 2% of sludge is put in a sludge thickener where sludge volume is reduced to half. Assume that number of solids in supernatant from thickener are negligible. The specific gravity of sludge solids is 2.2 and density of water is 1000 kg/m<sup>3</sup>. What is density of sludge removed from aeration. (Hint: Assume initial mass of sludge is 100 kg).

# **Computer Programming in Civil Engineering**

## **Assignment 4: Applications of Python in the field of Design of Steel Structures**

Date:

1. Design an unequal ISA to resist the tensile force of 225kN as per IS 800.  
Use M20 bolts. Assume suitable data if required.